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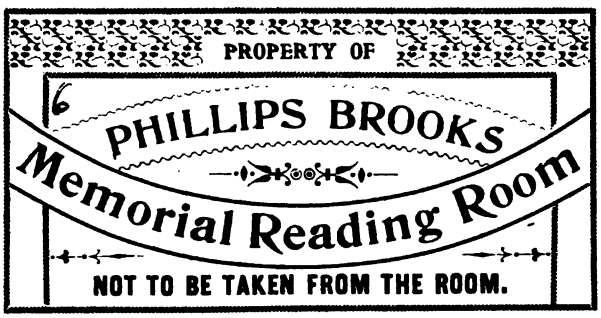
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CHAMBERS'S

ENCYCLOPÆDIA

A DICTIONARY

OF

UNIVERSAL KNOWLEDGE

NEW EDITION

VOL. IV

DIONYSIUS TO FRICTION

WILLIAM & ROBERT CHAMBERS, LIMITED
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CHAMBERS'S ENCYCLOPÆDIA

A DICTIONARY OF UNIVERSAL KNOWLEDGE

Dionysius OF ALEXANDRIA, often surnamed 'the Great,' was the greatest pupil of Origen, succeeded Heraclas as head of the Catechists' school in 232, became Bishop of Alexandria in 247, was banished during the persecutions of Decius (250) and Valerian (257), and died in 264. He distinguished himself by his wisdom and moderation in the great church controversies of his time, on the Novatian schism, on the baptism of heretics, on Chiliasm, and on the heresies of the Sabellians and Paul of Samosata. He was distinguished also as an exegete; the Apocalypse he refused to assign to the Apostle John on grounds which show that he possessed the critical faculty as well as an independent mind. Of his numerous writings only a few fragments remain; these were collected by Routh in vols. i. and iv. of his *Reliquiæ Sacræ* (Oxford, 1814), and in vol. x. of Mai's *Auctores Classici* (Rome, 1838). See Dittrich, *Dionysius der Grosse* (1867), and Morize, *Denis d'Alexandrie* (1881).

Dionysius OF HALICARNASSUS, a learned critic, historian, and rhetorician, was born about 50 B.C. He came to Rome about 29 B.C., and lived there on terms of intimacy with many distinguished contemporaries till his death, 7 B.C. His most valuable work is unquestionably his Greek *Archæologia*, a history of Rome down to 264 B.C., a mine of information about the constitution, religion, history, laws, and private life of the Romans. Of the twenty books of which it originally consisted, we possess only the first nine in a complete form, the tenth and eleventh nearly so, coming down but to 441 B.C.; of the rest, only a few fragments are extant. He was a greater rhetorician and critic than historian, and his extant works on oratory, on the criticism in detail of the great Greek orators, on the characteristics of poets and historians from the time of Homer to Euripides, and upon Thucydides and Dinarchus, possess great interest and value. There are editions by Reiske (1774–76), Schwartz (1877), and Jacoby (2 vols. 1885–88).

Dionysius, surnamed THRAX ('the Thracian'), a native of Alexandria, who taught at Rhodes and at Rome about 100 B.C. His *Technē Grammatikē* is the foundation of all subsequent European works on grammar. The best edition is that of Uhlig (Leip. 1884).

Dionysius THE AREOPAGITE (i.e. member of the Areopagus, q.v.), one of the few Athenians who, according to Acts, xvii. 34, were converted by the preaching of the Apostle Paul. A later tradition makes him the first Bishop of Athens, and a martyr of the church. The celebrated Greek writings which bear his name, and, connecting Neoplatonism with Christianity, laid the foundation for the mystical theology of the church, were not written by him, but attributed to him after a fashion not uncommon in antiquity. They are first mentioned in 533, when they were appealed to by the Monophysite sect of the Severians against the authority of the Council of Chalcedon. From the 6th century they were generally accepted as genuine, and exercised a very great influence on the development of theology. They include writings *On the Heavenly Hierarchy*, *On the Ecclesiastical Hierarchy*, *On Divine Names*, *On Mystical Theology*, and a series of ten *Epistles*. In the Western Church they are first referred to in one of the *Homilies* of Gregory the Great. In the 9th century Erigena, at Charles the Bald's command, prepared an annotated Latin translation; and he and many of the scholastic theologians who followed him drew much of their inspiration from this source. The date assigned to the pseudo-Dionysian writings is fixed by Kanakis as early as 120, by Frothingham as late as 520. Harnack holds that it has not yet been decided at what period between 350 and 500 they were written, and adheres provisionally to the second half of the 4th century, with a final recension about the year 500. This great unknown thinker was probably an Alexandrian. His fundamental thought is the

absolute transcendence of God, which he attempts to connect with Pantheism by regarding God as absolute causality, and as multiplying himself through his indwelling love in all things. His theology is twofold—on the one hand, descending from God to created things, and concluding from these the absolute inexhaustible being of the One; on the other hand, rising from things to God, denying of him everything that is conceivable, and finding him exalted above truth and error, being and not-being. 'The divine darkness is unapproachable light.' The Incarnation is part of the self-unfolding of God in the world, and the redemption of the individual is mediated by the three degrees of the heavenly hierarchy, and by the three degrees of the church's hierarchy—bishops, priests, and deacons, and the *media* between them are the six 'mysteries' or symbolical priestly actions, to each of which is attributed a special mysterious significance. The standard edition is that of the Jesuit Balthasar Corderius (Antwerp, 1634; Brescia, 1854; and reprinted in Migne's collection). There are translations in German by Engelhardt (1823), and French by Darboy (1845). See DENIS (ST); and the studies by Hipler (1861), Niemeyer (1869), and Schneider (1884); Dorner's *Doctrine of the Person of Christ*, div. ii. vol. i.; Harnack's *Dogmengeschichte*, vol. ii.; and Westcott in the *Contemporary* (1867).

Dionysius the Elder, tyrant of Syracuse, was born about 430 B.C. He was originally a clerk in a public office, but early showed a passion for political and military distinction. When the Agrigentines, after the conquest of their city by the Carthaginians, charged the Syracusan generals with treachery, Dionysius supported their accusations, and induced the Syracusans to appoint new commanders, of whom he himself was one. But in a very short time he supplanted his colleagues also, and so made himself at twenty-five absolute ruler of the city. To strengthen his position he married the daughter of Hermocrates, the late head of the aristocratic party. After suppressing with ferocity several insurrections, and conquering some of the Greek towns of Sicily, he made preparations for a great war with the Carthaginians, which began in 397. At first fortune favoured Dionysius, but after a short time he suffered a series of reverses so calamitous, that all his allies abandoned him, and he was shut up in Syracuse apparently without hope of escape. When he was about to fall a victim to despair, a pestilence broke out in the Carthaginian fleet. Dionysius took courage, and suddenly attacking his enemies by land and sea, obtained a complete victory. In the years 393 and 392 the Carthaginians renewed hostilities, but were defeated on both occasions, and Dionysius was enabled to conclude a most advantageous peace. He now turned his arms against Lower Italy, and in 387, after a siege of eleven months, captured Rhegium. From this time he continued to exercise the greatest influence over the Greek cities of Lower Italy, while his fleets swept the Tyrrhenian and Adriatic seas. But Dionysius was not contented with the reputation of being the first warrior and statesman of his age; he wished to shine as a poet also. He even ventured so far as to contend for the prize at the Olympic games, but the best reciters of the time, reading his poems with their utmost art, could not induce the judges to decide in his favour. Dionysius was more successful at Athens, where he several times obtained the second and third prizes for tragedy, his last production obtaining the first. He also invited many poets and philosophers to his court, as Philoxenus and Plato, but these distinguished guests were not always safe from his capricious violence. He adorned Syracuse with splendid temples and public buildings. One of his works was the gloomy and terrible rock-hewn dungeon called Lautumiæ. In 368 he renewed the war with the Carthaginians, whom he wished to drive out of Sicily altogether, but died suddenly next year, not without a suspicion that his physician had hastened nature to make favour with his son. Dionysius was a most vigorous but unscrupulous ruler. His last years were tormented with an excessive dread of treachery.

Dionysius the Younger, son of the preceding, succeeded his father in 367 B.C., and celebrated his accession by a splendid festival, which lasted ninety days. His political education had been designedly neglected by his father, and in consequence he grew up an indolent, pleasure-loving, and dissolute prince. Dion (q.v.), who was at once his father's son-in-law and brother-in-law, sought to improve him by the instructions of Plato, but his endeavours were frustrated by Philistus, the historian, who disgracefully encouraged the excesses of the youth. Dion was banished, but afterwards returning to Sicily, expelled Dionysius from Syracuse in 356. The latter fled to Locri, the birthplace of his mother, Doris, where he was hospitably received. He repaid the kindness of the Locrians by making himself master of their city, which he ruled despotically for several years. In 346 the internal dissensions of Syracuse enabled him to return thither, and here he ruled for three years until Timoleon came from Corinth to free Sicily. Dionysius soon had to surrender, and was allowed to spend the rest of his life at Corinth, where he haunted low company, spent his means, and had to keep a school for bread.

Dionysius Exiguus (or 'the Little'), so named either from his small stature, or by his own monkish humility, was a Scythian by birth, and became abbot of a monastery at Rome, where he died in 556. He was one of the most learned men of his time, translated various theological writings from Greek into Latin, and is especially noted for his fixing of the Christian era (see CHRONOLOGY), and his collection of canons. See CANON LAW.

Dionysus. The worship of Dionysus, who was originally the god of vegetation, and not till after the time of Homer the god of wine, was borrowed by the Greeks from the Thracians. When adopted as a Greek god he was naturally made the son of Zeus, the sky from which falls the rain that makes the vegetation grow. His mother, Semelē, was destroyed before his birth through her own folly in begging the sky-god to visit her in all his majesty of thunder and lightning. As the remainder of the period of gestation was accomplished in the thigh of Zeus, the paternity of Dionysus was made doubly sure by the myth, and Dionysus was called the 'twice born.' The spread of the worship of the god is mirrored in myths which represent him as bestowing blessings on those who accepted him, and madness on those who, like Lycurgus and Pentheus, resisted him. The peculiar characteristic of the cult is that it is *orgiastic*. Of the orgies as they were actually celebrated we may form an idea from the way in which at the present day in France (on the *jour des brandons*) the peasants carry torches, and utter loud cries, for the purpose of insuring fertility in vineyard and orchard; and in South Germany they dance and leap and make every kind of noise in order to 'rouse the corn,' 'to wake the spring'—the madder the dance and the cries, the more effectual the invocation. In mythology the 'orgies' are imagined as being performed by Mænades, Bacchantes, and others, who in their ecstasies rend animals to pieces, as they rush with their torches by night over the land. Part of the cult of Dionysus consisted in eating oxen and goats, which were regarded as the incar-

nation of the generative power of which Dionysus was the god. Mythology makes Dionysus himself, under the name of Zagreus, to have been devoured by the Titans; his heart alone was saved, and he was born again as the son of Semelē. The orgiastic worship of Dionysus explains the fact that wine when it became known was regarded as the gift of Dionysus (see BACCHUS).—The *Dionysia* were festivals held in his honour throughout Greece. In Attica alone there were four Dionysia at different seasons of the year—the most important, the *Lenæa*, celebrated with a procession and scenic contests in tragedy and comedy, out of which grew all the glories of the Greek drama.

Dioön. See CYCADS.

Diophantus, one of the last of the great Greek mathematicians, lived at Alexandria, most probably in the second half of the 3d century of our era. He died at the age of eighty-four. The titles of three of his works are *Arithmetics*, *Polygonal Numbers*, and *Porisms*. Of the first, which consisted of thirteen books, only six remain; of the second we possess merely a fragment; and the third has been entirely lost. The *Arithmetics* is the earliest extant treatise on algebra, but it would be rash to say that Diophantus was the inventor of algebra, though to what extent he was indebted to his predecessors cannot now be decided. The first book of the *Arithmetics* is occupied with problems leading to determinate equations of the first degree, the rest of the books with problems leading to indeterminate equations of the second degree, the sixth book in particular being devoted to the finding of right-angled triangles where some linear or quadratic function of the sides is to be a square or a cube. The treatise on *Polygonal Numbers* is not analytical but synthetical—i.e. in the manner of Euclid's arithmetical books—and in it numbers are represented by lines. The *Porisms* were probably a collection of propositions on the properties of certain numbers. The first translation of Diophantus was into Latin by Xylander (Wilhelm Holzmann) in 1575. The only edition of the Greek text is that by Bachet, published along with a Latin translation in 1621, and reprinted with the addition of Fermat's notes and many misprints in 1670. A translation into German by Otto Schulz appeared in 1822. See T. L. Heath's *Diophantos of Alexandria* (1885).

DIOPHANTINE ANALYSIS, so called from Diophantus, is that part of algebra which treats of the finding of particular rational values for general expressions under a surd form. A simple example of a diophantine problem is to find a right-angled triangle whose three sides are expressible by rational numbers, or in other words, to divide a square number into two squares (Diophantus, *Arithmetics*, ii. 9). A diophantine theorem less simple is the statement of Fermat, which even yet has only been partially proved, that the equation $x^n + y^n = z^n$ is impossible for every integral value of n greater than 2. The diophantine analysis is really a part of what is now called the theory of numbers, and its development is to be sought in the writings of those mathematicians, from Fermat and Euler downwards, who have cultivated this subject. Much information regarding it will be found in the second part of Euler's *Algebra*.

Dioptrics is that branch of geometrical optics which treats of the transmission of rays of light from one medium into another differing in kind. It consists of the results of the application of geometry to ascertain in particular cases the action of what are called the laws of refraction. See OPTICS.

Diorama. See PANORAMA.

Diorite. See IGNEOUS ROCKS.

Dioscorĕa'ceæ, an order of Monocotyledons, of which the genus Dioscorea (see YAM) is the type. There are about 150 species, temperate or tropical, all twining shrubs, with large rootstocks or tubers. *Tamus* (*Testudinaria*) *elephantipes*, a South African species, sometimes called Elephants' Foot, and Hottentots' Bread, has a large fleshy rhizome, with a rough cracked bark, which is used as food by the Hottentots in times of scarcity. Its congener, *T. communis* (Black Bryony), is the only British representative of the order.

Dioscor'idēs, PEDACIUS, or PEDANIUS, a Greek physician, was a native of Anazarba, in Cilicia, and, probably in the 2d century of our era, accompanied the Roman armies as physician through many countries. He has left a great work on materia medica, in five books, in which he treats of all the then known medicinal substances and their properties, real or reputed. His authority in botany and materia medica was long undisputed, and is still maintained in the East. The best editions of Dioscorides, including some smaller works bearing his name, are by Saracenus (1598) and Sprengel (2 vols. 1829–30).

Dioscuri. See CASTOR AND POLLUX.

Diosma. See BUCKU.

Dios'pyros. See DATE PLUM, and EBONY.

Dip, in Geology, is the inclination of strata downwards into the earth. The amount or angle of dip is the degree of deviation from a level line, or the plane of the horizon. See HORIZON.

Diphtheria (Gr. *diphthera*, 'a pellicle') was described in 1826 by M. Bretonneau of Tours as a form of very fatal sore throat, occurring chiefly in children, and apt to be confounded with Croup (q.v.), with malignant sore throat (*Angina Maligna*), as it is found in connection with Scarlet Fever (q.v.), and Tonsilitis (see TONSILS.) Diphtheria is distinct from these diseases, not only in the symptoms, but in the character and position of the morbid changes on the mucous membrane. It begins by malaise, feeling of chilliness, loss of appetite, headache, and more or less fever; soon the throat feels hot and painful, whilst the neck is stiff and tender. If seen early, the throat is red and swollen, but a false membrane of yellowish or grayish colour quickly appears in spreading patches on an inflamed and ulcerated base in the pharynx or back of the throat, and often extends down the œsophagus or gullet, one side usually being more affected than the other. There may be enlargement of the glands at the angle of the jaw, and albuminuria generally occurs at some stage of the disease. Diphtheritic membrane may be got on any mucous surface, or even on a wound; if it extends into the larynx, it gives rise to cough and difficulty in breathing. The throat affection is often accompanied by a low and very dangerous form of fever, with great and rapid loss of the patient's strength, which is still further reduced by the inability to take food; in other cases, the disease is fatal by paralysis of the heart, or by suffocation, due to invasion of the larynx, when tracheotomy may require to be resorted to. After the acute disease is over, the recovery may be delayed by paralytic symptoms of various kinds; or simply by extreme debility, with exhaustion and loss of appetite. Diphtheria is contagious, and has the peculiar tendency of tacking itself on to other diseases, especially scarlet fever, when it assumes a very fatal gangrenous form. Damp and temperate climates seem to favour its development, while the contagium may remain dormant for long periods. Outbreaks have been directly traced to impure drainage and bad water. One attack affords only slight protection against recurrence. The treat-

ment aims at keeping up the strength of the patient by means of concentrated beef-tea, milk, egg-flip, and alcohol. Iron in large doses is most valuable, and sometimes quinine. Locally, solvents, such as lactic acid or lime-water, are applied to the throat by a brush; antiseptics are also useful, the best being Condy's fluid, carbolic acid, and borax. Caustics ought not to be used; cauterisation, formerly in use, being cruel, dangerous, and useless; and the best authorities do not sanction the excision of the diphtheritic membrane. The paralysis may require to be treated with electricity. See GERM THEORY OF DISEASE.

Diphthong (Gr., 'having a double sound') means two vowel-sounds following one another so closely as to form but one syllable, as in *out*. In this combination the sound is really composed of an *a* as heard in *father*, and an *u* as heard in *put*. Many double vowels in English are not real diphthongs, there being only one sound heard. The only real diphthongs being *i*, as in *high*; *i* in *aye*; *oi* in *boil*; *ow* in *how*; and *ew* in *mew*. The spelling of the English language has little or no relation to the pronunciation in this matter. In many syllables written with two vowels, only one sound is heard, as in *bread*. The single vowel-letters, again, often have a diphthongal sound; thus the long sound of *i* as in *high*, is really composed of the sound of *a*, as heard in *father*, and that of *e* in *me*; and *tune* is pronounced as if written *teun*. Such words as *bread*, *field*, which are now monophthongs, were doubtless at one time real diphthongs, and are still so pronounced in many parts of England. On the other hand, the *ae* in such words as *aerated* is not a diphthong, and to write *ærated* is of course wrong.

Diplo'ma (Gr., 'a paper folded double,' from *diploō*, 'I double,' or 'fold'). This term originated in the ancient custom of writing solemn documents on two tablets of wax, which were doubled, or laid one upon the other (see DIPTYCH), or on writing material which was folded. The Roman emperors were in the habit of giving diplomas to public servants, and to couriers, to enable them to procure the use of the public servants and horses; hence diploma came to signify a royal charter or prince's letters-patent. The term is now mostly applied to instruments given by universities and other learned societies, in proof of the holder having attained a certain degree; to the licenses held by physicians and surgeons; and to certificates of merit awarded at exhibitions.

Diplomacy is the art of conducting the intercourse and adjusting the mutual relations of nations. The term owes its origin to the ancient use of public documents, known as diplomas, from their being written on two leaves or double tablets. From the point of view of the philosophy of law, diplomacy arises out of the necessary interdependence of states. This interdependence being recognised, the rights and duties of political intercourse flow from the rights and duties of recognition; and it is, consequently, from the general doctrines of the recognition of state-existence that the special principles of legation are to be deduced. Recognition implies separate existence, not potential only, but actual, and therefore only states having such separate existence are entitled to express their will through separate diplomatic agents. It is on this ground that the right of legation is denied to colonies, however important or distant from the parent state. A limitation in the rights and duties of legation also arises in the case of semi-barbarous nations, whose municipal law and the judgments of whose courts are not recognised by civilised states. Diplomacy has arisen out of the development of the European powers, and, as a uniform system, it is even now confined chiefly to these powers. Its practical rules are embodied partly in those international customs and usages which constitute what may be called common, and partly in those treaties which may be regarded as statute international law.

The frequent necessity for rapid decision in this department of politics has compelled even those nations who most jealously guard their constitutional rights to intrust at least provisional power of action to individual rulers. Thus in Britain the sovereign, independently of parliament, has technically the power to make peace and declare war. The practical guidance of the relations of Britain with foreign states is committed to the Secretary of State for Foreign Affairs and his department. The power, however, of sending ambassadors to, and receiving ambassadors from foreign nations remains an unalienable privilege of the crown. It was doubted whether an exception had not been made in the case of Rome, by the statutes passed against papal encroachments; but such doubts were removed by 11 and 12 Vict. chap. 108, which authorises the sovereign to enter into diplomatic relations, provided that no person in holy orders in the Church of Rome, or Jesuit, or member of any other religious order, community, or society of that church, bound by monastic or religious vows, shall be received as ambassador in London.

The existing diplomatic hierarchy, as fixed by the annex to the Treaty of Vienna in 1815, falls into three ranks. (1) Ambassadors, legates, or nuncios, who alone have the representative character; (2) Envoys extraordinary, or ministers plenipotentiary, accredited to sovereigns; (3) Chargés d'Affaires, who are entitled to transact business only with the Minister for Foreign Affairs. Every diplomatic agent must be furnished with a letter of credence stating the general object of his mission, and requesting that full faith and credit be given to what he shall say on behalf of his court. From the moment that a public minister enters the territory of the state to which he is sent, until he leaves the country, he is entitled to an entire exemption from the local jurisdiction, both civil and criminal. An English ambassador, with his family and suite, whilst abroad in the public service, is held to be domiciled in England; his house is on English ground, and he carries the municipal laws of his own state along with him. Debts incurred in his public capacity must be sued for in England, and, in the event of his transgressing the laws of the foreign nation to which he is accredited, he can be dealt with only diplomatically —i.e. England must be called upon to punish him. An ambassador, as representing a sovereign power, ranks in the court to which he is accredited immediately after the princes of the blood-royal.

The international law of Europe has attributed to certain states what are called *royal honours*, which entitle the states by whom they are possessed to precedence over all others who do not enjoy the same rank, along with the exclusive right of sending to other states diplomatic agents of the first rank. Such *royal honours* are enjoyed by the empires and kingdoms of Europe, and amongst Catholic states by the pope; and the same right extends to the United States of America. Where the rank of different states is equal or undetermined, different expedients have been resorted to for the purpose of avoiding a contest, and at the same time securing the respective rights and pretensions of the parties. This subject was left by the Congress of Vienna on the ancient footing of custom. The most important of these expedients is what is called the *alternat*, by which the rank and place of the various powers are changed from time to time, either in a certain regular order, or in one determined by lot. Thus,

in drawing up public treaties and conventions, it is the usage of the powers to alternate, both in the preamble and the signatures, in such a manner that the name of each state stands first in the copy intended to be delivered to it, whilst the others are arranged in the order determined by lot.

Colloquially the term is frequently applied to conduct which, if not altogether fraudulent, is characterised by a certain degree of cunning and subtlety. This use of the word probably arose from the popular impression that, in conducting the affairs of nations, there is in use a code of morality which would be condemned if practised by individuals in their intercourse with each other. Nor, judging from the old literature of legation, can it be said that this popular conception of the ambassador and his functions was altogether unfounded. Of late years, however, the general progress of international morality, and more advanced conceptions of international relations, have considerably modified the older view of the functions of diplomacy and diplomatists. Speech in the mouth of a diplomatist is no longer an instrument for the concealment of thought; an ambassador is no more a functionary commissioned 'to lie abroad for the advantage of his country,' but one selected to tell the truth on her behalf. In conducting honest negotiation with a view to preserve peace among the nations, so long as it is consistent with the honour of his country; in seeing that the rules of justice are observed among men; in preserving the weaker states against the more powerful; and in the less imposing, though not less difficult duty of watching over the equitable administration of the minor rules of international law, there lies before the modern diplomatist a sphere of action as honourable as it is arduous.

General convenience early suggested the use of one language in diplomatic intercourse. For many centuries Latin was the ordinary medium of political correspondence, but the preponderance of Spain towards the end of the 15th century contributed to the general diffusion of the Castilian tongue for this purpose. This again has been superseded by the language of France, which, since the age of Louis XIV., has become the almost universal diplomatic idiom of the civilised world.—The phrase *Corps Diplomatique* is usual for the whole body of ministers who are present at any court as representatives of foreign countries.

Diplomatics, a term sometimes applied to the science of dealing with ancient writings, is equivalent to *Palæography* (q.v.).

Diplozoon (Gr., 'double animal'), a remarkable flat worm or Trematode. It consists of two organisms fused together. The embryo, known as *Diporpa*, is ciliated and free-swimming, but soon relapses into parasitism. It loses its cilia, settles on a minnow's gills, loses its eyes, and remains for weeks or months like many another Fluke (q.v.). Finally, however, a curious phenomenon occurs. One individual moors itself by its ventral sucker to a conical knob on the back of another, 'which thereupon so twists itself as to fix the first individual in the same manner.' The cones and suckers are closely fused, but otherwise the secondarily twin animals remain independent. This double Trematode well deserves its name of *Diplozoon paradoxum*. See Zeller, *Zeitschcr. f. wiss. Zool.* xxix. (1877).

Diplozoon paradoxum.
(From Leunis, after Zeller.)

Dipnoi (lit. 'double-breathers'), a small order of fishes in which the air-bladder has become a single or double lung. See CERATODUS, LEPIDOSIREN, and MUD FISHES.

Dippel's Animal Oil, a panacea invented by Johann Konrad Dippel (1673–1734), a German chemist and alchemist. It was obtained in the manufacture of ammoniacal products by the distillation of bones. A mixture of oils passes over, and these, after being repeatedly distilled, eventually yield an aromatic liquid, free from fetid odour. This obtained a great reputation as an antispasmodic, and being present in the old spirit of hartshorn, gave it properties somewhat different from those of the modern sal volatile. Owing to the careless way in which it was usually manufactured, and the consequent disgusting odour and taste which it possessed, it has been quite discarded and is no longer used in medicine.

Dipper (*Cinclus*), a genus of birds in the Thrush family (Turdidæ), distinguished by an almost straight, compressed, sharp-pointed bill, by the possession of a nostril valve, and still more by their peculiar manners and habits. They frequent clear pebbly streams and lakes, feeding chiefly on molluscs and on aquatic insects and their larvæ, which they seek even under water, diving with great facility, and moving about by help of the wings. The dipper carries its rather short tail elevated after the manner of wrens, which it also resembles in the 'frequent becks' or dipping of the head, accompanied with an upward jerking of the tail.

Water Ousel (*Cinclus aquaticus*).

One species is found in Britain, the Common Dipper or Water Ousel (*C. aquaticus*), a bird rather smaller than any of the British thrushes, of a generally grayish-black colour, with throat and upper part of the breast pure white. It is found throughout the whole of Europe and the north of Asia, but chiefly in hilly and wooded districts. It is not gregarious. The dipper never fails to attract notice, as it sits upon some stone in the midst of or beside the stream, its white breast rendering it conspicuous as it repeats the movement from which it derives its name. Its song is not confined to the breeding season, and may even be heard among the frosts of winter. There is, of course, no truth in the common belief that the bird can walk on the ground at the bottom of the water. The very curious nest of interwoven moss, domed and with the entrance on the side, is built usually in some mossy bank close by a stream, and often near or under a cascade. The dipper breeds twice in the year. The statement often made that it eats the

spawn of salmon and other fishes, in the belief of which it is much persecuted in Scotland, has never been sufficiently authenticated. Nine other species of world-wide distribution are known.

Dipping-needle, or DIP CIRCLE. The magnetic dip or inclination, one of the three elements necessary for the complete determination of the earth's total magnetic force at any place, is defined to be the angle which the magnetic axis of a magnet, swinging freely in the plane of the magnetic meridian, makes with the horizon. The dipping-needle which is employed to determine its amount at any place, consists essentially, therefore, of a magnetic needle suspended in the plane of the magnetic meridian, so that it can indicate, on a graduated circle in its plane, the angle required. In the accompanying figure one form of the instrument is represented. A is a vertical brass circle, graduated into degrees and fractions of a degree, inclosed between circular glass doors (one of which is seen opened in the figure), and supported on the pillar P. This pillar fits into a socket in the horizontal circular disc B, also graduated at its margin, and from the base of the pillar two flat brass strips, CD, reach on opposite sides to the graduated edge. The horizontal disc is supported on three legs, whose lengths can be adjusted by screwing or unscrewing. On this horizontal circle the vertical

Dipping-needle.

circle can be turned in azimuth. The needle, NS, a thin flat piece of steel, pointed at both ends, is suspended in the plane of the vertical circle by means of hard, polished, cylindrical axles passing through its centre of gravity, and rolling on the agate edges, EE. When the indications of the needle are not actually being read, the axles may be raised by, so as to rest on, two Y-shaped brass edges, which are lifted or depressed again by turning the handle H. On the outside of the glass door a light cross-bar carries a flat rod, at each end of which a magnifying lens or microscope is placed to read off the dip of the needle as indicated by its ends, on the graduated vertical circle. For the purpose of setting the one circle truly horizontal and the other truly vertical, one level, L, is placed on the horizontal circle, and another, M, on the top of the vertical circle.

If the needle be swinging freely in the plane of the magnetic meridian, if its centre of gravity lies in the axis on which it is free to rotate, and if its magnetic axis coincides with its axis of figure, it will correctly indicate the dip. But there are numerous errors possible in such an instrument which can only be avoided by taking the mean of two observations which have errors of equal amount but of opposite sign. This duplication of observations has to be carried out for each of the known possible instrumental errors, so that finally the true angle of inclination or dip is obtained, as the mean of no less than sixteen readings. The errors in question may be due to the following causes: (1) The vertical circle may not be properly set, and in consequence, when the needle is standing vertically, it does not point exactly to 90°, as it should; (2) the bearings of the needle may not be exactly in the centre of the circle; (3) the centre of gravity of the needle may not be in the axis on which it can rotate; (4) its magnetic axis may not coincide with its axis of figure; (5) there may be friction or adhesion at the bearings.

In making an observation of the inclination with the instrument, the first requisite is the adjustment to verticality of the vertical circle by means of the levels. The plane of the magnetic meridian must then be found, and the axis turned round until the vertical circle is in that plane. This is done by finding the position in which the needle stands vertically, for in that position, which is at right angles to the plane of the magnetic meridian, the horizontal component of the earth's magnetic force is non-effective, owing to the mode of suspension; the vertical component only is effective, and causes the needle to hang vertically. The plane of the needle is then moved through 90°, and is thus brought into the magnetic meridian. In making this observation of the plane in which the needle stands vertically, it is necessary, in order to eliminate the effect of faults in construction already noted, to take a reading from the lower end, and one from the upper end of the needle; then, turning the circle round through 180°, to make other two in the same way; the mean of these four readings, with 90° subtracted, gives the plane of the meridian. To determine the angle of dip, four readings are taken, two with the face of the instrument towards magnetic east, and two with it facing magnetic west; one of each two being with a marked side of the needle facing the circle, the other being in the reversed position. The needle is then magnetised afresh, so that its polarity is reversed, and another series of four similar readings is obtained. The mean of these eight readings gives the true amount of the inclination.

The turning of the instrument through 180° is to avoid any error due to that noted above as (1); to counteract (2), readings of both ends of the needle are taken; presenting both faces (or sides) of the needle, neutralises the effect of any error such as (3); errors such as (4) are obviated by the reversal of polarity.

The dipping-needle is not of such form as is convenient for continuous registration; for these requirements—i.e. the variations of the vertical component of the earth's magnetic force, the vertical force magnetometer is used. See MAGNETOMETER.

Diprotodon, a huge Australian tertiary marsupial, a gigantic kangaroo. The head alone was 3 feet long. See KANGAROO.

Dipsaceæ, or DIPSACACEÆ, the order of Teasel (q.v.) and Scabious (q.v.).

Dipsas, a genus of non-venomous serpents of the family Colubriformes. The body is much compressed laterally; the head is thick, blunt, and distinct from the neck; the scales are smooth. They are nocturnal, arboreal animals, feeding chiefly on lizards, frogs, and small birds, and are most abundant in neotropical and oriental regions.

D. dendrophila, from the East Indies, is over six feet in length. *Dipsas cyanodon* is a large and beautiful species found in Java and Sumatra.

Dipsas cyanodon.

Dip-sector, an astronomical instrument for determining the dip of the horizon, is in principle similar to the Sextant (q.v.). See HORIZON.

Dipsomania, or OINOMANIA, as it is now sometimes termed, is a recurrent form of insanity, and consists in a paroxysmal craving for stimulants which impels its victim to indulge the insane propensity at all hazards. An attack, when once begun, is almost invariably carried on until the poison puts an end to the possibility of further excesses, either by sheer exhaustion of the system or by failure of the digestive processes. When the paroxysm has passed, there may be a prolonged period of abstinence, but contact with alcohol in any form is apt to be but the prelude to another lapse into the insane gratification of the imperious appetite. This condition is usually associated with mental decay, and more especially with moral degradation; and the sufferer sinks into a condition in which he shows little intellect beyond the low cunning and tricky deceit necessary to obtain the means wherewith to indulge his impulsive craving for drink. It occasionally arises from vicious habits due to want of self-control and self-respect, but much more commonly has its origin in some inherited tendency to mental disturbance. Dipsomania is therefore, as might be expected, one of the many manifestations of hereditary unsoundness of mind. Viewed in this light, the present state of the law in Great Britain is entirely inadequate to meet such cases, and it is to be hoped that legislation may be obtained granting powers to deal effectively with them, and prevent the grave social evils which they produce. See ALCOHOLISM, INSANITY, and INEBRIATES (RETREATS FOR).

Dip'tera (Gr., 'two-winged'), a large order of two-winged insects, distinguished even by Aristotle, includes the house-fly, blow-fly, midge, daddy-long-legs, gnat, mosquito, &c. The most important general characters are as follows: The wings are two, transparent, never folded, with predominant longitudinal veins; the hind-wings are transformed into small 'balancers' or 'halteres,' rarely absent; the mouth organs are adapted for piercing and sucking, the palps on the first pair of maxillæ are free or absent, those of the second pair are modified into a tongue or labella; there is a complete metamorphosis (larva, pupa, and imago); the larva is a footless maggot or a grub with secondary feet, its mouth parts are adapted for biting or for sucking; those of the pupa are adapted for sucking. The order is very large, numbering probably from 15,000 to 18,000 species, not including the fossil forms preserved in amber and the like. Many species, both as adults and as larvæ, are directly or indirectly of economic importance because of their attacks on man, domestic animals, household stores, and cultivated plants; others again mitigate the ravages of other insects. The order will be found illustrated under separate articles—e.g. BLOW-FLY, CORN INSECTS, DADDY-LONG-LEGS, FLEA, GNAT, HESSIAN FLY, HOUSE-FLY, MOSQUITO, &c. See Löw, *Beschreibung europäischer Dipteren* (1869–73); Taschenberg, *Die Flöhe* (1880); and F. Walker, *Insecta Britannica: Diptera* (1851–56).

Dipteraceæ, or DIPTEROCARPACEÆ, an East Indian order of thalamifloral dicotyledons, including about 112 species, of which many are majestic trees, valued alike for timber and balsamic resins (see SAL, COPAL, DAMMAR, &c.). *Dipterocarpus turbinatus*, the Gurjun tree, and other species, yield a fragrant oily resin, the so-called Gurjun balsam, while that of other species is sometimes called Dammar.

Diptych, a two-leaved writing tablet, in which were inscribed the names of living or dead Christians to be read aloud during the celebration of the eucharist. The practice was due originally to a custom under the Roman empire of magistrates, such as consuls, prætors, and ædiles, at the commencement of their office, giving away tablets inscribed with their names and portraits. In Christian usage it was in very early times customary to inscribe the names of dead bishops—a beginning of the calendars and martyrologies of later days. The insertion of the names of living persons may have had its origin in the ancient recital of the names of those who had voluntarily furnished the elements for the holy communion. It afterwards was extended to include the names of the living faithful, especially those in authority, ecclesiastical and civil. The commemoration of the faithful dead was originally distinct from any special prayer on their behalf. The earliest diptychs in existence are not older than the 5th century of our era. They are of various sizes, rarely exceeding eight inches by four, are sometimes of ivory and metal, as well as wood, and are adorned with an art that is elaborate, if not always beautiful.

Dipus. See JERBOA.

Dir'ce, wife of Lycus, treated with great cruelty her husband's divorced wife Antiope. The sons of Zeus by Antiope took vengeance on their mother's foe by tying her to a wild bull, which dragged her about till she died—a subject represented in a famous antique statue group.

Dircks, HENRY, civil engineer, born at Liverpool, 26th August 1806, is known as the author of works on perpetual motion (1861) and electrometallurgy; of *The Ghost* (in which he describes his invention, commonly called 'Pepper's Ghost') (1863), of a life of the Marquis of Worcester (1865), of *Inventors and Inventions* (1867), and of novels and essays. Died in 1873.

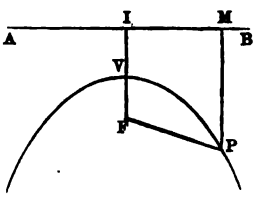
Director, one of a number of persons appointed to conduct the affairs of joint-stock undertakings, such as banks, railways, water and gas companies, fire and life assurance companies, and various kinds of manufacturing and trading companies. See COMPANY.—Director is a name used by Catholics for a spiritual guide and confessor.

Directorium is the part of the Catholic church calendar which gives the order of the festivals and prescribes the services for the several days of the year.

Directory, a name applied to a board of guardians over any commercial, industrial, or scientific enterprise. Historically the name refers to the body of five men—Lépeaux, Letourneur, Rewbell, Barras, and Carnot—to whom the executive was intrusted in France after the downfall of the Terrorists, 26th October 1795 (5th Brumaire III.), and which lasted till the 9th November 1799 (18th Brumaire VIII.). Its corruption and incompetence made government impossible, and it was overturned by the Abbé Sièyes and Bonaparte, who established in its stead the consulate, soon itself to fall before the imperial ambition of Napoleon.

Directory for Public Worship, a code of regulations concerning the different parts of public worship, drawn up by the Westminster Assembly in 1644, ratified by the English parliament in the same year, and adopted by the General Assembly of the Church of Scotland on the 3d February, and by the Scottish parliament 'without a contrary voice,' on the 6th February 1645. It was on express order from both Houses of the English parliament that the Westminster Assembly addressed itself to the work of preparing this Directory, to supply the place of the Book of Common Prayer, which had been abolished. In Scotland it was hailed as conducive to 'a happy unity and uniformity in religion among the kirks of Christ in these three kingdoms, united under one sovereign,' and to 'the corroboration of peace and love between the kingdoms.' Many of the regulations of the Directory are still complied with in all branches of the Presbyterian Church in Scotland, but in many things it has been generally departed from. The Directory is printed in vol. v. of Neale's *History of the Puritans*, and is usually appended to the Confession of Faith.

Directrix. If a point so move that its distance from a given fixed point is to its perpendicular distance from a fixed straight line in a constant ratio, it describes a conic section, of which the fixed straight line is termed the *directrix*, and the fixed point the *focus*. The constant ratio referred to is termed the *eccentricity*, and its magnitude determines the nature of the conic. Thus, if in the figure AB be the directrix and F the focus, if the point P move so that its distance from F is to its distance PM from AB in a constant ratio, then P will trace out a conic section, which will be an ellipse, parabola, or hyperbola, according as the ratio in question is less than, equal to, or greater than unity—i.e. as FP is less than, equal to, or greater than PM, or FV than VI.



Dirhem, a modification of the Greek *drachma* (see DRACHM), was the name under the califs for a weight of silver equivalent to about forty-five grains, and was also used for precious stones and medicine in Arabia, Persia, Egypt, and Turkey. As a coin the value varied, but may be given at 5½d. under the califs. In Turkey, the name dirhem has lately been given to the much smaller weight, the French gramme.

Dirk (Gael. *duirc*) is a dagger. In the complete equipment of the Scottish Highlander, the *skean-dhu* ('black knife') is worn thrust inside the stocking.—The side-arm worn by midshipmen and cadets of the royal navy when on duty is also called by this name. The weapon is a broad blade some 18 inches in length, furnished with a white fish-skin handle. This weapon, which superseded the sword in 1856, is clumsy, unsightly, and of small use for purposes of offence or defence.

Dirk-Hartog Island, measuring 40 miles by 10, lies off the west coast of Australia, and, with Peron Peninsula to the south, incloses the Freycinet Inlet, while, with two smaller islands to the north, it forms the breastwork of Shark's Bay.

Dirschau, a manufacturing town of Prussia, on the left bank of the Vistula, 20 miles SSE. of Danzig by rail, the line here crossing the river by a lattice viaduct (1850–57) 911 yards long. Polish from 1466 till 1772, it now has great railway works and sugar-factories. Pop. (1875) 9727; (1885) 11,146; (1890) 11,897.

Dirt-beds, the quarrymen's name, introduced into geology, of several layers which occur in the Purbeck Beds (q.v.), having the appearance of black dirt, and which were explored in 1857 by Mr Beckles, in 1880 by Mr Willett. They rest on the fresh-water limestones of the Purbeck, and consist of one principal layer, from 12 to 18 inches thick, and from two to four thinner layers. The substance is to a large extent a dark-brown or blackish earthy lignite, being the remains of an

Dirt-bed (Isle of Portland):
a, fresh-water calcareous slate, &c.; *b*, dirt-bed with stools of trees; *c*, fresh-water bituminous limestone, &c.; *d*, Portland stone, marine.

ancient vegetable soil. Through it are dispersed in considerable abundance rounded fragments of limestone (derived from the underlying bed) from 3 to 9 inches in diameter. Fossil Cycads (q.v.) are the predominant vegetable remains; they occupy their original upright position, having become fossil on the spots where they grew. The stumps stand erect for a height of from 1 to 3, or even more feet, and at distances from each other similar to what may be observed in a recent forest. Besides these, the dirt-bed contains the silicified stems of coniferous trees, laid prostrate, in fragments 3 or 4 feet in length. From the accompanying diagram it will be seen that the marine conditions under which the Jurassic limestone (Portland stone) was accumulated were succeeded by estuarine and fluviatile conditions, when the overlying calcareous beds forming the base of the Purbeck series were deposited. These beds were in like manner overspread with sandy carbonaceous clay, which eventually formed a land surface upon which grew a forest of cycads. Subsequently this forest was submerged and converted into a morass; and the trees decayed, and were eventually overturned by the force of wind or flood. Thereafter they were buried under newer accumulations of silt and calcareous mud, which now form the overlying fresh-water calcareous slate, &c.

Dis, the Roman equivalent of the Greek Pluto (q.v.). It is akin to *divus*, and originally denoted merely 'godhead' or 'deity.'

Disability, in Law, is either absolute, which wholly disables the person from doing any legal act—e.g. outlawry, excommunication, attainder, alienage—or partial, as infancy, lunacy, and drunkenness. For Catholic and Jewish disabilities, see CATHOLIC EMANCIPATION and JEWS.

Disbar, to degrade from the rank of barrister-at-law. This power is in England reposed in the benchers of the four Inns of Court. As the courts of law require that every barrister, before he is allowed to practise, must have been admitted to that office by one of the Inns of Court, so they will refuse to hear any one who has been deprived of his rank by the same authority. The power is rarely exercised, and only when the conduct of the offending party has been grossly irregular, one case of disbarring having occurred in 1862, and another in 1874. In the United States, the power to disbar is vested in the courts which have power to admit counsellors and attorneys to the bar.

In Scotland, the power to disbar rests in the Faculty of Advocates (see ADVOCATES).

Disc, in Botany, is a term applied with considerable vagueness by different authors to modified regions of the floral axis, particularly when forming a prominent ring supporting functional or rudimentary stamens, or bearing glands or nectary. See AXIS, FLOWER.

Disc and **Discobolus.** See QUOITS.

Discharge. See BOIL, PUS, WOUNDS, &c.

Discharge from service in the British army is a matter of right at the expiration of the period of 12 years (with the colours, or with the colours and in the reserve, as the case may be) for which a soldier has enlisted (see ARMY, Vol. I. p. 434; and ENLISTMENT). At the end of that period he is then entitled to be discharged, but without pension; but if in consequence of his good service he is allowed to re-engage for a further period of 9 years' army service, he becomes entitled to a pension, and may in some circumstances further prolong his service beyond 21 years, with a right to discharge and pension (unless forfeited by misconduct) after giving three months' notice. At the end of 16 years a re-engaged man can also, if recommended, obtain a free discharge, but without pension, which can only be earned by 21 years' service. Any soldier during peace may purchase his discharge at a rate varying with the length of time which he still has to serve and the corps to which he belongs, but not exceeding £35 as a maximum. He may be discharged by the competent military authority at any time if he has been convicted by the civil power either before or after enlistment, also when sentenced by court-martial to penal servitude or to be 'discharged with ignominy,' when reported by his commanding officer as 'incorrigible and worthless,' or when found medically unfit. He is always entitled if abroad to be brought to the United Kingdom free of expense, and to a parchment certificate stating his service, conduct, and cause of discharge, with a note of any qualification he may have for special employment in civil life.

Discharge of Seamen is conducted in the same form as the engagement of seamen. Each person discharged receives an official paper giving the particulars of the voyage, with his rating, &c. If there is any dispute as to the total amount of wages a seaman is then to receive, the superintendent of the government mercantile marine office where the seaman is paid off may adjudicate, if the amount in dispute does not exceed five pounds, and his decision is final; or he may leave the matter to be settled in a court of law. A seaman who is discharged abroad and becomes distressed may be sent home at the expense of the owner of his last ship, or at the expense of the Mercantile Marine Fund. Under Indian acts, Lascars and other native seamen who may be discharged elsewhere than in India must be returned to the port they shipped at. See CREW.

Disciples of Christ. See CAMPBELL (ALEXANDER).

Disciplina Arcani (Lat., 'Discipline of the Secret'), a term first employed by the German controversialists Tentzel and Schelstrate (1683–85) to denote a discipline of the early church, founded upon the words of Christ in Matt. vii. 6, and on 1 Cor. iii. 1–2, and Heb. v. 12–14, in virtue of which the knowledge of certain doctrines and the liberty of presence at certain rites connected with the most solemn mysteries of the Christian religion were withheld by the initiated from pagans and catechumens. Both unbelievers and catechumens were removed from the church at the commencement of what was afterwards called the *Missa Fidelium* (see MASS); such doctrines as regarded the sacraments of baptism and the eucharist were either not mentioned in the presence of these classes, or were referred to in enigmatical language, unintelligible to the uninitiated. This principle of reserve accounts for the absolute silence as to the eucharist preserved in many early Apologies; the earliest indications of the discipline are met towards the close of the 2d century. After the 6th century, all need for it having disappeared, the practice was discontinued. See Newman's *Arians;* Rothe, *De Disc. Arcani;* and Bonivetsch, in the *Zeitschrift für historische Theologie* (1873).

Discipline. See ARMY DISCIPLINE, Vol. I. p. 438; CHURCH DISCIPLINE, Vol. III. p. 235.

Discipline, BOOKS OF, the First and Second, embody the constitution and order of procedure of the Church of Scotland from the period of the Reformation. The *First Book of Discipline,* or the 'Policie and Discipline of the Church,' was drawn up under a commission from the Privy-council of Scotland, in 1560, by John Knox and other four ministers—John Row, John Spottiswoode, John Winram, and John Douglas. These ministers, the same year, had prepared the doctrinal Confession of Faith of the church, which was inscribed among the acts of parliament as a statute of the realm; but for the practical government and discipline of the church, a form of order more elaborate than that imported from Geneva was required, and this was provided in the *First Book of Discipline.* It was approved by the General Assembly, but on being presented to the Privy-council several members manifested opposition to some things in the book, and it was not ratified by the council as such. Most of the members, however, subscribed it, and pledged themselves to set forward its regulations. These had reference principally to (1) the providing of ministers for the numerous congregations all over the country, but as ministers were then few in number, the temporary expedient was resorted to of appointing readers, exhorters, and superintendents; (2) the order of public worship and dispensation of the sacraments; (3) the establishment of schools in every parish, and of colleges in every 'notable' town; (4) the provision to be made for the support of ministers, schoolmasters, and the poor; and (5) the mode of dealing with offenders against the laws of the church. Subscription of the *First Book of Discipline* was required of all ministers of the church before admission to office.

On account of the urgent need which was felt for such a book, it was prepared with haste, and several important matters were soon found to have been omitted. So early as 1563 a revised book of discipline was desiderated, but in consequence of the harassments of civil dissensions the revision was postponed. In 1575 a committee was appointed to take charge of the matter. Of this committee Andrew Melville was a prominent member, and the result of its labours was—

The *Second Book of Discipline,* or 'Heidis and Conclusiones of the Policie of the Kirk.' This was received and adopted by the General Assembly in 1578, and in 1581 that venerable body ordered that it should be engrossed at length in their register, and that copies should be taken by all the presbyteries of the church. Efforts were made to have it ratified by parliament at the time, but without success. It was, however, on the basis of the *Second Book of Discipline* that the constitution of the Church of Scotland was settled by the Scots parliament in 1592, and again in 1690. It is sworn to in the National Covenant, and was ratified by the General Assembly in 1638 as well as in 1645, when the Assembly received and adopted the 'Form of Church Government' prepared by the Westminster Assembly of

Divines. It was not intended that the *Second Book of Discipline* should annul or supersede the first, but rather that it might amplify and qualify its regulations. Profiting by the experience gained under the operation of the first book, the church by the second abolished the temporary expedients to which the exigencies of the case had obliged them formerly to resort; and in the new book the Presbyterian system was established on the broad and solid platform on which it stands to the present day. Both Books of Discipline are still standards in the Church of Scotland, and also in some of the other Presbyterian bodies which have seceded from it.

Disco, an island on the west coast of Greenland, under the parallel of 70° N. It is mountainous, reaching a height of 3000 feet, and has a total length of about 90 miles, and contains much excellent coal. The harbour of Godhavn is on the southern coast.

Discoboli, Cuvier's name for the Lumpsuckers (Cyclopterus), beside which he placed the Remora (q.v.). The term is still used for the family to which the Lumpsucker (q.v.) belongs.

Discomycetes. See FUNGI.

Discontinuance. See ABANDONMENT.

Discord is a combination of notes which leaves the ear unsatisfied unless it is followed by further combination, usually a concord, which is termed the *resolution* of the discord. See MUSIC.

Discount is an abatement made when a debt or bill is paid before its due date. True discount in arithmetic is the difference between the amount of a future payment and its present value. Thus if £105 be due one year hence, the discount (at 5 per cent.) will be £5, and the present value £100; for £100 will amount to exactly £105 in one year at 5 per cent. But the practice of bankers and bill-discounters, which is sanctioned by mercantile usage, is to charge *interest* on the principal sum for the period discounted—i.e. from the date when the cash is advanced till the date when payment is due. In the above example, a banker would charge £5, 5s. for discounting a bill of £105 due one year hence, at 5 per cent.; so that he gets an advantage of 5 per cent. over the arithmetical discount, which, as we have seen, is £5. The rate of discount varies according to circumstances, the official bank-rate being usually higher than that obtainable in the market. In the case of foreign bills, instead of a fixed charge being made for discount, the usual practice is to quote a rate of exchange lower than the current rate, so as to cover this charge. The term discount is also applied to the depreciation in value of stock, &c. Thus if a loan is issued at the price of £90 cash for a nominal £100, it is said to be at a discount of 10 per cent. Shopkeepers often grant a discount on prompt payment of an account, or as an encouragement to further dealings.

Discovery. The English common law did not permit a party to an action to be a witness; but a court of equity would compel him to discover or disclose facts which his opponent had a right to know. Parties may now give evidence; but discovery is granted before trial, in any division of the High Court, of such facts or documents as a party requires in order to frame his own case. But a party is not permitted, by means of discovery, to obtain a premature disclosure of the case of his opponent. In the United States, the rules of practice are substantially the same as those of the English courts.

Disease, according to its literal construction, a state of *dis-ease*, or absence of the condition of health, in which all the faculties and organs of the body and mind work together harmoniously and without sensible disturbance. It is common to treat of disease as being *functional* or *organic*—i.e. evidenced by changes of function or of structure; but function and structure are so closely allied in fact and in nature, that the more this distinction is examined, the more vague and impalpable it becomes, and it can therefore only be kept up as a provisional and conventional arrangement. (See PATHOLOGY, MEDICINE, GERM THEORY OF DISEASE (under GERM); and for individual diseases, see under their names. The diseases of plants are treated at PLANTS; of animals, under such separate headings as ANTHRAX and DISTEMPER.)

A classification of diseases is a necessary preliminary to any general inquiry regarding them; particularly to such statistical methods as are involved in the tabulation of causes of death by registrars, in returns of hospitals, and of the medical departments of the army and navy, &c. The standard authority in Britain as regards diseases affecting man is the *Nomenclature of Diseases*, published under the supervision of the Royal College of Physicians of London. We give a short outline of the arrangement adopted in the second edition (1885). The list includes nearly 900 names of diseases, besides the various poisons and injuries specified, which extend it to more than 1200.

I. General Diseases, or diseases of the whole body, and those which may be distributed in several parts at one time.

Group A. Diseases dependent on morbid (i.e. disease) poisons (specific febrile diseases). Sub-group (1) (including all the most familiar)—e.g. smallpox, measles, scarlet fever, typhus, diphtheria, enteric (or typhoid) fever, cholera; (2) malarial diseases—ague, beri-beri, &c.; (3) erysipelas, pyæmia, septicæmia, &c.; (4) venereal diseases—syphilis, gonorrhœa; (5) diseases usually occurring only in animals—hydrophobia, glanders, splenic fever or anthrax.

Group B. Diseases dependent on external agents other than morbid poisons. Sub-group (1) Diseases dependent on parasites, animal or vegetable; (2) effects of poisons; (3) effects of injuries (including heat, cold, electricity, over-exertion, &c.) and climate; (4) diseases produced by errors of diet—surfeit, starvation, scurvy, alcoholism.

Group C. Developmental diseases—immaturity, malformations, debility, old age.

Group D (not classified) includes rheumatism, gout, tumours, tubercle, cretinism, leprosy, anæmia, diabetes, &c.

II. Local Diseases (arranged under the systems and organs of the body affected). Only the most important groups are here given.

Diseases of the nervous system (brain, spinal cord, and nerves). Sub-section (1) Inflammation, abscess, softening, &c. of its various parts; (2) apoplexy, paralysis (many forms), convulsions, epilepsy, hysteria, neuralgia, &c.; (3) insanity, idiocy, &c.

Diseases of the circulatory system (heart, arteries, veins, &c.)—e.g. pericarditis, valvular heart-disease, aneurism, varicose veins. Diseases of the respiratory system (larynx, lungs, &c.)—e.g. laryngitis, bronchitis, pneumonia, pleurisy. Diseases of the digestive system (mouth, throat, stomach, intestines, liver, &c.)—e.g. stomatitis, sore throat (of various kinds), gastritis, enteritis, hernia or rupture, congestion of liver, gallstones, peritonitis. Diseases of the lymphatic system (spleen and lymphatic glands and vessels)—e.g. ague-cake, lymphadenoma, elephantiasis. Diseases of the urinary system (kidneys, bladder, &c.)—e.g. Bright's disease, movable kidney, cystitis, calculus or stone. Diseases of the generative system (testicles, uterus, &c.)—e.g. hydrocele, ovarian tumour. Diseases of the organs of locomotion

(bones, joints, muscles, &c.)—e.g. caries, necrosis, synovitis, ankylosis, curvature of spine, club-foot, ganglion. Diseases of the skin—eczema, nettle-rash, shingles, acne, chilblains, corns.

Diseased Meat. See MEAT.

Disestablishment. See STATE RELIGION.

Dishonour of a Bill. A bill is said to be dishonoured when the person on whom it is drawn, and to whom it is duly presented, either for acceptance or for payment, refuses to accept or to pay. See BILL OF EXCHANGE.

Disinfectants are, strictly speaking, agents which can prevent infectious diseases from spreading, by destroying their specific poisons. The term is, however, often applied to all substances which destroy or neutralise bad odours, though not all such have the power of counteracting infection. Many infectious diseases have now been proved, and all are believed, like Putrefaction (q.v.), to be due to special micro-organisms which are found in different parts of the body, and are communicable in different ways in different diseases (see GERM THEORY). The action of disinfectants is therefore exactly analogous to that of Antiseptics (q.v.), and consists in the destruction of low forms of life. But the two classes do not necessarily correspond, as the same substance may have unequal poisonous effects on different forms. It is of the utmost importance to discover the conditions which are most deadly to each disease-poison, and to apply them, if possible, within as well as without the diseased body. But little has yet been done in this direction.

Carbolic acid, which probably stands highest in popular esteem as a disinfectant, is undoubtedly one in the strict sense. It is not, however, in the very dilute state that it can act thus, and it is necessary to use it comparatively concentrated before good can result. Thus a 2 per cent. solution, mixed with vaccine lymph, completely destroys it, but a more dilute solution has almost no action on it. As a deodoriser, carbolic acid is not so energetic as chlorine and permanganate of potash, but there is this great difference, that while the acid destroys the organic substances which give rise to the offensive odour, the others mainly attack the odour itself, and therefore require to be applied frequently if perfect sweetness is desired. Thus a piece of putrid flesh is not rendered odourless so quickly by carbolic acid as by the other substances named, but one thorough application of it will prevent the recurrence of decay, a property not possessed by the others.

The vapour of carbolic acid is not a disinfectant at ordinary temperatures, as bacilli are not destroyed, even when exposed to it for six weeks. It is therefore evident that the mere exposure of that substance in vessels is of no service in disinfecting a room. It is curious that carbolic acid dissolved in oil or alcohol has no antiseptic action whatever, but that if water be present, as in the case of a wound, it acts powerfully.

Sulphurous acid has long been in repute, both in the form of solution and in the gaseous state. Recent experiments on cultivated bacilli seem to prove that, while in the liquid state it is a powerful disinfectant, it has little action either as dry gas or along with water vapour.

Mercury salts, such as the perchloride (corrosive sublimate) and biniodide, are powerful disinfectants, and are much used at present as antiseptics. For general domestic use, however, they have great disadvantages. The former attacks metals, and therefore ruins many pipes, while it is very rapidly neutralised by the presence of organic matter, especially where sulphuretted hydrogen has been developed. The biniodide is preferable, but neither of them is completely satisfactory. Of all the long list of popular disinfectants, chlorine, bromine, iodine, osmic acid, potassium permanganate (Condy's fluid), and corrosive sublimate seem to be the most certain and rapid in their action, but all of these are more or less open to objections. The employment of fumigating pastilles, burning brown paper, camphor, benzoin, mastic, amber, lavender, and other odoriferous substances, is merely serviceable in cloaking over the offensive, fetid, and hurtful gases, and should never be resorted to unless in conjunction with the use of other agents possessing the properties of true disinfectants.

It will be seen from the foregoing that a general, satisfactory disinfectant is still a desideratum, and that even those in most use require favourable conditions, and a more lavish application than is generally forthcoming. See, for Condy's fluid, the article MANGANESE.

Dislocation consists in the displacement of one bone from another with which it forms a joint (*put out of joint* being the popular expression). Dislocations are generally the result of sudden accident, but may be the result of disease, or may be congenital. The displacement may be *partial* or *complete;* and surgeons classify their cases into *simple* dislocations, when the skin remains unbroken, and *compound*, when there is a wound by which the external air may communicate with the joint. Occasionally, in addition to the dislocation, there are fractures of the bones, or lacerations of important blood-vessels in the neighbourhood, or other injuries; it is then termed a *complicated* dislocation. Dislocation is a rare accident in infancy and old age, because in the former the joint-ends of the bones are very flexible, and yield to violence; while the aged skeleton is so rigid that the brittle bones fracture under force that would drive mature and stronger ones out of their sockets. Dislocations are most frequent between the ages of twenty and sixty. Persons with weak muscles, and lax, long ligaments, or those in whom the latter have been softened by inflammation of the joint, are predisposed to dislocation. The shoulder is far more frequently dislocated than any other joint in the body; in the lower extremity the hip most often suffers.

General Symptoms of a Dislocation.—After a blow, fall, or violent muscular exertion, a limb is found to have lost its natural mobility at the injured joint, though there may be some movement in abnormal directions under examination; there is great pain, and the shape of the part is changed; but soon swelling ensues, and every distinctive mark about it is obscured. If left alone, or merely treated as an inflamed joint, the swelling gradually subsides; but the immobility continues, the limb is crippled for months or years, when at last nature forms a new socket for the end of the bone, and some amount of useful motion is recovered. The proper shape of the part is never restored, but remains an eyesore to the patient, and a disgrace to the surgeon.

The general treatment of dislocations consists in their *reduction*, or bringing the displaced bone back into its place. Its return is opposed by the muscles attached to it, these being stimulated to contraction by the pain of the operation, and by the ligaments surrounding the joint, which generally fix it in its unnatural position. Sometimes it is necessary to remove this spasm of the muscles, and in former days bleeding from the arm, emetics, the warm bath, &c., were generally made use of; nowadays chloroform or ether attains the same ends, and renders the treatment of dislocations much more simple and humane than before the introduction of anæsthetics.

Till about the year 1870, reduction of dislocations was generally effected by means of *extension*.

When the surgeon is about to reduce a dislocation in this way, he fastens the part of the limb above the displaced bone or the trunk, so as to afford him *counter*-extension; he then pulls on the limb either with his hands, or with a bandage or skein of worsted attached to it. This he fixes by making a *clove-hitch* on it—i.e. two loops in opposite directions laid together (see figure), and slipping it up the limb to the point desired, where a wet bandage has previously been applied to give a firmer hold. In old-standing cases in the larger joints, the hands grew weary before the extension had been kept up sufficiently long; and it was often found necessary to adapt pulleys to draw upon the clove-hitch, as with them the traction could be made as strong as the surgeon desired. Sudden, forcible pulling is useless and hurtful, the main object being merely to tire out the muscles which resist the attempts at reduction; when they are exhausted, the bone will generally slip back into its place with an audible snap.

Clove-hitch.

Of late years, however, reduction by extension has been to a very large extent given up in consequence of the general adoption of reduction by *manipulation*. This method, known it seems from ancient times, but curiously neglected, consists in executing certain complex movements of the dislocated limb which effect the return of the displaced bone to its socket by ingeniously utilising its unruptured attachments and evading the opposition of the muscles, by fraud rather than by force. It is particularly applicable to the hip, which, as it is commanded by the strongest mass of muscles in the body, always presented the most formidable obstacles to the old method. The first paper on this subject which attracted general attention was by Dr Reid of Rochester, U.S. (1851); and in 1869 Professor Bigelow of Boston published a careful and exhaustive discussion of injuries to the hip, with such full and clear directions for the manipulation method, as to secure its general adoption in the case of this joint by surgeons in this country as well as in America. The method, however, had been described and used in France and elsewhere, though with less care and precision, in the earlier half of the 19th century.

The class of persons called Bonesetters (q.v.) almost invariably give the opinion, in cases of stiff joints brought to them, whether as the result of disease or injury, that 'a bone is out;' and if a regular practitioner has been treating the case, further say that he has failed to detect it. They are almost invariably wrong in this opinion; for there are very few cases of dislocation not easily recognisable, at all events after the swelling following the accident has subsided. When, however, the forcible movements they employ succeed in improving the condition of the joint, their view is naturally adopted by the patient and his friends that they have replaced the 'bone.' In most cases of this kind, what really takes place is the rupture of Adhesions (q.v.) remaining after sprains or bruises in the neighbourhood which limited and rendered painful the movements of the joint.

Whenever a dislocation occurs, the nearest medical man should be summoned, even should the mere displacement be rectified at once, because no such accident can occur without some tearing of the soft parts, and it will depend on the after-treatment whether the joint will ever become useful again or not. It must also be remembered that the sooner a dislocation is reduced the easier is the reduction. Since the introduction of anæsthesia, however, and the subcutaneous division of tissues, many ancient cases may be improved, and many crippled limbs restored to usefulness.

Dislocation, or FAULT, a term used in Geology to characterise certain displacements common among rocks. Rocks have been fractured and displaced, or shifted along the line of breakage. Such faults may occur with or without distortion of the fractured rock-masses. Sometimes the fissure is smooth and close. In other cases the rocks are jumbled and shattered along the line of dislocation, and the fissure (sometimes several yards in width) is often filled with a breccia of blocks and debris forming what is termed *fault-rock*. The opposite walls of a fault are not infrequently smoothed, polished, and marked with rectilinear striæ, which are called Slickensides (q.v.), and similar markings frequently occur on the faces of the joints that invariably abound in rocks in the neighbourhood of faults. Dislocations are rarely quite vertical, their inclination from the vertical being called their *hade*. The diagram shows one of the simplest kinds of fault. The amount of vertical displacement of the beds is the *amount* of the throw, and is measured by protracting a line across the fault, from the truncated end of some particular bed, *a*, until it is reached by a perpendicular, AB, dropped from the other end of the selected stratum. All normal faults hade in the direction of downthrow, so that when a miner meets a dislocation, he has only to look at the hade to ascertain at once whether he must seek for

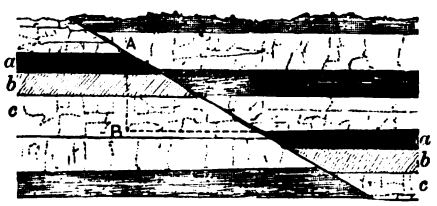


Diagram of Dislocated Strata.

the continuation of the displaced seam at a higher or lower level. Thus, if he happened to work the coal-seam, *a*, shown in the diagram, up to the dislocation at A, he would see from the hade of the fault that the missing seam must be sought for at a lower level, and he would describe the fault as a downthrow or downcast; whereas, if he reached the fault from the lower level, he would call it an upthrow or upcast. There is another class of faults in which the hade is not in the direction of downthrow: these are termed *reversed* faults. They rarely occur in strata which are not highly folded and plicated, but in regions where the rocks give every evidence of great lateral crushing and squeezing, as in true mountains of elevation, they are of common occurrence. Remarkable faults of this kind have been discovered in the north-west of Scotland. The inclination from the vertical of some of these faults is very great, in fact some approach horizontality, so that the strata on the high side overlie the rocks on the lower side of the fault, like successive strata in a conformable series. One set of rocks belonging to a low horizon has been pushed horizontally over the surface of another set pertaining to a higher horizon for distances of 10 and even 20 miles. The amount of vertical displacement produced by normal faults may vary from an inch or two up to many thousand feet. Thus, the great fault between the Highlands and Lowlands of Scotland has a downthrow of not less than 8000

feet, while the similar dislocation between the Lowlands and Southern Uplands of the same country amounts in places to 15,000 feet.

Dismal Swamp, measuring 30 miles from north to south by 10 in breadth, lies chiefly in Virginia, but partly in North Carolina. In the centre is Lake Drummond, about 6 miles broad; elsewhere its dense growth of cypress and cedar has been greatly thinned, and part of the region has been reclaimed. The tract is intersected by a canal connecting Chesapeake Bay and Albemarle Sound.

Dismas, the name which Catholic tradition has attached to the penitent thief, while his impenitent comrade is styled Gesmas.

Dismembered. See DEMEMBRÉ.

Disorderly House. See NUISANCE.

Dispensaries are institutions for supplying the poor with medical advice and medicines. They are of two kinds, provident and free. The first are excellent institutions for encouraging habits of thrift, and training the poor not to depend on medical charity. The members of provident dispensaries pay a few pence weekly, which entitles them and their families to advice and medicine when necessary. The medical officer attends at the dispensary every morning to prescribe for those who call; after a certain hour he goes the round of the district, and visits those who are too ill to attend at the dispensary. It is often necessary in starting these institutions that there should be certain honorary members paying a subscription that will cover the expense of the building and drugs; the pence of the ordinary members should cover the officer's fee. Free dispensaries much resemble the out-patient department of hospitals, without the advantage of having wards to which the worst cases can be relegated. In Ireland, since 1851, when the Irish Dispensaries Act was passed, every district has a dispensary, where the poor are entitled to advice and medicine on presenting tickets, which are distributed by relieving officers, guardians, &c. The first dispensary founded in Britain was the Royal General Dispensary, Bartholomew Close, London, opened in 1770. There are now over a hundred dispensaries in London, of which the greater number are provident; and such institutions are numerous in many cities in England, America, and the colonies. See HOSPITALS.

Dispensation, the remission of a law in a particular case by competent authority. It is generally admitted, even by the most extreme of the Roman Catholic canonists, that no dispensation from the natural and moral law can be granted by any human power (Lignori, *Theol. Moral.* vi. 1119). On the other hand, it is generally held that the pope can dispense from oaths and vows, because in this case the obligation is founded upon an act of free human will, which the pope may annul. Further, with regard to positive divine laws—i.e. with regard to things which are not essentially good or evil, but which God has been pleased to command or prohibit by special revelation, it is held that the pope may declare that a particular case does not really fall under the law. For the rest, the pope may dispense from the general laws of the church. He may, e.g., allow a man to marry his deceased wife's sister, for the prohibition is derived solely from the church law, the Mosaic code, as such, having no authority among Christians; and, therefore, the supreme authority in the church may dispense from it. Of such dispensations the most noteworthy was that allowing Henry VIII. to marry Catharine of Aragon. In the earlier periods of church history, bishops and provincial councils also dispensed from the general law of the church, but since the time of Innocent III. the pope alone can do so as a general rule, and bishops only in certain cases mentioned by the canon law, unless, indeed, they act as papal delegates. Papal dispensations, if they are of a public nature, are granted through the Apostolic Dataria; if they concern the secret tribunal of conscience, through the Penitentiary. Bishops, in the exercise of their ordinary power, dispense from the proclamation of banns, from certain 'irregularities' which impede ordination, from clerical residence, &c. Many canonists add that bishops may dispense in pressing cases, where recourse to the pope is impossible, and the approval of the pope may be certainly presumed. Besides this, in virtue of faculties which may be obtained from the pope for five years at a time, a bishop can dispense from the law of abstinence from flesh-meat, from all the ecclesiastical impediments which make marriage unlawful, and from some of those which nullify it, from most 'simple' vows, &c. The vicar-general can dispense in very few cases, except by commission of the bishop. During the vacancy of a see, the bishop's ordinary power of dispensation passes first to the chapter and then to the vicar-capitular. Parish priests, &c. have no power of dispensation. The Council of Trent (Sess. xxv. c. 18) requires that dispensations be given only for a 'just and urgent' cause, after full consideration, and gratis. The last word, however, does not exclude the payment of the statutory fees.

In the English Church, papal dispensations were swept away by 25 Henry VIII. chap. 21. The Archbishop of Canterbury grants special licenses for marriage, and the bishop of the diocese may dispense a clergyman from residence, or grant him leave to hold more than one living.

In civil matters, the dispensing power of the crown, grossly abused by James II., was abolished by the Bill of Rights, and the sovereign's power of pardoning criminals is the sole form of it which is left.

The term dispensation is also used in Mosaic or Jewish dispensation, Christian or gospel dispensation, for the systems of rights and duties imposed by Providence under the Old Testament economy and that of the New respectively.

Dispersion. The refractive index of a transparent medium is different for different kinds of light. Thus, when white light passes through a given prism, the rays of different refrangibility of which it is composed are bent by different amounts from their original common direction. They are said to be *dispersed.* The dispersion for the given prism depends upon the difference of the refractive indices of the extreme rays of the visible spectrum. It varies with the substance and the angle of the prism. The relative breadth of any two parts of the spectrum varies with the substance of the prism. This constitutes the so-called *irrationality* of dispersion. In general, rays of short wavelength are more refracted than rays of long wavelength, but in some refracting media this law breaks down in part. This is known as *anomalous dispersion.* The term *false dispersion* is applied to the scattering of light by reflection from motes suspended in a transparent medium. See LIGHT.

Displayed, a heraldic term used to describe the position of an eagle or other bird with its wings expanded.

Disposition, in the Law of Scotland, is a deed of conveyance and alienation, which transfers a right to property, either heritable or movable. The most common form of disposition is that which conveys heritage from a seller to a purchaser. Dispositions of movable subjects are also known in practice. Another form of disposition is the

general disposition and settlement, which is used to settle the whole succession to an estate including both heritable and movable property. When such a succession is settled by a conveyance to trustees with specified powers, the deed is called a trust-disposition and settlement. All these deeds have a form, similar, indeed, but varying according to the nature of the property conveyed and its destination. For disposition in security, see (under HERITABLE AND MOVABLE) HERITABLE SECURITIES.

Disputation, an exercise of logical and dialectic skill, in which one party advanced an argument, and the other sought to refute it. Challenges to such exercises were often issued—e.g. at Paris in 1577, by the 'Admirable' Crichton. Memorable religious disputations were those between Knox and Kennedy (1562), and between Laud and Fisher the Jesuit (1623). The practice survives as an academic form.

D'Israeli, ISAAC, man of letters, was born at Enfield in 1766, the only son of Benjamin D'Israeli (1730–1816), a Jewish merchant, who in 1801 was made an English citizen. Isaac was educated at a school near Enfield, and for two years at Amsterdam under a freethinking tutor; in 1782 he returned home, bent on authorship. He published two volumes of verse and seven romances; but his *Curiosities of Literature* (6 vols. 1791–1834), the fruit of much reading at the British Museum, showed his forte to lie not in creative literature, but in the illustration of history and literary character. To this he devoted himself with much success, his chief other books being *Calamities of Authors* (1812–13); *Quarrels of Authors* (1814); *Commentaries on the Life and Reign of Charles I.* (5 vols. 1828–30), which won him the honour of D.C.L. from Oxford; and *Amenities of Literature* (1840). Though somewhat slipshod and inaccurate, they are pleasant, readable works, and gained for their author the friendship and admiration of Byron, Scott, Southey, Moore, Bulwer Lytton, and Rogers, the last of whom observed, with his usual sneer: 'There's a man with only half an intellect who writes books that must live.' In 1802 Isaac D'Israeli married Maria Basevi (1775–1847), and by her he had one daughter and four sons, the eldest the famous statesman, Lord Beaconsfield (q.v.). Always a lax observer of the Jewish faith, he broke with the synagogue in 1817, and had all his children baptised. In 1829 he removed from Bloomsbury Square to Bradenham House, Bucks, where, after nine years of blindness, he died 19th January 1848. See, prefixed to the 1849 edition of the *Curiosities*, a memoir by Lord Beaconsfield, who also published a collected edition of his works (7 vols. 1858–59).

Disruption. See FREE CHURCH OF SCOTLAND.

Diss, a market-town of Norfolk, on a rising-ground above a mere of 5 acres, 19 miles SSW. of Norwich. It has a good Perpendicular church, with a fine peal of bells, of which, early in the 16th century, John Skelton was the unholy rector. The old weaving trade has long been a thing of the past. Pop. (1851) 2419; (1881) 3845; (1891) 3763.

Dissection. See ANATOMY.

Dissection Wounds. The practical study of anatomy is attended with certain dangers, which, however, during the last half-century have been much lessened. The atmosphere of the dissecting-room, now comparatively pure by the application of proper ventilation and other sanitary measures, was, a generation ago, too commonly loaded with noxious emanations, which more or less poisoned the blood of those who continuously inhaled it, and consequently produced nausea, sickness, diarrhœa, a bad taste in the mouth, and other symptoms. Dissection wounds, which are always attended with a certain amount of risk, were rendered more dangerous by the low state of the system, induced by the depressing influence of the surrounding air. Now, probably in consequence partly of the purer air, and partly of the general and extensive use of antiseptic injections into the vessels of the subjects to be dissected, it rarely happens that severe symptoms follow a cut or puncture; it is in cases of post-mortem examinations, undertaken soon after death from erysipelas, pyæmia, and allied diseases, that there is most danger of a wound leading to serious consequences. When, however, a wound occurs during dissection, the wounded part should be tightly ligatured and encouraged to bleed freely, or if there be no bleeding, should be sucked, and then freely touched with carbolic acid or some other caustic. Such wounds, like any others, may be followed by irritation, suppuration, &c., without serious consequences. But if dangerous poison has been absorbed, and is going to act, the patient begins to have a feeling of general illness in less than twenty-four hours. He is low-spirited, faint, and chilly, and often complains of nausea. Then come rigors, intense headache, rapid and sharp (but weak) pulse, a coated tongue, vomiting (sometimes), and great restlessness. The general symptoms increase in severity, the breathing becoming difficult, the pulse very rapid and weaker, the tongue dry, brown, and often tremulous when protruded, and the skin more or less yellow. The case may terminate fatally at or before this stage; or abscesses may continue to form, from which the patient may more slowly sink; or if he survive, the arm may remain stiff and useless, or some of the fingers may be destroyed by gangrene. The treatment, both general and local, is similar to that of Pyæmia (q.v.); and see POISON.

As a precautionary measure in post-mortem examinations, the surgeon, especially if he be out of health, or if the patient have died from a disease of an erysipelatous character, should thoroughly anoint his hands with lard. Very thin india-rubber gloves have been recommended as a safeguard to dissectors; but they have not been found to answer, probably from the constraint to which they subject the action of the fingers.

Dissenters. See NONCONFORMISTS.

Dissepiment, in Botany, the partition between two Carpels (q.v.) in an ovary or fruit composed of a number of carpels. See OVARY.

Dissidents is a general term for dissenters in various countries, but has been specially used of the Polish non-Catholics or *dissidentes*—Lutherans, Calvinists, Greeks, and Armenians (not, however, including Anabaptists or Socinians).

Dissolving Views are pictures painted upon glass, and made to appear of great size and with great distinctness upon a wall by means of a magic lantern with strong lenses and an intense oxy-hydrogen light, and then—by removal of the glass from the focus, and gradual increase of its distance—apparently dissolved into a haze, through which a second picture is made to appear by means of a second slide, at first with a feeble, and afterwards with a strong light. Subjects are chosen to which such an optical illusion is adapted, such as representations of the same object or landscape at different periods.

Dissonance is a combination of musical sounds which produces beats. See SOUND, MUSIC.

Distaff, the staff on which the flax or wool is fastened, and from which the thread is drawn in spinning by hand. See SPINNING.

Distemper (Fr. *détrempe*, from *detremper*, 'to moisten;' Ital. *tempera*), a method of painting in which opaque colours are mixed with water and such glutinous substances as size, white of egg, the sap of the fig-tree, &c., and applied to a smooth surface of dry plaster or *gesso*, spread commonly upon wood, but sometimes upon canvas. It is a process of great antiquity; and it was the ordinary method by which the early Italian and Flemish painters produced their easel-pictures (see PAINTING). Such works, when they have been afterwards oiled or treated with an oil-varnish, are frequently difficult to distinguish from oil-pictures. It is to be distinguished from Fresco (q.v.), in which the colours are applied to a fresh damp surface of plaster, with which they become incorporated. Distemper is now most commonly employed for scene-painting.

Distemper is a typhoid inflammation affecting the mucous membranes of young dogs, and resembling in many respects the strangles of young horses, and the scarlatina and other such complaints of children. Like these, it is generally contagious, occurs only once in a lifetime, runs a definite course, is accompanied by low fever and debility, and is most successfully treated by good nursing and attention to diet and regimen. It is divided into five different forms—catarrhal, pneumonic, intestinal, hepatic (known as yellows), and nervous. The catarrhal always accompanies and frequently precedes the other forms. The eyes are red or yellow, weak, and watery; the nose dry and hot; draughts of air or movements of the animal readily excite sneezing or cough; there is dullness, fever, and loss of appetite. The thickened slimy mucus which the inflamed membrane after some days secretes, accumulates about the eyes and nostrils, and lodging in the bronchial tubes, prevents the free access of air and the proper purification of the blood. Hence ensue distressed breathing, increasing weakness, and symptoms of nervous disturbance, such as staggering gait, chorea, and fits. All dogs are liable to distemper, but the delicate and highly bred varieties suffer most severely, and amongst them the mortality is very great. Bleeding, physicking, and all irritating and reducing remedies, must be carefully avoided, and a good dry bed in a comfortable airy place provided. The stomach, which is generally overloaded, should be relieved of its contents by an emetic, which, for an ordinary sized English terrier, may consist of two grains each of tartar emetic and ipecacuanha, with eight or ten grains of common salt, given in a wine-glassful of tepid water. If no effect is produced, the dose must be repeated in twenty minutes. Constipation, if present, should be corrected by half an ounce each of castor and olive oil, to which, in large dogs, a few grains of gray powder is a useful addition. The febrile symptoms, if acute, may be alleviated by giving four times daily, in cold water, five drops of laudanum, and five grains each of nitre and hyposulphite of soda. Distressed breathing will be relieved by applying to the chest and sides, for an hour or two continuously, a thick flannel cloth, wrung at short intervals out of hot water. The throat may also be rubbed with hartshorn and oil, and the nostrils sponged and steamed occasionally. Give frequently, and in small quantities at a time, milk and bread, or any other such simple and digestible food; and when recovery is tardy, and weakness ensues, endeavour by nursing, tonics, and stimulants, to support the strength. See *Management and Diseases of the Dog*, by J. Woodroffe Hill (new ed. Lond. 1881).

The term distemper is sometimes applied to Influenza in horses, and epizootic Pleuro-pneumonia (q.v.) in cattle.

Distich (Gr. *distichos*, 'consisting of two rows') is the classical name given to any two lines, but especially to a hexameter and pentameter, making complete sense, the character of which is seen in the following well-known example by Schiller:

> Im Hexameter steigt des Springquells flüssige Säule,
> Im Pentameter drauf fällt sie melodisch herab;

which was thus Englished by Coleridge:

> In the hexameter rises the fountain's silvery column,
> In the pentameter aye falling in melody back.

It was much used by the Greeks and Romans as a vehicle for the expression of single thoughts and sentiments; and hence became almost exclusively employed for the classical epigram. The greater poets of modern Germany, as Goethe and Schiller, have also shown a fondness for the distich, and remarkable skill in its use. A collection of moral maxims in Latin, ascribed to a certain Dionysius Cato (q.v.), are called *Disticha*, and were highly popular during the middle ages.

Distillation is the name given to the process of applying heat to a liquid, or, it may be, a solid, in order that certain constituents may pass away in vapour, and, by suitable arrangements, be obtained in the form of a liquid. When the vapour does not condense as a liquid, but only as a fine dust or flour, the process is called *Sublimation* (q.v.). The natural evaporation of water, by the heat of the sun, or warm air currents, the ascent of the vapour into the colder regions of the atmosphere, and the condensation there into clouds and mists, with the subsequent rain-shower, form together the grandest example of distillation. The apparatus for artificial distillation essentially consists of three parts, the Still (or RETORT, q.v.), Condenser, and Receiver. The *still* is made of glass, copper, iron, or earthenware, according to the nature of the substances to be placed in it. In experimental chemical work, glass is almost the only material admissible, while in the preparation of alcohol from grain, copper-stills are commonly employed. The *condenser* is made in an infinity of forms, the object being to condense the vapours disengaged from the still as rapidly and effectually as possible. For this purpose it is important that the condenser shall expose a large surface to the cooling-medium, water or air. Owing to its rapidity in conducting heat, and the thinness of pipes made of copper, this metal is generally employed in the construction of condensers. Whatever the form, the principle is the same—viz. that the hot vapours pass through a tube or vessel surrounded with cold water, which running in a constant stream, passes away more or less warm after it has done its work. The *receiver* merely consists of a suitable vessel in which to receive the *distillate*. As the forms of apparatus are capable of infinite variety, so the conditions of distillation are innumerable; the best defined types going under the names of Fractional Distillation, Destructive Distillation, and Distillation in Vacuo.

In *Fractional Distillation* a mixture of liquids having different boiling-points is put in the still and heat is applied. If the vapours were allowed to pass over together and the distillate to be received in a single receiver, it is evident that nothing would be gained; for the different liquids would re-mingle in the receiver. If, however, the temperature be raised very slowly, and especially if the vapour requires to rise through a high *head*, or tube, before passing into the condenser, it will be found that the more volatile liquids pass over first in a state of comparative purity, and while the others follow as the heat is increased. If the receiver be frequently changed, a series of *fractions*, or portions of liquid, are obtained,

corresponding to the different substances present in the still. For example, if a mixture of glycerine, water, alcohol, chloroform, and ether were distilled, the ether would distil first, then the chloroform, next the alcohol, and lastly, the water, while nearly all the glycerine would be left behind. This then is fractional distillation.

Destructive Distillation, or Dry Distillation as it is sometimes called, is best exemplified when coal is heated in an iron still or *retort*, as in the manufacture of gas. Now, in coal there are only traces of moisture capable of distillation, but when strongly heated, the coal is destroyed, or *decomposed*, and a large number of substances distil over, some of which, like lighting gas, are permanently in the gaseous state, others like Creasote (q.v.) are liquid, while others, such as naphthaline, are solid bodies at the ordinary temperature. Here no distillation takes place until the substance heated is destroyed, hence the term destructive distillation. Further examples are the distillation of wood in close vessels, at a red heat, when charcoal is left in the vessel, and wood-vinegar, wood-spirit, tar, &c. pass over in vapour, and are condensed; and the heating of bones in similar retorts, when animal charcoal is left in the retort, and Dippel's animal oil distils over. See CHARCOAL, COAL-TAR, and DIPPEL'S ANIMAL OIL.

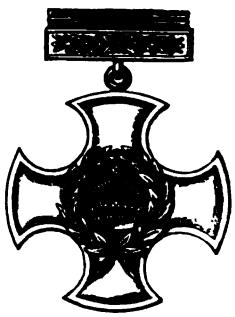
Distillation in Vacuo.—When water is heated in a kettle it eventually boils, and if a thermometer be plunged into it, the mercury is seen to remain stationary at a temperature of about 212° (100° C.). It will be noticed, however, that when the barometer is low, the temperature of the boiling water is somewhat below 212° (100° C.), and that when the barometer is very high, the temperature is also high. On the summit of Mont Blanc, it is found that water boils at about 180° (82° C.); while in a vessel from which the air has been removed by an air-pump, it continues to boil even when the temperature falls down to the freezing-point (see BOILING.) There are many substances which are injured by heat, such as extract of malt and sugar, and when solutions of these bodies require to be evaporated on a large scale, they are always distilled *in vacuo*, so that the water may be removed without unduly heating the vessel.

There is another very interesting method of distillation whereby liquids which, alone, cannot be distilled without decomposition, are made to distil in presence of the vapour of some other liquid. Thus, glycerine is not, practically speaking, capable of being distilled, but when heated with high-pressure steam, it readily distils over, and can thus be purified. The great object of distillation is purification, and in the manufacture of the fragrant volatile oils of lemon, lavender, &c., it is necessary to distil them along with water so as to avoid overheating of the oils, and consequent injury. Not only is the flavour improved by this treatment, but they distil at a lower temperature along with water than when alone. The term distillation in excise language refers to the distillation of alcohol alone. For information on this subject, see FERMENTATION, ALCOHOL, BRANDY, GIN, SPIRITS, and especially WHISKY; under which latter head the subject of the duties payable and of illicit distillation are also treated.

Distilled Water is the condensed product obtained by the distillation of water. All natural waters, even rain-water, contain certain saline matters (common salt, &c.) in a state of solution, from which they can only be completely freed by the process of distillation. The characteristics of distilled water are, that it possesses a mawkish, insipid taste, without odour or colour, and when evaporated to dryness in a vessel, it ought to leave no residue. Unless very specially prepared, it is sure to contain traces of free ammonia, and, when this is the case, it is liable to form a green vegetable growth in any bottle containing it. The other properties of distilled water are noticed under WATER.

Distilled Waters is the name for what is obtained by distilling water along with the parts of plants containing essential oils. Rose-water and lavender-water are familiar examples.

Distinguished Service Order. This order was instituted by royal warrant on 6th September 1886 for rewarding the distinguished services of naval and military officers who have been honourably mentioned in despatches. Foreign officers who have been associated with British forces in naval and military operations are eligible as honorary members of the order. The Companions of the order rank immediately after those of the Order of the Indian Empire. The Sovereign is head of the order. The badge consists of a gold cross, enamelled white, edged gold, having on one side in the centre, within a wreath of laurel enamelled green, the imperial crown in gold upon a red enamelled ground, and on the reverse, within a similar wreath and on a similar red ground, the cipher V.R.I.; and it is suspended from the left breast by a red riband, edged blue, of one inch in width.



Dis'tomum. See FLUKE.

Distortion. When any body is subjected to the action of a deforming force, or stress, the corresponding deformation, or strain, is sometimes termed a *distortion*. In this limited sense the term is frequently used in treatises on elasticity. The definition would almost indicate some relation between a distortion and the force causing it. Such relation was first given by Hooke (1635–1703) in he law which bears his name: Distortion is proportional to the distorting force. Thus, for example, if a plank of wood supported at each end be deflected at the middle through a certain space by the placing there of a given weight, twice the weight will give twice the deflection, and so on. See ELASTICITY.

Distrain. See DISTRESS.

Distress, in English law, is the common-law remedy by which a man may enforce payment of rent or other duties, or may impound another's cattle trespassing upon his land. Distress is defined as the taking of a personal chattel out of the possession of the wrong-doer into the custody of the party injured, without process of law. Distress was formerly an incident of all feudal services, such as suit of court, and fealty: it was also used to compel obedience to the orders of a court leet. In modern days, distress is practically enforced chiefly for non-payment of rent, for non-payment of rates and penalties, and upon cattle straying upon land not belonging to their owner. Cattle so straying may be impounded and retained as security till their owner make satisfaction. Distress for rates and penalties is allowed by the statutes imposing them. In this species of distress, and distress for non-payment of rent, the articles are not merely kept as security, but may be sold to pay the amount due. Whatever goods the landlord finds on the premises, even goods belonging to a stranger (not being a lodger), may be distrained; but animals *ferœ naturæ*, and goods delivered to the tenant by way of trade (as horses in a smithy, garments

at a tailor's), may not be taken. Lodgers' goods are protected against distraint by an Act of 1871; bedding, wearing apparel, and tools or implements of trade to the value of £5 are also protected. Under the Law of Distress Amendment Act, 1888, distress can only be levied by a certified bailiff. A landlord may, by a statute, 11 Geo. II. chap. 19, distrain goods fraudulently carried off the premises; and by the same statute he may, with the assistance of the peace-officer of the parish, break open doors to obtain the goods so removed.—In the American Union, some of the states have abolished distress, as being harsh to the tenant, and unjust in favouring the landlord over other creditors.

In Scotland, the term distress was formerly in use; the right to lay hold of straying cattle and the landlord's right of hypothec are analogous to the English law. See POINDING.

D'Istria, DORA. See GHIKA.

Distribution, in Political Economy, refers to the method in which the products of industry are shared among the people concerned. The methods of distribution have varied and do vary in accordance with the state of social development. They depend on legal as well as on economic conditions. They depend mainly on the ideas and institutions which prevail with reference to property in the three requisites of production—viz. land, labour, and capital. In countries where slavery prevailed, the slaveholder, as the owner alike of land, labour, and capital, disposed at his pleasure of the entire product of industry. Under the feudal system, by which the cultivator was attached to the soil and had a fixed interest in it, he was obliged to render to his superiors dues in labour, in kind, and latterly in money, which were fixed by custom or authority. Where the system prevails of cultivators owning the soil, as it does in America, and among the peasant proprietors of the European continent, the owner, inasmuch as he unites in his own person land, labour, and capital, disposes of the entire product, except such portion as may be claimed by the money-lender. In cases where the state owns the land, the cultivator pays a rent or tax to the government, and retains the remainder. The *metayer* system still exists in Italy, the owner advancing the land and stock (in whole or in part), and receiving from the cultivator a fixed share of the produce, generally one-half.

In Great Britain, and to a large extent in other countries with a highly developed industry, land, labour, and capital are supplied respectively by three different classes of persons, and their share in the produce is determined by free competition. The classical political economy of England may be defined as a description and analysis of such an economic condition of society. It claims to be a science only in so far as the competitive system prevails. The landlord's share in the produce thus determined is called rent; that of the capitalist and employer is designated as interest, profit, earnings of management, &c.; the labourer's share is wages. It should be pointed out that under such a system the central function in distribution, as well as in production, rests with the employer. As he originates and controls the productive process, so in the distributive process he settles with landlord and labourer, and then disposes of the produce. If the employer operates in whole or in part with borrowed capital, interest on that capital must also be deducted from his share of the produce. All these claims satisfied, the amount of his share will depend on his success in disposing of the product.

Whatever the arrangements regarding property and the distribution of the fruits of industry may be, account must be taken of the share claimed by the government in the form of taxes, for the maintenance of army and navy and other means of defence, for justice and police, and for education, &c. Some sections of the so-called professional classes are from this source paid for services rendered to the state. But the clerical and teaching professions derive their income more or less from corporate property, while the legal and medical professions obtain their share of the distribution mostly from the services they render to private individuals.

It is now admitted that economists have bestowed excessive attention on production, to the neglect of the problem of distribution. But the reproach has a much wider application than to economists merely, for it may generally be said that while modern communities have enormously increased their productive forces, they have not yet solved the problem of distribution. The enormous inequalities of distribution are a danger felt by all thinking men. It is a question which is more and more challenging the attention of statesmen and economists. An economic system can be satisfactory only when a high standard of production finds its complement in a reasonable and equitable distribution, supplying to the mass of the citizens the means for their due physical, intellectual, and moral development. Merchants, wholesale and retail, are said to effect the distribution of manufactured products, acting as middlemen between the manufacturer and consumer. For a special method of seeking to secure the equitable distribution of profits amongst those who earn them, see CO-OPERATION.

Distribution. See GEOGRAPHICAL DISTRIBUTION.

District of Columbia, a district of the United States, containing the federal capital, is bounded on the west by the river Potomac, and on all other sides by the state of Maryland. Copyright 1889 in U.S. by J. B. Lippincott Company. It was originally 10 miles square, and embraced lands on both sides of the Potomac, the portion east of the river (60 sq. miles) being ceded to the general government by Maryland, and that west of the river (30 sq. miles) by Virginia in 1788–89. The latter section, however, was retroceded to Virginia in 1846, and the present district, containing Washington (q.v.) and Georgetown (q.v.) has an area of 70 sq. miles: land, 60; water, 10. The Federal City, afterwards called Washington, was laid out from a plan furnished by Major L'Enfant, and the public buildings were erected and completed before December 1800, when the seat of government was removed hither from Philadelphia. In 1814 the British burned the Capitol, White House (the president's residence), and executive buildings, besides much private property, the total damage being estimated at $2,500,000. The district remained an unorganised territory, under the sole government of congress, up to the year 1871, although it had a county organisation, and the two cities held charters for their local government; a congressional committee each session recommended such legislation and appropriations as were deemed needful for it. An Act passed in 1871 organised a territorial government, and provided for a governor to be appointed by the president, and approved by the senate; for a secretary, appointed by the president; and for the election of a delegate to congress, to serve for two years. There was also a legislature, with eleven councilmen appointed by the president, and twenty-two delegates chosen by the people. In 1874, however, congress placed the whole control and government of the district in charge of three commissioners, appointed by the president and

approved by the senate. These have charge of all administrative affairs and make all appointments to offices in the district; the citizens have nothing to say in relation thereto, nor is a vote given to them either in district or national affairs.

There are a number of suburban villages springing up in the district, and the real estate is increasing in value very rapidly. Among institutions of note outside the capital are the Soldiers' Home, 3 miles to the north (with grounds covering 500 acres, endowed with $118,719 remaining in 1851 of the sum levied on the city of Mexico), to which each private soldier in the United States army pays a small tax of twelve cents a month; the Columbia Institution for the Deaf and Dumb (1857), whose collegiate department (1864) admits students from all parts of the United States; and the government hospital for the insane, about a mile from the city, with accommodation for a thousand patients, drawn from the army and navy, and from the District of Columbia. Pop. of the district (1800) 14,093; (1850) 51,687; (1870) 131,700; (1880) 177,624; (1885) 203,459; (1890) 230,392.

Ditch, in Agriculture, is a trench usually made along the sides of fields, so that all the drains may be led into it, or along the top of a field to divert surface water. A hedge is often planted along the side, and the two form a better fence for cattle. In cold undrained lands, the earth thrown out of the trench forms a mound of dry earth, which is particularly serviceable for the growth of thorn-hedges. Accordingly, this is the common mode adopted in planting hedges in such districts, where the subsoil is often close, tenacious, and not well suited for their growth. Various forms of ditches are made; sometimes a double ditch is adopted, and the hedge planted between. In arable lands, however, since the general use of small and large pipes, ditches have in many cases been converted into underground drains, which has effected a great saving of land, as well as giving to the fields a tidy appearance, and often a more convenient form. See DRAINAGE.

Dithyrambus, originally a surname of Dionysus, of uncertain derivation and meaning, was subsequently applied to a species of lyric poetry cultivated more particularly at Athens, and characterised by loftiness and vehemence of style, which, however, at a later period, degenerated into bombast and extravagance. The Dithyrambus was originally a passionate hymn, sung by one or more revellers to the music of a flute; but Arion is said to have invented for it a regular choral or antistrophic form. He is also spoken of as the inventor of the tragic style, as having introduced among lyrics of a more festive and joyous character, gloomy dithyrambs, representing the sorrows of Dionysus. Lasus of Hermione freed the dithyramb from its antistrophic character; and thenceforward it became more and more mimetic and dramatic. It was out of the mournful dithyrambic songs that the stately and solemn tragedy of the ancient Greeks arose. But few fragments of the dithyrambic poetry survive.

Ditmarsh, DITHMARSCHEN, or DITMARSEN, the western district of Holstein, lying between the Eider and the Elbe, with an area of 531 miles, and a pop. (1890) of 80,122. It is low-lying and fertile, and has to be defended by dykes from flooding. Originally a part of Saxony, and from 1474 till 1559 practically an independent state between Germany and Denmark, the district still retains many ancient peculiarities. The *Landbuch*, containing the ancient laws, dates from 1348. The *Chronik* was written in the Lower Saxon dialect by Adolfi (1559–1629).

Dittany (*Dictamnus*), a genus of Rutaceæ, of which the common species, also called Bastard Dittany or Fraxinella (*D. albus*), a native of the south of Europe, is an old inmate of our gardens. It is a perennial, with unbranched stem, pinnate leaves, and a fine raceme of white or rose coloured (var. *fraxinella*) flowers. The plant diffuses a powerful fragrance from its numerous oil-glands when in flower, and during dry hot weather exhales such a quantity of volatile oil, that it is said that a slight flash has been obtained by its sudden combustion when a candle is brought near it on a warm summer evening. The root is thick, white, and very bitter, and was formerly in medicinal repute.—Dittany of Crete, used as a febrifuge, is a very different plant (*Origanum Dictamus*), a kind of Marjoram (q.v.).

Diu, a seaport, situated at the eastern extremity of a Portuguese island (7 × 2 miles) of the same name, off the south coast of Kathiawar, 180 miles NW. of Bombay. Once an important city of 50,000 souls, it has sunk in importance till now the whole island has but 12,636 inhabitants, mostly fishermen. Some magnificent buildings still attest its ancient splendour, such as the Jesuit College (1601), now a cathedral. The place has been in possession of the Portuguese ever since 1535, and stood a famous siege in 1545.

Diuretics, medicines having the property of increasing the secretion or excretion of urine, and on this account much employed in dropsies, as well as in a variety of other diseases. The principal diuretics are the salts of potash, especially the nitrate, acetate, and bitartrate (cream of tartar); squill, in powder, vinegar, or syrup; digitalis or foxglove, in powder or infusion; the decoction or infusion of broom-tops (*scoparium*); nitrous ether (in sweet spirit of nitre); caffeine, the active principle of coffee; the alcohols and ethers, with most of the volatile oils, especially that of juniper, as in gin; the berries of the common elder; the tincture of cantharides or Spanish flies; turpentine, &c. The last named (from the alcohols onwards in the above enumeration) are more or less irritating in their effects on the urinary organs, and should not be used without due consideration as to the requirements of the particular case. Cream of tartar and the broom-decoction form one of the safest and best diuretic mixtures which can be employed in domestic use; or cream of tartar may be given alone, either dissolved in hot water and allowed to cool, or in substance along with syrup.

Divan is a Persian word meaning collection, society, council, audience-chamber, as also the kind of cushioned seats or sofas which in reception-rooms in the East are ranged against the wall. Another meaning is a collection of poems—in which special sense of the term Goethe used it for his *West-östlicher Diwan*.

Diver, or LOON (*Colymbus*), a genus of birds of the family Colymbidæ, emphatically oceanic, and confined to northern latitudes. They have a strong, straight, rather compressed, pointed bill, about as long as the head; a short and rounded tail; short wings; thin compressed legs placed very far back, a short hind-toe, and the other digits completely webbed. They fly well, but are particularly expert in diving. They prey upon fish, which they pursue under water, making use of their wings as well as of their legs and webbed feet in their dexterous swimming. On land they can hardly walk, and the name *Loon* is supposed to refer to this incapacity, and to be from the same root with *lame*. They nest on the islands, rocks, or shores of lochs and fiords, but except at breeding-time keep to the water. In winter they sometimes follow the rivers inland. The Great Northern Diver or Loon, also called the Immer

or Ember Goose (*C. glacialis*), is a bird about 2½ feet long, exhibiting no little beauty of plumage; the upper parts black, spotted with white; the head black, with tints of green and blue; the belly white. In winter and in youth it is predominantly brownish-gray and white beneath. It is a winter visitant of the British coasts, even to the farthest south, and is occasionally seen in inland districts; is found in like manner in most parts of Europe, the north of Asia, and North America as far south as Texas, but it breeds chiefly in the more northern regions, as Labrador, Iceland, and Spitzbergen. Its cry is very peculiar and wild, has been likened to the howl of a wolf, and is in some countries superstitiously regarded as ominous of evil. The bird is easily tamed, and becomes very familiar.—The Black-throated Diver (*C. arcticus*) is another northern bird, of similarly wide distribution, but much smaller size, being only about 26 inches in length. It is found round the coasts of Britain, and occasionally breeds in the fresh-water lochs of the north of Scotland. The upper head and neck are ashen-gray, the cheeks and throat black, the general upper surface black with white spots, the under surface white with posterior black spots. In youth and winter it is blackish-brown above, and white beneath.—The Red-throated Diver (*C. septentrionalis*) is also found in all the northern parts of the world, is more common in Britain than either of the other species, and is the bird generally called Loon on the British coasts. In size it scarcely equals the Black-throated Diver. Its back is brownish-gray, the belly white, the throat red. In winter, like the preceding species, this diver is more soberly coloured, and without the red throat. The flesh of all the divers is dark, tough, and unpalatable. The name is sometimes extended to allied genera. See AUK, GREBE, PENGUIN, &c.

Great Northern Diver (*Colymbus glacialis*).

Di'ves (Lat., 'rich'), the name popularly adopted for the 'rich man' in the parable of the rich man and Lazarus, from the Vulgate translation.

Dividend, the sum falling to be divided among the creditors of a bankrupt from the realised assets, after payment of the expenses. The dividend is reckoned at so much per pound of the claims, and the term is applied both to the whole sum divided and the proportion falling to each creditor (see BANKRUPTCY). The profits of a bank, railway, or other joint-stock company, distributed annually or half-yearly among the shareholders, are also called dividends; and the same term is used to denote the interest payable on the public funds, and sometimes on other loans and debentures.

Dividing Engine. See GRADUATION.

Divid'vi, or LIBIDIBI, the curved pods of *Cæsalpinia coriaria* (see CÆSALPINIA), a West Indian and South American leguminous tree, are of remarkable astringency, and are imported especially for use in tanning.

Divination (Lat. *divinatio*; Gr. *manteia, mantikē technē*), the act of obtaining the knowledge of unknown or future things by supernatural revelation, or more strictly, the knowledge of the divine thought manifested to the human soul by objective or subjective signs, and apprehended by means outside the range of the rational. It postulates a belief in a divine providence, and the possibility of reciprocal relations between man and God considered as being able to contribute to man's happiness. Its essential characteristic is thus a belief that the divine thought may be comprehended by the human understanding in a knowledge of a special nature, more or less direct, more or less complete, but always through supernatural means, with or without the concurrent agency of the reason. Thus its domain includes all that the human mind can apprehend by its own powers; in the first place, the future, in so far as it escapes rational foresight; in the second place, the past and the present, in so far as they are inaccessible to ordinary investigation. This supernatural knowledge, says M. Bouché-Leclerq, has been oftener applied to the investigation of the past or of the present than to that of the future. Most of the ancient prodigies were considered as having their causes in the past; the result of their interpretation was always to make known the present will of the gods, and through that, but indirectly, the secrets of the future. And in the future even, considered as capable of being modified, divination oftener teaches that which should happen in accordance with the actual plan of providence, than reveals that which actually will happen. It is closely connected with magic, which may here be defined summarily as the art of voluntarily producing effects contrary to the laws of nature, by a mastery over obscure supernatural forces. Many of its methods consist in the interpretation of the marvellous effects produced at first by magical receipts, and there is an element of magic in every practice or rite destined to prepare or to produce an act of divination. While magic is the consequence of the active knowledge which permits the human will to make use of supernatural influences, the specially prophetic faculty—the particular function of the diviner—on the other hand, is the result of the contemplative knowledge which places the divine thought within the scope of the human intelligence. The former is an enlargement of the activity and of the human initiative at the expense of the divine freedom; the latter is like an increase of visual power added to the understanding.

Otherwise a broad distinction may be made between *artificial* divination by haruspication, astrology, lots, the interpretation of prodigies, lightning, augury, and the like; and *natural* divination, by dreams and prophetic oracles, considered as the direct revelation of the divine will, or an inward intuition flashed with irresistible conviction upon the human soul. The last subjective divination follows from that conception of the prophetic function which had its place in the philosophical system of Plato. It proceeds by a state of psychic exaltation or prophetic ecstasy, which suspends the intellectual energies of the human agent in a kind of sympathetic passivity suitable for the transmission of the divine thought. The conditions most favourable for receiving the divine impressions have beforehand been induced by the weakening or the destruction of the individuality of the medium through certain morbid physiological conditions, as ecstatic enthusiasm, deep sleep, sickness, or the approach of death—the last, a notion that lingers long in the heart of our modern

civilisation. The scientific spirit of Aristotle rejects external divination and accepts subjective prophecy, but reduces it to nothing more than the natural exercise of a special faculty. 'It is neither easy,' he says, 'to despise such things, nor yet to believe them.' The Stoical school maintained divination because the gods were too beneficent to have denied to men a gift so good, but they identified providence with necessity or the inevitable connection of causes and consequences, and thus involved divination in an illogical confusion betwixt fatalism and free-will, the only reason for its existence that remained being its utility. The usual attempt at an explanation was that divination and the consecutive resolution of man had been foreseen with the rest by providence, and that thus its end was active co-operation in the realisation of the divine plan. The Epicureans made divination impossible by leaving it neither object nor agent, for their gods exercised no providence over men. The sceptical Lucian imitates Aristophanes in his amusing burlesques on the difficulty which Apollo feels in composing his official hexameters. The brilliant Carneades left divination in its fatal dilemma betwixt necessity and free-will, and Cicero follows with a halting conservatism, unable entirely to surrender his wishes to a conviction that his logic demands. Pliny the naturalist and Suetonius feel all the embarrassments of the old dilemma, and their attitude to divination may to some extent be explained by classifying them as superstitious rationalists. Plutarch, an eclectic Platonist, enumerates with marked particularity all the prodigies and miracles that had happened to his heroes, and seems to have believed in an innate human faculty for divination, a state of receptivity through which the soul becomes the instrument of God, just as the body is the instrument of the soul. With the spiritual revival that marked the rise of Neoplatonism, we find divination again established and based on cosmic sympathy. The Egyptian ascetic Plotinus accepted inward revelation, and directly ascribed all the phenomena of divination to the agency of the gods and other spiritual forces. Porphyry had an intensely vivid sense of the spiritual in nature, and regarded the supernatural and its external expression almost as the least extraordinary of all her secrets. The divine communicates itself to the human through inward illumination in specially gifted souls, and to others less highly endowed through dreams, chance presages, and voices.

The early Christian controversialists accepted the supernatural inspiration of the Pagan oracles, but explained that it came not from God, like that of the Hebrew prophets and the saints, but from the devil. It was easy for them to demonstrate the fallacy and errors of the ancient oracles, but they were hardly logical in, at the same time, accepting such of these as could be interpreted as foretelling the coming of Christ or some of the peculiar dogmas of Christian theology. It was St Augustine who finally formulated the orthodox opinion of western Christianity on the subject in a special treatise, *De Divinatione Dæmonum*. He limits greatly the part ascribed to conscious fraud in the function of the diviner, as he found the whole mystery sufficiently explained by the intervention of the bad angels, which existed in such countless numbers. The devils imitated as far as possible the divine methods, and hence we have false dreams, visions, and prophetic inspirations resembling in everything save their origin those so often vouchsafed to the saints. Thus early Christianity agreed perfectly with Paganism upon the facts of divination, simply substituting the wicked angel for the good genius and the gods of a polytheistic religion. It merely eliminated the external rites, as infected with magic, substituting for these prayer, and preserved everything that came spontaneously from God, as dreams, visions, and prophetic inspirations. Perhaps the feelings that lay at the heart of the faith in the ancient divination helped unconsciously to prepare the human mind for the Christian belief in providence, in the efficacy of prayer, and in a special revelation of God to man.

Many of the most ancient forms of artificial divination have survived to our own day, even in the heart of our vaunted modern civilisation. The sense of the efficacy of these methods undoubtedly depends on the association of ideas in supposed analogies, and in symbolism. The Samoan rain-doctors wet a stone when they want rain, and dry it at the fire when they want dry weather; and sorcerers all the world over bring harm upon their victim by wishing it strongly, or by prophesying that it will happen, as well as by symbolically representing it in some simple act, as by torturing a wax-model or the like. There is an elemental confusion between the subjective and the objective connection which the primitive mind is unable to distinguish. It cannot resist the conviction that association in thought involves similar connection in reality. The analogies are not consciously arbitrary, but admit fairly of ratiocination if we can get into the proper mental attitude to commence the chain. Rousseau's conviction of his salvation or damnation from his hitting or missing a tree with a stone is based upon a mental process natural enough to the primitive mind. Added to this is the belief in the direct agency of supernatural powers which influence the casting of lots or the tossing of a coin, now a mere mechanical appeal to blind chance, but once a solemn attempt to educe the divine will. Early grave ideas of supernatural interference with games of chance linger long in folk-lore, and we still turn our chair to change our luck at dice or cards, and attach absurd importance to certain numbers for lottery-tickets. The Moravian Brethren even chose their wives by sortilege or casting lots with prayer, just as the Hebrew patriarchs did at grave or doubtful junctures three thousand years ago. The ancient Greek *kottabos*, by which fortune in love was discovered by the particular splash made by wine thrown out of a cup into a metal basin; the *astragali*, or knuckle-bones of the Romans, used for divination and as dice; the Polynesian divination by spinning the *niu* or cocoa-nut to see if a sick person will recover; and the playing-cards by means of which Gypsies still read fortunes at English fairs (*cartomancy*), are enough to show the great variety in range of methods of divining. Many of these have been gravely formulated and systematised into pseudo-sciences. Thus astrology was not only one of the most serious studies of the ancient Chaldæans, but was still more than respectable in the time of Newton; augury by the sight and cries of birds alone gave employment to a whole college of officials in ancient Rome; and the ordeal by fire or battle had the most solemn sanction of the medieval Christian church.

Many of the notions lingering in folklore about the hearing of certain birds on the right or the left hand, or the meaning attached to first meeting certain animals or people and the like, may be understood by symbolism; but many more are now at least completely inexplicable and hopelessly confusing. Dreams to animistic thinkers are directly due to spiritual intercourse, and their symbolical interpretation (*oneiromancy*), either as taken directly or by the equally valid method of contraries, has been practised from the days of Joseph until now, and has given rise to a rich crop of folk-lore superstitions everywhere. Divination by the appearance of entrails, or *haruspication*, was much

respected by the ancient Romans, and is still practised by the Malays and Polynesians. Somewhat similar to it is *scapulomancy*, the method of divining by the cracks and lines made in a shoulder-blade placed in the fire. Palmistry, or *cheiromancy*, has still its thousands of votaries and its own literature, and is warmly defended by those who fail to see how childish is the sham symbolism, and how entirely arbitrary are all the analogies on which it is based. Other methods of divining again depend on the more or less conscious action of the agent, who none the less, however, is either a knave or a dupe. Such is the *planchette*, by means of which answers in writing are given from the spirit-world; but the most famous form in this kind is the divining-rod, with its supposed power of indicating a hidden spring of water, a vein of ore, or a buried treasure (*rhabdomancy*). Of the same nature are the ancient *coscinomancy*, with a hanging sieve and shears, and the ordeal of the key, both highly useful where a culprit was apt to betray himself by his fears. Other of the thousand forms of divination are *bibliomancy*, by opening at random the Old or New Testament, or such popular books as the works of Homer or Virgil; *crystallomancy*, by looking into a crystal or beryl to see the future represented directly in pictures, or symbolically by figures capable of being interpreted; *geomancy*, by the observation of points or lines on the earth, or on paper; *pyromancy*, by the behaviour of fire; and *botanomancy*, from the chance combinations made by the wind upon leaves of trees on which words and questions had been written. Of profound significance also are the barking of dogs, the fall to the right or left hand of stones or sticks flung upwards, the behaviour of a ring hung over a cup at the approach of particular persons, the spots on the finger-nails, the physiognomy of the persons met by chance at critical periods, the blowing off the seeds of the dandelion, or the pulling off the petals of the daisy with certain time-honoured formulas repeated the while. Countless omens are derived by means of hemp sown at midsummer, by nuts burned before a fire, from certain appearances of green ivy leaves, willow-wands, and the like; while those who are observant of the proper rites may ward off ill-luck, and force the future to their convenience, with the sign of the cross, and the use of the horseshoe, silver, or the holly. The future is often foretold also by apparitions, and these are not infrequently, as in the classical case of the witch of Endor, capable of being called forth for the purpose of prophesying by powerful sorcerers.

Divination is founded on faith, but has often also been helped by fraud. It is a sincere although fallacious philosophy, and finds its strongest support in the fancied proofs of its truth that strike the minds of a primitive people, who forget or overlook the misses in their eagerness to verify the hits. The persistent tendency to believe what one wishes to believe, and the inherent human craving for mysteries and wonders, account for any belief. 'The human understanding,' says Bacon, 'when any proposition has been once laid down (either from general admission and belief, or from the pleasure it affords), forces everything else to add fresh support and confirmation; and although most cogent and abundant instances may exist to the contrary, yet either does not observe or despises them, or gets rid of and rejects them by some distinction, with violent and injurious prejudice, rather than sacrifice the authority of its first conclusions.'

See the articles APPARITIONS, ASTROLOGY, AUGURIES, CHARM, DEMONOLOGY, DREAMING, OMEN, ORACLE, ORDEAL, MAGIC, MYSTICISM, PALMISTRY, and SORTES VIRGILIANÆ; also Bouché-Leclerq's *Histoire de la Divination dans l'Antiquité* (4 vols. 1879–82); and F. W. H. Myers on 'Greek Oracles' in his *Essays—Classical* (1883).

Divine Right, a term applied to describe the source of the power claimed for the monarch, by the royalist party, in the great controversies between the monarchical and parliamentary or commonwealth parties in England in the 17th century. The monarch was held to be the immediate representative of the Deity, to whom alone he was responsible for all his actions—a principle which relieved him from all human responsibility, and gave him an absolute claim to the obedience of his subjects. Two of the confessions of Henry VIII.'s reign—the *Institution* and *Necessary Doctrine*—both insist on the duty of passive obedience as a corollary of the fifth commandment; and Cranmer so altered the coronation oath at the accession of Edward VI., as to make the king's hereditary right wholly independent of election or the will of the people. But the doctrine became full fledged only after the quiet transfer of the crown from the Tudor to the Stewart dynasty showed that the hereditary principle was firmly established; and James I. constantly harped on the necessity of this great principle. The chief writers on the side of divine right were Salmasius and Sir Robert Filmer; on the other, Milton, Algernon Sidney, and Harrington. The controversy died a natural death after the accession of the Hanoverian dynasty. The miraculous power claimed by English sovereigns of curing the 'king's evil' (see SCROFULA) by the royal touch, was a consequence of their divine right.

Diving. The 'treasures of the deep' have at all times been the subject of much visionary exaggeration, and the accounts of the exploits of divers equally extravagant. Thus, it is sometimes affirmed that the pearl-divers of the East acquire by practice the power of remaining under water from 15 to 20 minutes, or even two hours. It need scarcely be said that these accounts are absurd, no such endurance being possible. The more skilful divers may remain under water for 2 or even 3 minutes; and 4 minutes 29½ seconds is claimed to have been attained in a glass tank (see PEARL). Most divers suffer severely from the continual efforts in holding the breath; blood-shot eyes and spitting of blood are common among them. It is noteworthy that if one about to dive breathes hard for a short time, he is then able to hold his breath much longer under water (see SWIMMING). The rude mode of diving is now but little used except for pearl and sponge fishing. Even for these purposes the diving apparatus is now largely used, the diver thus collecting, it is computed, as much as twenty naked divers under the old primitive regime, and being able to remain from two to four hours under water. In the Mediterranean sponge-fisheries, hundreds of sets of diving apparatus have long been in use, and the dress has been introduced into the fisheries at the Bahamas, Bermuda, Australia, &c.

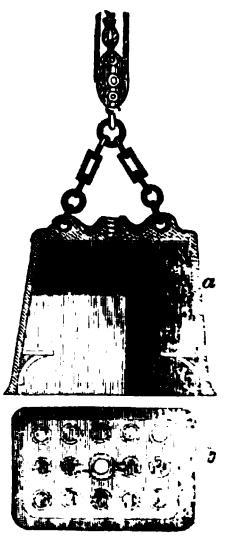
DIVING-BELL.—For all such purposes as sub-aqueous works upon the foundations of piers, bridges, &c., or the exploration and raising of sunken vessels, the efforts of the unaided diver would be almost valueless, and, accordingly, various contrivances for supplying air to the diver have been made. Roger Bacon (1240) is said, on most doubtful authority, to have invented a machine for working under water. Taisnier's description of the *cacabus aquaticus*, or aquatic kettle, used by two Greeks in Spain, at Toledo in 1538, in the presence of the Emperor Charles V. and a multitude of spectators, is one of the earliest reliable accounts of a diving-bell. From his description, this must have been similar in principle and construction to the modern diving-bell, but of clumsy dimensions, and wanting in efficient means of renewing the supply of air. In

1620 Lord Bacon in his *Novum Organum* describes the crude method in vogue in his day, in which no means of replenishing the air were employed. Towards the close of the 17th century, many attempts were made, and much capital sunk in submarine exploration, but the primitive nature of the apparatus employed rendered the various enterprises undertaken abortive. Dr Halley's diving-bell, about 1720, was a wooden chamber of about 60 feet internal capacity, open at the bottom, where it was loaded with lead, to keep it perpendicular in its descent. Strong pieces of glass were set in the upper part, to admit light. Casks filled with air, and loaded with lead, were let down with the bung-hole downwards; and from these a supply of air was drawn by means of a hose. John Lethbridge, about the same time, constructed a conical bell, into which he forced compressed air by means of bellows, enabling him to remain over half an hour beneath the surface. In 1754 Dr Richard Pococke saw a diving-bell used at the Needles to raise what they could of the wreck of a man-of-war. 'They are let down in a machine made of leather, strengthened at the knees and shoulders, and, if I mistake not, on the head, with brass. There are two leathern tubes to it—one for the air to go down and to speak by, the other to pump out the air. They stay down five minutes' (*Travels through England*, Camden Soc. 1889). In 1779 Smeaton employed an oblong box supplied with air by means of a pump on the surface, for repairing the bridge at Hexham, in Northumberland.

The form of diving-bell now in use was first constructed by Smeaton for work at Ramsgate, in 1788. It was of cast-iron, and weighed 50 cwt., its height 4½ feet, length the same, and width 3 feet. It sunk by its own weight, and was lighted by stout pieces of bull's-eye glass, firmly cemented in brass rings near the top. The next improvement of importance was that due to Rennie, who designed in 1813, for the works of Ramsgate Harbour, a diving-bell of cast-iron, 6 feet high, 4 feet 6 inches wide, and 6 feet long. Six bull's-eyes of glass in the top admitted light. Air was admitted through the top by a valve, and was supplied by an air-pump through a 2½-inch hose. The interior of the bell was fitted with seats, chains for attaching stones, &c., and a rail for carrying tools. The bell, which weighed about 5 tons, was suspended by stout chains to a crab fixed to a truck travelling on an overhead gantry, and was successfully employed in various undertakings carried out by its designer. A large diving-bell, designed by Mr Stoney for the construction of the North Wall at Dublin, is 16 feet square at the top, and 20 feet square at the bottom, weighs 80½ tons, and is used for lowering 350-ton blocks of walling. Access is gained to the bell by means of a wrought-iron shaft and air-lock, thus obviating the necessity of raising the bell. This apparatus has been both efficient and economical in working.

The air-chambers of the caissons used for founding the piers of bridges are nothing more than huge diving-bells, only they remain in position when sunk to the requisite depth, and are filled up solid with masonry (see CAISSON). At the St Louis Bridge across the Mississippi, the maximum depth attained was 110½ feet, and the greatest pressure 51 lb., a pressure which proved fatal in a few instances to the workmen. The air-chambers of the caissons of the Forth Bridge were 70 feet in diameter, and 7 feet high. The work of excavation was carried on by electric light, and presented a singularly novel and weird spectacle. The maximum pressure was about 33 lb. per sq. inch above the atmosphere. The altered conditions of existence under a pressure of three atmospheres presents many points of interest. The voice sounds unnatural, and as if proceeding from another person; whistling is impossible. Effervescing drinks open flat, the pressure outside being equal to that accumulated in them. A feeling of lassitude is generally experienced on return to ordinary atmospheric conditions. The passage through the air-lock on entering, and the gradual admission of pressure, is at times, and more especially to novices, accompanied by severe pains in the ears; but with due care, and the observance of the prescribed simple expedients, these pass away. The workmen accustomed to subaqueous existence suffer no inconvenience from being below water.

The principle of the diving-bell will be easily understood by floating a piece of lighted candle or a wax match on a cork, and then covering it with an inverted tumbler, and pressing it downwards; the candle will descend below the level of the surrounding water, and continue burning for a short time, although the tumbler be entirely immersed. The reason is obvious enough: the air in the tumbler having no vent, remains in it, and prevents the water from occupying its place, so that the cork and candle, though apparently under water, are still floating, and surrounded by the air in the tumbler; the candle continues burning until the oxygen of the air is exhausted, and then it goes out, as would the life of a man under similar circumstances. If vessels full of air, like the barrels of Dr Halley, were submerged, and their contents poured into the tumbler, the light might be maintained; but this could be better done if a tube passed through the tumbler, and air were pumped from above through the tube into the tumbler.

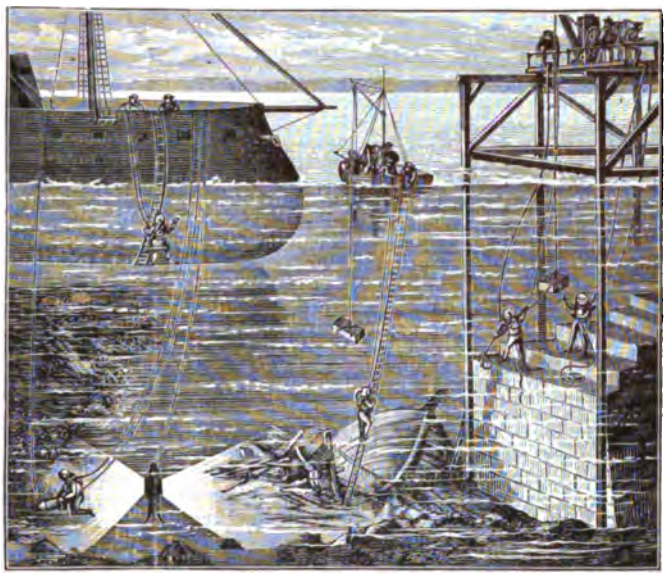


Diving-bell:
a, section showing inside;
b, top.

The modern diving-bell, which is made of cast-iron like Smeaton's, is supplied with air in this manner. It must be remembered that air is compressible, and diminishes in bulk in proportion to the pressure, so that at a depth of about 33 feet in water, it would occupy half the space it filled at the surface; if the inverted tumbler were carried to this depth, it would be half-filled with water. A considerable quantity of air has therefore to be pumped into the diving-bell, merely to keep it full as it descends; the air thus compressed exerts a corresponding pressure, and would rush up with great force if the tube were open and free. This is prevented by a valve opening downwards only. When the diving-bell has reached its full depth, the pumping is continued to supply air for respiration; and the redundant air overflows, or rather *under*flows, by the open mouth, and ascends to the surface in great bubbles. The diving-bell is provided with a platform or seat for the workmen, and suspended from a suitable crane or beams projecting from a barge or pier; men above are stationed to work the pumps, and attend to the signals of the bellman. These signals are simply made by striking the sides of the iron diving-bell with a hammer, and as sound is freely communicated through water, they are easily heard above. One blow

signifies 'more air;' two blows, 'stand fast;' three, 'heave up;' four, 'lower down;' five, 'to eastward;' six, 'to westward;' &c. These, of course, may be modified as agreed upon. Messages are also sent up, written on a label attached to a cord.

DIVING-DRESS. — In Schott's *Technica Curiosa*, published in 1664, is described a *lorica aquatica*, or aquatic armour, which consisted of a leathern dress and a helmet to protect the diver from the water. In 1721 Halley describes a contrivance of his own of nearly the same kind; its object was to enable the diver to go out from the bell and walk about. He was to be provided with a waterproof dress, and a small diving-bell, with glass front, as a helmet over his head, which was to be supplied with air by means of a tube from the diving-bell. Kleingert, of Breslau, in 1798 devised a diving-dress, consisting of strong tin-plate armour of cylindrical form encasing the diver's head and body; the lower portion of his person being clad in stout leathern costume. A pipe conveyed air to the diver, whilst a second pipe returned the air when vitiated to the surface. This apparatus was available only for depths up to 20 feet.



Divers at Work.

The open helmet diving-dress was invented in 1829 by Augustus Siebe, and marked considerable advance on previous attempts. This dress consisted of a copper helmet with breastplate attached, a canvas jacket being fastened to the latter. The lower part of the jacket was left open (hence the name), and the air escaped by this outlet, hence the water was only a few inches below the diver's mouth, and he had to maintain a vertical position. Leather boots loaded with lead were also worn.

Diving-dress.

In 1839 Siebe obviated the dangers attendant on the open dress by perfecting his modern close dress —a waterproof costume covering the whole body, save the head and hands, of strong tanned twill with mineralised india-rubber collars and cuffs. The helmet is made of tinned copper with three circular glasses in front; sometimes guards are added to protect them. The front eye-piece is made to unscrew and enable the diver to receive or give instructions without removing the helmet. One or more outlet valves are placed at the back or side of the helmet to allow the vitiated air to escape. These valves only open outwards by working against a spiral spring, so that no water can enter. The inlet valve is at the back of the helmet, and the air on entry is directed by three channels running along the top of the helmet to points above the eye-pieces, enabling the diver to always inhale fresh air, whilst condensation on the glasses is avoided. The helmet is secured to the breastplate below by a segmental screw-bayonet joint, securing attachment by one-eighth of a turn. In some dresses the escape valve is regulated at will by the diver, and being placed in front of the breastplate, enabling him to vary the pressure, and even to float himself by closing the valve and inflating his dress, but except in the hands of a skilled man this may prove a source of danger. Hence many makers, when an adjustable valve is desired, substitute one which rights itself as soon as the diver's hand is removed. The junction between the waterproof dress and the breastplate is made watertight by means of studs, brass plates, and wing-nuts. The diver carries back and front weights, each about 40 lb. The boots, made of stout leather with leaden soles, weigh about 20 lb. each. The helmet weighs about 40 lb. The diver in using the dress has usually two weights of about 40 lb. each on his shoulders, and lead soles, of 15 lb. each, to his boots. A life or signal line enables the diver to communicate with those above. The air-pipe is made of vulcanised india-rubber with galvanised iron wire imbedded. The cost of a dress with all essential apparatus is about £140.

In the diving-dress invented by Mr Fleuss, and patented by him in 1880, the diver is independent of supplies of air from above. A strong copper cylinder fastened to the back of the diver carries a supply of compressed oxygen, regulated at will by a jamb screw-valve. The carbonic acid exhaled by the diver is absorbed by caustic soda in a receptacle fixed above the copper cylinder, whilst the nitrogen is breathed over and over again. In this dress, which weighs about 26 lb., and can be adjusted in a few seconds, a man may remain below the surface for several hours without harm. In clear water and at moderate depths, no light is required, but where illumination is necessary, an improved oil-lamp, invented by Siebe, supplied with air by a small force-pump, is employed. Both arc and incandescent electric lights are now used for this purpose with

most satisfactory results. Experiments have been made to utilise the telephone, but communication by means of a slate or ordinary signal line remains universal. Siebe states the greatest depth to which a man has ever descended to be 204 feet, equivalent to a pressure of 88½ lb. per sq. inch. Slight men of muscular build, with good circulation, sound hearts, steady nerves, and temperate habits, make the best divers.

The British Admiralty and Royal Engineers train a large staff of divers. Every vessel in the British navy of any tonnage carries apparatus and one diver. Flag-ships carry, as a rule, two divers. The German and other navies also train divers.

Divining-rod, often called the *Virgula Divina*, the *Baculus Divinatorius*, the Caduceus or wand of Mercury, the Rod of Aaron, is a forked branch, usually of hazel, and sometimes of iron, or even of brass and copper, by means of which minerals and water may be discovered beneath the surface of the earth. The rod, when suspended by the two prongs, sometimes between the balls of the thumbs, indicates by a decided inclination the spot over which the concealed mine or spring is situated. It has often been used also to discover the authors of a crime, as by the famous Jacques Aymar in a case of murder and robbery at Lyons in 1692. Many men, even of some pretensions to scientific knowledge, have been believers in the occult power ascribed to this magic wand. Agricola, Sperlingius, and Kirchmayer all believed in its supernatural influence. Bayle, under the word *Abaris*, in his Dictionary, gives some ingenious arguments both for and against the divining-rod. It seems to be still believed in, not only by Cornish miners, but even by English civic officials, here and there, in the last decade of the 19th century.

It is hardly necessary to say that men who know anything of scientific method in the examination of nature regard this alleged power of the divining-rod as due either to conscious knavery or to a more or less unconscious delusion, the whole phenomena merely being due to the effect of a strong impression on the mind acting through the agency of the nerves and muscles. The divining-rod delusion should for ever have been laid to rest by Chevreul's *De la Baguette divinatoire, &c.* (1854). See also the essay in Lang's *Custom and Myth* (1884).

Divisibility is that property in virtue of which the whole may be broken up into parts. This process of division may be conceived to be carried on indefinitely so far as space is concerned. But the question of infinite divisibility as applied to matter at once raises the further question of the existence or non-existence of atoms (see ATOM). The actual division of matter may be carried on to a great extent. A thickly gilt silver rod has been drawn out into a fine wire still covered with a continuous coating of gold, the thickness of which must have been about $\frac{1}{1000000}$th of an inch. A small particle of common salt placed in a flame will colour it for some hours; and one grain of musk can scent, by its slow evaporation, the air of a room for years.

Divisibility, in the Theory of Numbers, is that property of any number whereby it may be divided by another without remainder. To find the condition of divisibility of one number, N, by another, D. Let $N = b_0 + b_1 r + b_2 r^2 + \ldots + b_{m-1} r^{m-1} + b_m r^m$, where b_0, b_1, &c. are coefficients, and r is the *radix* of the notational scale (see NOTATION). Introducing D and − D along with r, this may be written: $N = b_0 + b_1 (D + r - D) + b_2 (D + r - D)^2 + \ldots + b_m (D + r - D)^m$. Expanding the terms on the right-hand side of this equation, it will appear that $\frac{N}{D}$ will be an integer if $b_0 + b_1 (r - D) + \ldots + b_m (r - D)^m$ be divisible by D. For example, if $r = 10$ (i.e. if the number be given in the denary or ordinary scale), and D = 9, and therefore $r - D = 1$, any number will be divisible by 9 if the sum of its coefficients b_0, b_1, &c. be so—i.e. if the sum of its digits be divisible by 9. Further rules found in this manner are fully given in Mackay's *Arithmetical Exercises.*

Division, of an army, is the smallest unit which contains all branches of the service. It is a small army in itself, under a general officer, and capable of acting independently. Its strength and composition are very variable. The table shows a British division on a war footing as laid down under new instructions in 1889.

	Officers.	Non-com. Officers and Men.	Horses.	Guns.	Wagons.
Divisional Staff.....	18	58	46	..	..
2 Infantry Brigades (each 4 Battalions)..	260	8434	1072	4	236
1 Squadron of Cavalry...	6	138	144	..	4
3 Batteries of Artillery..	19	510	421	18	39
1 Company of Engineers.	7	210	70	..	13
Ammunition Column....	5	125	221	..	53
Commissariat & Transport Department....	7	157	184	..	29
Medical Department....	5	40	6	..	10
Total.....	327	9732	2164	22	384
At Base.....	16	752			

The guns with the infantry are machine guns. Tents, ammunition, three days' rations for men and two days' forage for horses, are provided for.

The divisions of foreign armies are similar in strength and composition. The name division is also given to a body of cavalry consisting of two or more Brigades (q.v.); and in the British army to three batteries of field artillery, acting under a lieutenant-colonel; to the two guns with their wagons, horses, men, and stores, which constitute a lieutenant's command in a Battery (q.v.); and to the groups of garrison artillery (comprising regulars, militia, and volunteers) which have been formed under the territorial system, in eleven of the military districts of the United Kingdom. See DEPÔT.

Naval Division.—For convenience of command and manœuvring, a fleet is divided into two, three, or more divisions, and each division into two subdivisions. Each division is commanded by a flag-officer.

Division of Labour is based on the principle that industry can be best carried on when each man has a special work to do. Constant practice in doing the same thing leads to a perfection which could not otherwise be attained. The classical illustration of it in the history of political economy is that of pin-making as given by Adam Smith: 'One man draws out the wire, another straights it, a third cuts it, a fourth points it, a fifth grinds it at the top for receiving the head; to make the head requires two or three distinct operations; to put it on is a peculiar business; to whiten the pin is another; it is even a trade by itself to put them into a paper; and the important business of making a pin is in this manner divided into above eighteen distinct operations, which in some manufactories are all performed by distinct hands.' In this way ten men could make about 48,000 pins in a day, whereas, if they worked separately and independently, they certainly could not each of them have made twenty, perhaps not one pin in a day. Adam Smith offers the following reasons why the division of labour secures greater efficiency: 'First, the increase of dexterity in every particular workman; secondly, the saving of the time which is commonly lost in passing from one species of work to another;

and lastly, the invention of a great number of machines which facilitate and abridge labour, and enable one man to do the work of many.' Economists believe, however. that Smith has laid too great stress on both the second and third of the above reasons.

Though the name of Adam Smith has been so closely associated with the principle of the division of labour, the importance of it had been recognised before, notably by Plato in his *Republic*, and by Adam Ferguson in his *History of Civil Society*. And it is hardly necessary to say that the invention of labour-saving machinery has rendered the example of the principle which he drew from pin-making almost entirely obsolete as an illustration of the existing methods of industry. (A good example of division of labour is given under CUTLERY: an ordinary three-bladed pocket-knife goes through more than a hundred processes. See also NEEDLES.) Pins, which were made in thousands through the co-operation of human hands, are now turned out in millions by the aid of machinery. In modern industry very little is due to the direct operation of the human hand; almost everything is done by a machine. The development of steam and electricity as the motive powers, both of production and exchange, has along with the parallel development of machinery completely revolutionised the conditions of industry, necessitating a division of labour on a far wider basis than that contemplated by Adam Smith. At the present day it is not a mere question of personal adaptation, but of local, national, and international fitness and specialisation for carrying on different forms of industry. Differences of climate and of other natural conditions, as well as differences of industrial development, impose upon nations a most comprehensive division of labour.

This division of labour, it must be obvious, has as its necessary complement an elaborate combination or organisation of labour. In every large industrial undertaking, whether it be a factory, railway company, or any other, the highest efficiency can be attained only when, every man having his proper work to do, each man's work effectually contributes towards the general result. It is only through the wise selection of the fittest persons for each class of work, and their special adaptation to it, that such an organisation can be maintained. Thus the division of labour is only a factor in the wider problem of the organisation of labour, necessary to the success of every great industrial undertaking. See LABOUR.

But while the division of labour is necessary towards an efficient industry, economists recognise that it has many disadvantages. It is attended with a monotony of occupation, which is not favourable to the development of the general intelligence and capacity of the workmen. Each man can perform his own narrow function, and beyond that his skill does not go. The monotony itself is most painful, especially under the long hours of work which prevail in so many countries. But the worst feature of all is that through the changes which so frequently occur in the industrial world, owing to the introduction of new machinery and other causes, the class of work to which the men have been trained may be entirely superseded. The most striking instances of this in the history of English industry was hand-loom weaving, rendered obsolete by the introduction of the power-loom. Workmen thus trained and specialised have a great difficulty in finding, and in adapting themselves to, any other form of occupation.

Division of Labour, a conception borrowed from Economics and introduced into Biology by Milne-Edwards, to describe the difference of function exhibited by the individual members of an animal colony, or by the different organs, tissues, and cells of a single organism. The figure of a hydroid colony, Hydractinia, shows how members, primarily and fundamentally the same in structure, become set apart as nutritive, reproductive, sensitive, and protective. The same division of labour or predominance of special functions in different individuals is beautifully illustrated in the Siphonophora—such as the Portuguese Man-of-war (q.v.). At a much higher level, vivid illustrations of the same fact may be found among the social Ants (q.v.) and Bees (q.v.). But division of labour in some degree is essential to every organism. Even in a single unit mass or cell, it is hardly possible for all the parts to be entirely in the same external and internal conditions; certain portions become more contractile, others more sensitive, others more nutritive, and so on. In a ball of cells, such as Volvox, the inequality in the conditions becomes more marked; the inside cells are not in the same state as their outside neighbours; they thus become seats of different vital processes, and distribution of function or division of labour is the result. The same process may be traced in the gradual evolution of tissues and organs, as also in the development of special 'persons' with limited and preponderant functions in animal colonies. When the predominance of some function has been established, it brings with it difference of structure. This differentiation or, when it concerns a colony, polymorphism is the structural side of the physiological fact of the division of labour. See COLONIAL ANIMALS, DIMORPHISM, HYDROZOA, &c.

Hydractinia echinata (after Allman): *a*, nutritive individuals; *b*, reproductive; *c*, protective; and *d*, sensitive individuals.

Divorce is the disruption of the legal tie between husband and wife. The desire to obtain a release from the matrimonial bond has existed under all systems of law or custom. In heathen nations, such release has often been permitted on very insufficient grounds. The Romans of the late republic and the empire permitted divorce at the will of either spouse; but a husband divorcing without cause forfeited the wife's dowry. The Emperor Constantine was the first to prohibit divorce at the mere will of the parties; after some fluctuations in the state of the law, the grounds which would justify husband and wife respectively in divorcing were settled by Justinian. These changes in the law were partly due to the introduction of Christianity.

The Jewish law of divorce is contained in Deut. xxiv. 1–4. The Christian view of marriage is declared in Matt. xix. 9; Mark, x. 9–12; Luke, xvi. 18; and 1 Cor. vii. Marriage was held by the early Christians to be a sacred tie, not to be dissolved except for unfaithfulness. By the canon law it was regarded as a sacrament, and the tie could not be broken, even in the case of adultery, except by a papal dispensation. In cases of misconduct, a separation *a mensâ et thoro* might be decreed; or if the marriage had not been regularly contracted, it might be declared null *ab initio*. Suits for

separation, or for a declaration of nullity, belonged to the ecclesiastical courts. These rules of the canon law were not uniformly adopted by European states; but in 1562 the Council of Trent established in Catholic countries the rule that marriage should be deemed indissoluble, even after adultery.

Many of the Reformers disputed the Catholic view of marriage. For reasons stated by Milton in his tract on the subject, they permitted a certain liberty of divorce. But in England the old rule held its ground till 1857–58; marriage could only be dissolved by a special act of parliament. A husband petitioning for such an act was required first to sue for a separation, and to bring an action for damages against the seducer of his wife. Divorce, therefore, was possible only for the rich.

By an Act of 1857 the jurisdiction in divorce and matrimonial causes was transferred to a new civil court, which since 1873 has formed part of the High Court of Justice, Probate, Divorce, and Admiralty Division. A decree of divorce may now be pronounced by a single judge, trying the case with or without a jury; but the decree is a decree *nisi* (i.e. a decree, *unless* cause be shown to the contrary), which cannot be made final until six months have elapsed. A husband may obtain a divorce on the ground of his wife's adultery; he may also obtain damages against the co-respondent. A wife may obtain a divorce on the ground of the husband's adultery, if aggravated by cruelty, incest, bigamy, rape, &c., or by desertion without cause for two years. The law is therefore unequal as between husband and wife; the reason of the inequality is, that unfaithfulness on the part of a wife throws doubt on the legitimacy of the children of the marriage, while unfaithfulness on the part of the husband does not. Mere desertion, however long continued, is not ground for a divorce, but for an action for restitution of conjugal rights. The husband may be ordered to pay an alimentary allowance to his divorced wife; and the court may make orders in respect of the custody, maintenance, and education of the children of a dissolved marriage. A petitioner who is himself or herself in fault is not entitled to the remedy of divorce; thus, the petition of a husband may be dismissed on the ground of recrimination, if he has himself been unfaithful; and if the wife, as sometimes happens, refuses to press the countercharge, it may be the duty of the Queen's Proctor to intervene and call the attention of the court to the facts. The petition may also be dismissed on the ground of collusion or connivance, if, for example, the husband has encouraged another man to make improper advances to his wife; or on the ground of condonation, if he has forgiven her, or continued to cohabit with her after discovering her offence. Similar rules apply to the petition of a wife. The confession of an accused party is evidence against him or her; but proof of this nature ought to be received with caution. If the respondent is of unsound mind, and therefore unable to plead, the petitioner will not be allowed to proceed with his case. Divorced persons are free to marry again; they cannot require a clergyman of the Church of England to marry them; but a clergyman who refuses must permit the use of his church for the purpose.

In Scotland, since the Reformation, the courts have decreed divorce, on the petition of either spouse, on the ground of adultery. An Act of 1573 makes desertion without cause for four years a ground for an action of adherence; and, if redress is not obtained by that means, decree of divorce may be pronounced. It is not permitted that marriage should take place between offending parties. In case of divorce, the offending party forfeits all pecuniary benefit which might accrue from the marriage (see ALIMENT). Separation may be obtained on the ground of ill-usage, and perhaps desertion. Bars to divorce are condonation, connivance, collusion, but not recrimination.

In France, divorce was established during the Revolution, abolished under the Empire, and restored by a law of 1884, which permits husband or wife to claim a divorce on the ground of adultery, cruelty, or conviction for any infamous crime. In most Protestant countries, divorce is granted for adultery, and other reasons. In some Protestant German states, divorce is scandalously easy; the divorces granted by the Unitarian authorities at Klausenburg, Transylvania, are notorious. In all Mohammedan countries, divorce is extraordinarily easy, a few words of repudiation from the husband practically sufficing to loose the marital bond.

In America, the laws of the states vary. In South Carolina, at one time, divorce was entirely unknown. In most of the states, adultery, ill-usage, and desertion are now regarded as good reasons for divorce; in some, drunkenness, imprisonment, and even incompatibility of temper are added to the list. There are in the United States no ecclesiastical or other specially constituted matrimonial courts; as a general rule, the civil courts have jurisdiction to dissolve the marriage of a party who is a citizen thereof, or domiciled therein; but there is an appeal to the Federal courts in cases where the state courts have mistaken the limits of their jurisdiction. In British colonies where the basis of the law is English, the principles of the law, subject to local legislation, are the same as in England.

In England, during 1850–87, the petitions for judicial separation and for divorce or dissolution of marriage numbered respectively 2784 and 10,561, of which 985 and 7321 were successful. In the United States, during 1867–86, there were 328,716 divorces granted—216,733 of them to wives, and 126,557 for desertion, 66,635 for unfaithfulness.

Questions frequently arise as to the competency of a court to annul a marriage contracted in another country on grounds which would not in that country be regarded as sufficient. As a general rule, the courts of a country have jurisdiction in matrimonial causes over all persons *bonâ fide* domiciled therein. But the English courts would probably refuse to recognise the dissolution of an English marriage by a foreign court on grounds not held sufficient in England. See Eversley, *The English Law of Personal and Domestic Relations* (1885), Lord Fraser's works on the Scotch law, and the American works by Reeves and Schouler; also the articles in this work on MARRIAGE, ADULTERY, HUSBAND AND WIFE, PARENT AND CHILD.

Dix, JOHN ADAMS, American statesman and soldier, born in Boscawen, New Hampshire, 24th July 1798, was appointed cadet in the United States army in 1812, ensign in 1813, and lieutenant in 1814, and while on the staff of General Jacob Brown studied law. In 1828, with the rank of captain, he resigned his commission, and settled in Cooperstown, New York. In 1830 he was appointed adjutant-general, and from 1833 to 1840 was secretary of state and superintendent of schools for the state of New York. He was for four years a democratic United States senator, and secretary of the treasury from January 11, 1861, to the end of Buchanan's administration. At the outbreak of the civil war he was appointed a major-general of volunteers, and in July 1861, he took command of the Department of Maryland, where he rendered effective service to the cause of the Union; from 1863 to the close of the war, he commanded the Department of the East. He was appointed minister to France in 1866, and elected governor of New York by the Republicans

in 1872. He died in New York city, 21st April 1879. His memoirs were published (1883) by his eldest son, the Rev. Dr Morgan Dix.

Dixie, or DIXIE'S LAND, a term which came, by a popular error, to be identified with the South and Southern institutions during the civil war. It is derived from a Northern negro refrain, which was sung in New York about the beginning of the 19th century, and which expressed the supposed regrets of the slaves of a man Dixie, who had shipped his slaves to the South as the abolition sentiment grew stronger. This rude chant afterwards was developed into the melody that for a time became the rival of *Yankee Doodle*.

Dixon, WILLIAM HEPWORTH, an English writer and traveller, was born in Manchester, 30th June 1821, early became a merchant's clerk, but soon determined to devote himself to a literary life. He had already written much, and even edited for two months a Cheltenham paper, when in 1846 he settled in London. In 1854 he was called to the bar, but did not practise. A series of papers, published in the *Daily News*, on 'The Literature of the Lower Orders,' and another on 'London Prisons,' attracted considerable attention. The latter reappeared in a volume published in 1850. Before this, but in the same year, he published *John Howard, and the Prison World of Europe*. It was with difficulty he could induce a publisher to accept it, yet when published it went through three editions in one year. Dixon now devoted himself principally to historical biography. In 1851 appeared the first edition of his *William Penn*, a work called into existence by the onslaught made by Macaulay on the eminent Quaker, in which Dixon undertook, not without success, to disprove the great historian's charges. In 1852 was published his *Life of Blake*, and in 1860 his *Personal History of Lord Bacon*, two works which were indeed popular, but failed to satisfy competent critics. From 1853 to 1869 Dixon was editor of the *Athenæum*. His books of travel, all bright and interesting, include *The Holy Land* (1865), *New America* (1867), *Free Russia* (1870), *The White Conquest* (1875), and *British Cyprus* (1879). His *Spiritual Wives* he issued in 1868. Accused of indecency in his *Free Russia*, he brought an action for libel against the *Pall Mall Gazette*, and was awarded a farthing damages. His historical works include *Her Majesty's Tower* (4 vols. 1869–71), *The History of Two Queens* (Catharine of Aragon and Anne Boleyn; 4 vols. 1873–74), and *Royal Windsor* (1878–80). His novels are unimportant. He died suddenly in London, 27th December 1879.

Dixon Entrance, a strait on the west coast of North America, separating Queen Charlotte Islands from the Prince of Wales Archipelago, and so dividing British territory from a part of Alaska.

Dizful, a town in the Persian province of Khuzistan, about 190 miles W. of Ispahan, on the river Diz, here crossed by a handsome bridge of twenty arches. It has over thirty-five sacred tombs, and nearly as many mosques; but half the town consists of subterranean excavations in the rock, on account of the heat. It has a large trade in indigo, and is noted for the manufacture of reed-pens, which are exported to India and Constantinople. Pop. 25,000. Fourteen miles SSW. lie the ruins of ancient *Susa*.

Djezzar (i.e. 'butcher'), the name given, on account of his cruelty, to Achmed Pasha, famous for his obstinate defence of Acre against Napoleon I. He was born in Bosnia about 1735, and rose, through murder and treason, from the condition of a slave to be pasha of Acre. In the beginning of 1799 the French entered Syria from Egypt, and advanced from victory to victory till they reached Acre, which was laid siege to on the 20th March. By advice of Sir Sidney Smith, Djezzar was induced to hold out; and such was the savage doggedness of his defence, that Bonaparte was obliged to retire on the 21st of May. He died at Acre in 1804.

Djinn, or JINN. See DEMONOLOGY.

Dmitrov, a town of Russia, dating from 1154, on a tributary of the Volga, 42 miles N. of Moscow, with some trade. Pop. 9206.

Dnieper (ancient *Borysthenes*), one of the large rivers of Europe, has its source, near the Volga and the Western Dwina, in certain swampy forest-lands in the north of the Russian province of Smolensk. It flows with a general southerly direction past Kiev, Ekaterinoslav, and Alexandrovsk to the Black Sea. Its embouchure (increased by the waters of the river Bug) forms a gulf nearly 50 miles in length, with a breadth of from 1 to 6 miles. Its principal affluents are the Desna and Soj from the east, and the Pripet, Beresina, and Druz from the west. The total length of the Dnieper is 1330 miles, and its drainage area embraces 245,000 sq. m. Some of the finest provinces of the Russian empire lie within its basin. At Dorogobush the stream becomes navigable, but below Kiev and at other points traffic is interrupted. Below Ekaterinoslav, indeed, there are no less than sixteen rapids in the course of about 25 miles; but these impediments to navigation have been overcome in part by blasting. The produce of the southern provinces is usually conveyed down the river to ports on the Black Sea, but many vessels pass annually from the Dnieper to the Baltic by the Brest-Litovsk canal (50 miles) and other waterways. The important river-traffic is now mostly below Smolensk; the chief fisheries are between Kherson and the estuary. The stream is permanently bridged at Kiev only, but boat-bridges and ferries are numerous along its banks. At Smolensk, the waters of the Dnieper are frozen from November to April; at Kiev, they are ice-bound only from January to the end of March; and at Kherson the river is frequently open all the year. See KINBURN.

Dniester, a river, chiefly of Russia, but having its rise in the Carpathian Mountains, in the Austrian crown-land of Galicia. Its general course, until it reaches the Russian territory, is south-east; it then runs east for a short distance, and thence south-east and south-south-east, separating Bessarabia from Podolia and Cherson, and enters the Black Sea by a shallow shore lake, 18 miles in length and 5 in breadth, between Akjerman and Ovidiopol. The total length of the Dniester is 650 miles, and it drains an area of nearly 30,000 sq. m. Its current throughout is very rapid, and after reaching the Russian frontier, rushes muddy and turbid through a broad, flat plain. The navigation is interrupted by a series of falls and whirlpools near Jampol. Wood and grain are the chief products conveyed down the river. Fishing-villages are frequent along its banks in Bessarabia.

Do'ab (from the Sanskrit, 'two rivers;' cf. Punjab) is a term used in India for the country between any two rivers, but specially the space inclosed by the Jumna on the south-west and the Ganges on the north-east—a space extending from Allahabad to the base of the Himalayas, a distance of upwards of 500 miles, with an average breadth of 55 miles. It is the granary of upper India, its great natural fertility having been increased by the Ganges, Lower Ganges, and Eastern Jumna canals, and the extensive irrigation system which these render possible. It is all well cultivated, and is densely peopled throughout.

Dobell, SYDNEY, poet, was born at Cranbrook in Kent, 5th April 1824. His father, a wine-merchant, removed to London about 1827, and in 1835 to Cheltenham; with Gloucestershire and with his father's business Sydney's whole after-life was connected. Under the influence of a sect, the 'Freethinking Christians,' founded by Samuel Thompson, his grandfather, he developed a hot-house precocity, and at fifteen became engaged to the girl whom he married at twenty. He never quite recovered from a severe illness (1847); and the chief events of his life were visits in quest of health for himself or his wife to Switzerland (1851), Scotland (1854–57), and Cannes, Spain, and Italy (1862–66). He died at Barton End House, among the Cotswold Hills, 22d August 1874. His principal works are *The Roman*, by 'Sydney Yendys' (1850); *Balder* (Part I. 1854); *Sonnets on the War* (1855), in conjunction with Alexander Smith; and *England in Time of War* (1856). The first and the last achieved a success to wonder at. For though some of his lyrics are pretty, though his fancy is ever sparkling and exuberant, his poems as a whole are nerveless, superfine, grandiose, transcendental. 'Spasmodic' does hit them off better than comparison either with Shelley or with Donne. Professor Nichol edited his collected poems in 1875, and his prose works in 1876 as *Thoughts on Art, Philosophy, and Religion*. See his *Life and Letters* (2 vols. 1878), and the memoir by W. Sharp prefixed to his selected poems (1887).

Döbeln, a town of Saxony, on an island formed by the Mulde, 40 miles SE. of Leipzig by rail, with foundries, and manufactures of fire-engines, machines, cigars, cloth, leather, sugar, carriages, and pianos. Döbeln dates from the 10th century, and in spite of its sufferings at the hands of the Hussites and in the Thirty Years' War, has preserved a number of interesting old buildings. Pop. (1885) 11,972; (1890) 13,892.

Do'beran, a favourite bathing-resort of Mecklenburg-Schwerin, 2½ miles from the Baltic, and 25 miles NE. of Wismar by rail. It has a ducal palace, dating from 1232, is connected by rail (4 miles) with a large sea-bathing establishment, and has a strongly chalybeate spring. Pop. 3905.

Döbereiner, JOHANN WOLFGANG (1780–1849), professor of Chemistry in Jena, and friend of Goethe, is remembered for what is called *Döbereiner's Lamp*, a piece of platinum sponge which ignites a jet of a mixture of oxygen and hydrogen or of common air directed on it.

Dobrovsky, JOSEPH, the founder of Slavic philology, was born August 17, 1753, at Gyermet, near Raab in Hungary, where his father, a Bohemian by birth, was stationed in garrison. He studied mainly at Prague, in 1772 entered the Jesuit order, and was successively a teacher, a family tutor, and the editor of a critical journal. In 1792, at the expense of the Royal Bohemian Scientific Society, he made a journey to Denmark, Sweden, and Russia, to search after the fate of those Bohemian books and MSS. which the Swedes had carried off from Prague during the Thirty Years' War. Till his death, January 6, 1829, he was reckoned one of the highest authorities on all matters connected with Bohemian history and literature. Among his works are *Scriptores rerum Bohemicarum* (1784), a history of the Bohemian language and literature (1792), a German-Bohemian dictionary (1802–21), *Glagolitica* (1807), and *Institutiones Linguæ Slavonicæ* (1822). See his Life in German by Palacky (1833).

Dobrudja (variously spelt *Dobruja*, *Dobrudscha*, or better, *Dobrutcha*), the south-eastern portion of Roumania, between the lower Danube and the Black Sea, transferred to the principality by the Berlin Congress of 1878, which fixed the southern limit at a line from Silistria on the Danube to Mangalia on the sea-coast. The north-east of this region is occupied by marshes and the delta of the Danube; the rest mostly a treeless steppe, too dry for farming, on which large herds of cattle, horses, and sheep are raised. The climate is malarious and unwholesome, and the inhabitants are a feeble folk. Roumanians and Bulgarians are the most numerous; many of the immigrant Circassians formerly settled here, Tartars and Turks having since 1878 gone to Turkish territory. There are some 16,000 Turks still, with 15,000 Russians, and a number of German colonists. A railway traverses the district. Area, 6102 sq. m.; pop. 106,943.

Dobson, HENRY AUSTIN, poet, was born at Plymouth, January 18, 1840. He was educated at Beaumaris, Coventry, and Strasburg, and at first intended to follow the profession of his father—a civil engineer, but in 1856 entered the civil service as a Board of Trade clerk. His earliest poems, published in 1868 in Anthony Trollope's *St Paul's Magazine*, have been followed by a multitude of poems in some of the best contemporary magazines, more especially in the more artificial forms of French verse, the rondeau, the ballade, and the villanelle. These are all marked by rare perfection of form, while many are informed with true natural pathos, or reveal genuine satirical strength. His chief collections of verse are *Vignettes in Rhyme, and Vers de Société* (1873), *Proverbs in Porcelain* (1877), and *At the Sign of the Lyre* (1885). The volume entitled *Old World Idylls* (Lond. 1883) consisted in great part of pieces selected from the first two. In prose Dobson has published a life of Fielding in the 'English Men of Letters' series (1883), and of Steele in 'English Worthies' (1886), *Thomas Bewick and his Pupils* (1884, new ed. 1889; republished from the *Century* magazine); *Horace Walpole: a Memoir* (1891), and a Life of Hogarth (1891). He wrote the critical notices of Hood, Gay, Praed, and Prior for Ward's 'English Poets' (1880); contributed the articles on the three last named, and on Fielding, Goldsmith, Hogarth, and Richardson to the present work; and has edited *Eighteenth-Century Essays* (1882), Gay's *Fables* (1882), Goldsmith's *Vicar of Wakefield* (1883), Beaumarchais' *Le Barbier de Séville* (1884), and *Selections from Steele* (1885).

Dobson, WILLIAM, portrait-painter, was born in London in 1610. He was introduced to Charles I. by Vandyck, whom he succeeded as king's serjeant-painter and groom of the privy chamber. He attended the king at Oxford, where he painted his portrait, and those of the Prince of Wales, Prince Rupert, and other members of the court. The disturbances of the time and his own careless habits threw his affairs into confusion, and he was imprisoned for debt, and died in poverty, 28th October 1646, shortly after his release. His finest portraits are lifelike and well executed, resembling those of Vandyck. Examples are preserved at Coombe Abbey, Bridgewater House, Devonshire House, the National Portrait Gallery, and at Hampton Court, where is the excellent painting of himself and wife.

Doce'tæ (from the Gr. *dokeō*, 'I appear or seem') was the name given in the early church to those heretics who held that the human nature of Jesus Christ was a semblance and not a reality. The docetic tendency originates in the oriental and Alexandrian notion that matter is as such imperfect and impure; and the Gnostic and Manichæan heretics found it impossible to conceive the essential union of the divine nature with a body composed of matter. The difficulty was got over in one of three ways: the body of Christ was either considered a real earthly body, but not belonging essentially to his nature, and only assumed for a

time; or it was declared to be a mere appearance or illusion (as by Marcion, the Ophites, the Manichæans); or, finally, it was believed to be a heavenly body, composed of ethereal substance, though having the appearance of being material (as by Basilides, Bardesanes, Tatian, Valentine). Clement of Alexandria and Origen are most free from traces of Docetism; the Priscillianists and Bogomiles may be reckoned amongst the Docetæ. See GNOSTICISM, and the works on the History of Dogma.

Dock. The large genus Rumex of the order Polygonaceæ is usually divided into Docks and Sorrels, the latter distinguished not only by their peculiarly acid taste, but by hastate leaves and usually dicecious flowers (see SORREL); those of the docks proper being generally hermaphrodite. They are large perennial herbaceous plants, natives chiefly of temperate climates, with large generally lanceolate or ovate leaves, and panicles of small greenish flowers. They have great tap-roots, and are with difficulty eradicated from pastures. They also multiply rapidly by seed. The best mode of dealing with them is generally found to be repeated cutting away of their leaves and shoots, by which the plants are killed. Many of the species prefer watery places. Several of the European ones have found their way to North America, where they have reinforced the indigenous species as troublesome weeds. The large astringent roots of various species, notably of the Great Water-dock (*R. Hydrolapathum*), as also of the Monk's Rhubarb (*R. alpinus*), were much esteemed in medicine until superseded by more powerful remedies. They have also been used in dyeing.

Dock, an inclosure for the accommodation of shipping, and of which there are three principal kinds—wet-docks; tidal docks, which may with more propriety be called harbours or basins; and dry or graving docks; besides floating-docks, which are widely different from the others.

Wet-docks are for the purpose of maintaining a level nearly uniform with that of high-water, so as to keep vessels always afloat, and to avoid straining by taking the ground, also to save them from rubbing up and down the quays with the rise and fall of the tide, and to secure that the quays shall not be sometimes too high and at other times too low for convenience in shipping or discharging cargoes. Wet-docks are generally surrounded by quay or wharf walls of masonry or brickwork, but where they are wanted chiefly for laying up vessels in, and not for loading or unloading, their margin is sometimes only a natural sloping beach. They are of most importance in places where there is a great rise and fall of tide, such as at Bristol or Liverpool, where the range of tide is about 30 feet, or in the Thames, where it is 20 feet; indeed wherever the range exceeds 12 feet they are almost indispensable; while, again, in the Clyde at Glasgow, where the tides are small (about 10 feet at spring-tides), there are no wet-docks strictly speaking, but simply tidal basins excavated to a great depth under the low-water level. Such also is the case along the east coast of North America, where the tides range from 9 feet 6 inches at Boston to 1 foot 8 inches at Baltimore and Galveston. The Queen's Dock at Stobcross, Glasgow, for example, has a depth of 20 feet at low-water, so that the largest vessels are nearly entirely water-borne at the lowest state of the tides. There has, however, recently been constructed at Greenock, where the tide has the same range as at Glasgow, the James Watt Dock of 13½ acres extent, and having a depth on the sill at high-water of 32 feet. Wet-docks are generally entered by means of what is called a Lock (q.v.), having two sets of gates, separated by the length of the largest vessel using the dock, which enables vessels to enter or depart for a considerable time before and after high-water; but frequently, for the sake of economy both in space and in cost, they have only one set of gates, so that vessels can only enter or depart at or very near high-water of the day.

The water in wet-docks is sometimes, by means of pumping or artificial reservoirs, kept up permanently at as high a level as that of the highest tides; but this involves the necessity of locking up or down always except at the highest tides. The tendency to silt up by deposits of fine mud is of common occurrence, and dredging, or some other plan, must be resorted to for the purpose of keeping the dock reasonably clear. In almost all cases, wet-docks require to be occasionally emptied for the purpose of cleaning. Docks must have proper moorings both on the quays and floating in the basin for making vessels fast to. They are also generally provided with sheds to keep goods dry, with cranes for shipping or unloading heavy articles, and with staiths or drops in the case of coal-shipping ports, and now they very frequently have rails laid along them.

Dock-gates, when on a small scale, are opened and shut by means of chains worked by hand, either by winches or capstans; but when on a large scale, and particularly in recent years, they have in most cases been moved by hydraulic machinery.

No docks in the world are on so splendid a scale as those of London, Liverpool, and Birkenhead. Surrounded with substantial stone quays, provided with gates, placed under a proper police, and otherwise managed in a costly manner, these, as well as nearly all other docks in Great Britain, require to be supported by rates levied from the vessels resorting to them; and for levying these rates, powers are taken in the acts of parliament authorising the construction of the respective docks. Sometimes the dock dues or rates are imposed on vessels in bulk according to tonnage, and in other instances, the rates are so much per ton, according to the nature of the goods. The Liverpool dock receipts have in recent years, including Birkenhead, exceeded a million and a quarter sterling. Generally, the dues are complained of as being a heavy burden on commerce; and complaints on this score, along with the high railway charges between Liverpool and Manchester, were the chief reason for the projection of the Manchester Ship Canal. But so enormous is the cost of constructing docks, that when owned by joint-stock companies they do not often yield good returns for the money invested. The most remarkable circumstance connected with English docks is the rapid extension of the dock-system on the Mersey at Liverpool. The original old dock contained an area of 3 acres 1200 yards, and 557 lineal yards of quay space. The total area is now (1889) 324 acres, and the quay space 21 miles 1496 yards in length. The Birkenhead Docks contain 159 acres, and have a quay space of 9 miles in length. The whole area of the London Docks on the north side of the river, exclusive of Tilbury, is 395 acres, and the area of dock property 940 acres. The Surrey and Commercial Docks, on the south side of the river, have a land and water area of about 330 acres.

The most important of the London Docks are the Royal Albert and Victoria (fig. 1), which form a continuous line of docks across a neck of land between the Bugsby and Gallion reaches of the Thames. The Victoria Main Dock contains 74 acres, and its tidal basin 16 acres, the depth over the sill at high-water being 28 feet; the dock is 1050 feet in width, with jetties on the southern side, which increase the berthage and quay room.

Connected with this dock there is an hydraulic lift and 8 graving-docks. The cost was £706,500. The connecting channel between this and the Albert Dock is 80 feet in width; the dock itself is 6500 feet long and 490 feet wide, and without jetties; the entrance lock is 550 feet long, 80 feet wide, and has a depth of 30 feet at high-water; the area is 84 acres, and the length of quays 3 miles. There are, opening off the dock, two graving-docks, respectively 500 and 400 feet in length, with

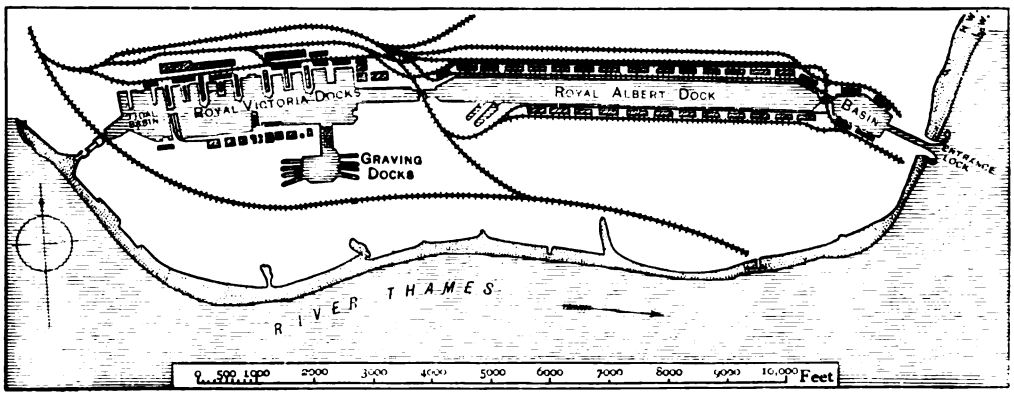


Fig. 1.—Plan of the Royal Albert and Victoria Docks, London.

entrances of 84 and 76 feet. The walls of this dock are built wholly of concrete, and the quays are lighted by electricity.

The Tilbury Docks have the deepest water of any in the United Kingdom. They are situated 26 miles below London Bridge. Next the river is a tidal basin of 19½ acres, with a depth of 46 feet at high-water; from this extends the lock, 700 feet long and 80 feet wide, to the main dock, which has an area of 57 acres, and a depth of 38 feet at high-water.

Fig. 2 shows part of the most important of the

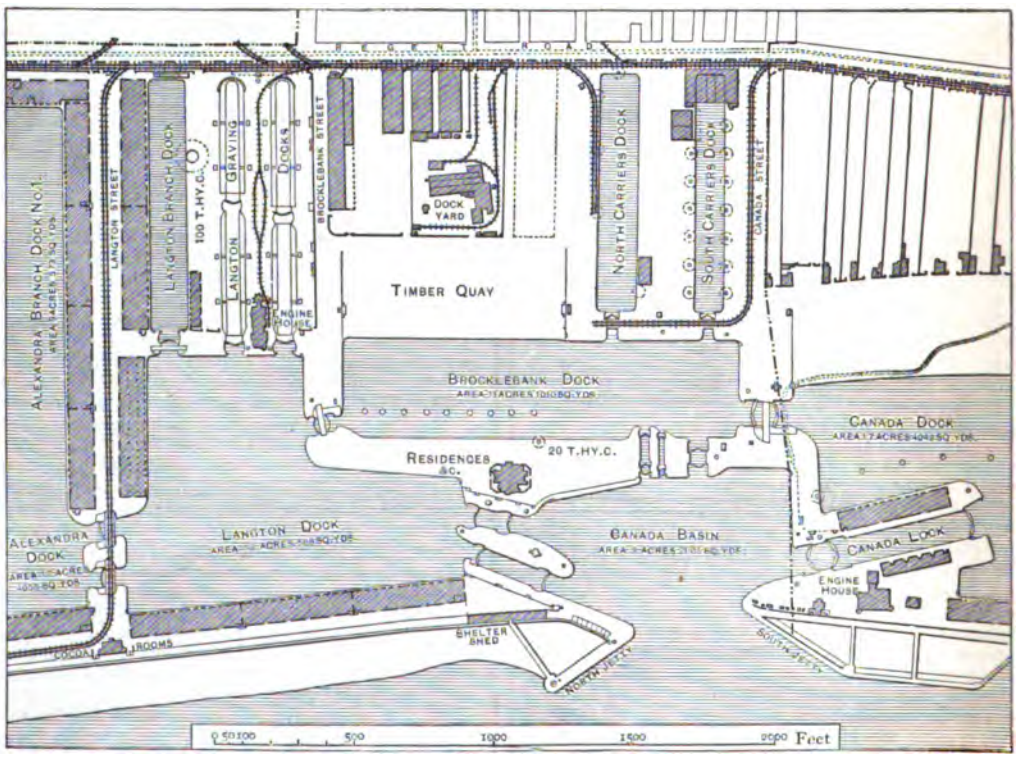


Fig. 2.—Plan of the Canada Basin, and its connections, Liverpool.

Liverpool Docks. They are approached from what is called the Canada Basin. In the Langton branch there is an hydraulic crane capable of lifting 100 tons, the charge for the use of which is £1 per hour for 100-ton lifts. This dock is remarkable for the extensive sluice arrangements, designed by Mr Lyster, for keeping the entrances to the river free from silt. These sluices are capable of discharging

1,750,000 cubic feet of water per minute, creating an outward current of 10 miles an hour. The area of the whole of the Liverpool Docks, including land and water, is 1075 acres.

In connection with wet-docks, outer or tidal basins are frequently formed between the entrance lock and the river or sea, admitting of a large additional traffic being accommodated; the entrances to these basins are provided with a single pair of sea-gates, which are kept open till half-tide, so that inward-bound vessels may run into them up to that time, and be afterwards passed into the dock by means of the lock; and in like manner, outward-bound vessels can be passed out to the sea long after high-water. As an example of the size of these half-tide basins, it may be stated that at Penarth Dock, which is 18 acres in extent, the half-tide basin is 3 acres, the width of entrance 60 feet, and the depth at high-water springs 35 feet.

The following table gives the dimensions of various docks, with depth over the sill at high-water in ordinary spring-tides:

	Length in feet.	Breadth in feet.	Depth.
			ft. in.
Cardiff—West Bute.....	4000	200	28 8
" East.....	4300	300 to 500	31 8
Penarth.....	2100	370	35 0
Barrow—Devonshire....	2500	250	25 6
Avonmouth.....	1400	500	38 0
Kingston—Victoria.....	1440	378	26 2
" Albert.....	3350	200 to 430	28 5
London—Albert.....	6600	490	30 0
Leith—Albert.....	1100	450	26 6
" Edinburgh.....	1500	650	26 6
Belfast.....	680	225	22 0
Tyne—Northumberland.	3700	over 600	24 0
" Albert-Edward...	1300	" 700	36 0
Antwerp—Kattendyk...	3000	" 500	
St Nazaire—Penhouet..	3600	" 750	
	Area.	Length of Quay.	
Liverpool—Canada.....	17¼ ac.	1272 yd.	26 6
" Langton.....	18½ "	1322 "	29 0
" Alexandra...	17⅔ "	1085 "	32 0
Birkenhead—West Float.	52 "	2 m. 210 yd.	32 0
" East Float.	60 "	1 " 1506 "	32 0

Tidal docks require no particular description; they are merely basins surrounded by quay walls, and having open entrances permitting the free flow and ebb of the tide, as at Glasgow, Greenock, &c., and they have the advantage of requiring no opening or shutting of gates. With small tides they answer very well, and they are sometimes made deep enough to keep vessels afloat at low-water; but with tides of considerable range they are attended with the disadvantage of large vessels grounding at low-water, and from the large volume of water, generally more or less turbid, which enters at every tide, they are much more liable to silt up than wet-docks are. For ridding them of muddy deposits, the plan is sometimes resorted to of letting out a reserve of water with a sudden gush from an inclosure at the inner end, at the time the tide has receded. This is called scouring. Such is the process pursued at Boulogne and elsewhere. Tidal docks or basins have been formed on a large scale at Hamburg, also at Rotterdam; at the former, the harbour quays extend to about 3 miles. Havre, Honfleur, and St Nazaire resemble English ports with docks; Antwerp, Rotterdam, and Hamburg have accommodation on the river quays as important as their docks; at Rouen and New York, quays and wharves suffice.

The Kingston Tidal Dock at Glasgow, made in 1867, has an area of 5½ acres, a quay space of 2490 feet in length, and a depth of 23 to 24 feet at high-water. The Queen's Dock, finished in 1880, has an area of 33¾ acres, a quay space of 10,000 feet, and a depth of 27 to 30 feet at high-water. The quays are furnished with powerful hydraulic cranes, the pressure being produced by steam-engines of 175 horse-power acting on an accumulator giving 700 lb. to the square inch. The dock entrance is 100 feet in width. These docks are tidal and unfurnished with gates, and vessels drawing under 20 feet can pass out or in at any time of tide.

Dry-docks or *Graving-docks* are used for the purpose of laying vessels dry for examination or repairs. They may have their entrance either from a wet-dock or from a tidal harbour; but the former is by much the better arrangement, as it admits of vessels being docked or taken out at any time of tide, and it keeps a more equal pressure on the gates, thereby making them less liable to leak. They require to be built of good watertight masonry. The entrance has generally a pair of folding-gates, pointing outwards, to exclude the water; but sometimes it is closed by means of a Caisson (q.v.). When the tides are very large, the bottom of the dock may sometimes be placed above low-water, so that it may be run dry without pumping; but generally when the rise of the tide is small, the bottom of a

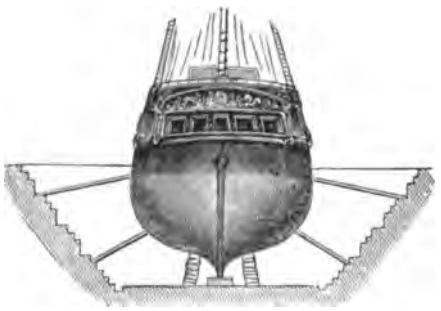


Fig. 3.—Section of Dry-dock.

dry-dock for the reception of any but very small vessels is below that level, in which case a steam-engine and pumps, with a well and water-channels leading to it, are required for emptying the dock. The floor is nearly level, and the keel of the vessel to be docked rests on wooden blocks fastened down to prevent them floating, and of such a height as to admit of the shipwrights getting under the vessel's bottom. Side-shores are put in, to keep the vessel in an upright position, and blocks are fitted in under the bilges as soon as possible after the water has been got out of the dock. The sides generally consist of stone steps called altars, for the purpose of fixing the lower ends of the shores, and also for the convenience of supporting the workmen's scaffolds. Dry-docks are frequently made long enough to hold three or four vessels of considerable size at one time, in which case they are placed, not in the centre line of the dock, but obliquely across, so as to give more available length.

The use of the graving-dock is frequently superseded by that of Morton's patent slip (see SLIP). Graving-docks of large dimensions are very expensive works, and the difficulty of making them watertight is, in certain situations, very great. Liverpool has twenty-three graving-docks, having a total length of 12,489 feet of floor, many of them being 600 feet, and some even as high as 768 feet in length. The graving-docks at Birkenhead are the largest in the United Kingdom; there are three of them of the length respectively of 930, 750, and 750 feet, and width of entrance of 60, 50, and 85 feet, with depths of water of 24 feet 9 inches, 27 feet 9 inches, and 27 feet 8 inches, at high-water spring-tides over the sills.

Floating-docks were at first built of timber, in

the form of a large box with a flap-door falling down on strong hinges at one end. Such docks are moored in still and shallow water, with a depth just sufficient to allow the vessel to float into them as they rest on the bottom. The flap-door is then raised up, and the water pumped out. These timber docks are incapable of being used in deep water, in consequence of their want of stability.

It was not until the introduction of iron as the material for constructing them, that floating-docks were made capable of working in deep water, and able to take in the largest class of ships. Mr G. B. Rennie's docks are said to be the first of the kind that were made of iron. Mr Thomson, of Edinburgh, designed in 1859 a great iron floating-dock for the port of Sourabaya, Java; and he determined to make every separate piece of the Sourabaya Dock from drawings, and to dispense altogether with the costly operation of building up in this country. There were upwards of 75,000 separate plates, ribs, and angle-irons, every one of them shaped, accurately punched with numerous holes, and ready to be riveted into their places. The dock was composed of five great watertight compartments; and these were divided in their longitudinal direction into five separate divisions, making in all 25 watertight compartments, any one of which could be filled or emptied at pleasure; thus affording complete command over the dock, and admitting of its being put into any required level, notwithstanding any irregularity in the distribution of the weight resting on the dock. The watertight compartments were all completely under the command of powerful centrifugal steam-pumps, so that they could be separately filled or emptied in a very short time; and thus the dock could be heeled over to one side, for the purpose of getting at the bottom for repairing or cleaning it. This tilting over could be accomplished by filling the compartment at one side, and emptying all the others.

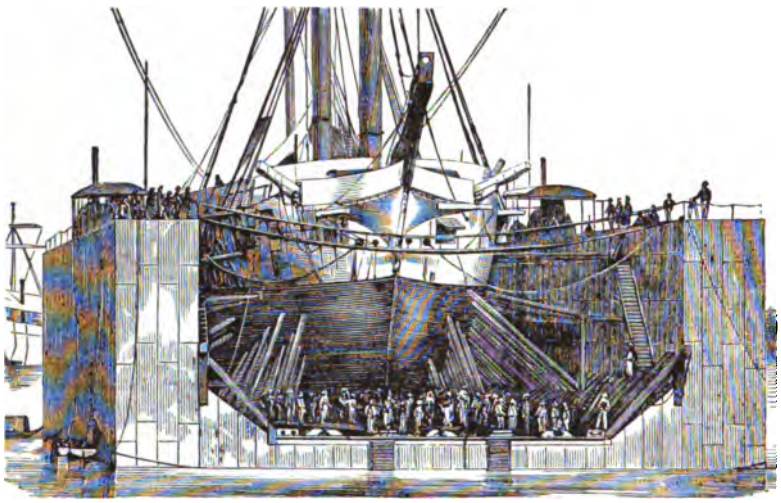


Fig. 4.—Floating-dock at Saigon.

It must be mentioned that floating-docks require engineering skill for their management, and, unless very carefully handled, are liable to serious accidents. Some have been wholly lost; one erected at Rio Janeiro proved unmanageable, and was never used; and a fatal disaster occurred in connection with one at Callao. To overcome such disadvantages, Mr Edwin Clark invented the Hydraulic Lift Graving-dock, London. It consists of a pontoon, filled with water, and sunk between two rows of iron columns; and the pontoon, when the vessel has been placed over it, is raised by hydraulic pumps acting on the pontoon by chains.

Fig. 4 is a view of the dock at Saigon in Cochin-China, constructed by order of the French government, and put together nearly in the same way as that at Sourabaya. Its performances proved in every way most satisfactory; it easily lifted, high and dry out of the water, the 70-gun frigate, *Persévérante*. None of these iron docks have doors or gates for excluding the water. The bottom part is made of sufficient buoyancy to float the vessels clear out of the water, and the equilibrium of the dock is maintained during the time it is under water, for the purpose of admitting a vessel, by the great displacement offered by the hollow sides.

One of the most remarkable of recently constructed floating-docks was that sent out to St Thomas, West Indies, in 1867, and designed by Mr Frederick J. Bramwell. It is 300 feet long, 72 feet wide clear between the sides, and has a double bottom 9 feet 9 inches deep. The sides are open girders, not hollow boxes, as in the Sourabaya Dock, and immense rectangular air-vessels called 'floats' are placed between the side girders, and are capable of being moved up and down by screws in order to preserve the stability of the whole while it is being raised or lowered. By an accident which happened very soon after its arrival at St Thomas, this dock was sunk, and it was only raised to the surface in 1871, after operations which lasted a year and a half. Its lifting power is 8357 tons. A dock sent to Bermuda in 1869 (see BERMUDAS) has a lifting power of 16,700 tons, and is 381 feet long. The docks made by Messrs Rennie for Cartagena and Ferrol have been very notable and successful. The former weighs about 4400 tons, and is credited with a total lifting power of 11,500 tons; while that at Ferrol should sustain a weight of no less than 13,040 tons. See L. F. Vernon Harcourt, *Harbours and Docks* (2 vols. 1885).

Docket (from the same root as *dock*, 'to cut off or clip'), a small piece of paper or parchment, containing a brief or summary of a large writing. All attestations or declarations annexed to written instruments are called dockets, more particularly those that are done by a Notary-public (q.v.).

Dock Warrants are orders or authorities for the removal of goods and merchandise warehoused in the various docks. The orders are granted by the proper officer at the docks, on application of the importer, in favour of any one whom the latter shall name. Careful rules as to obtaining warrants are laid down by the East and West India Dock and the London Dock Companies. These rules are, in a great measure, followed by the other dock companies in the kingdom. Unless the rules are complied with, goods will not be delivered from the docks. Warrants may be obtained for either the whole or a part of a cargo consigned. A warrant may be assigned by the holder. A single warrant may also, at the desire of the holder, be

divided into smaller warrants, and these also may be assigned. In case a warrant is lost, a new warrant will not be issued till the loss has been advertised, and the holder furnish the company with an engagement to indemnify them for any loss which may arise.

Dockyards, ROYAL. Under the names of the several towns where the royal dockyards are situated those establishments are briefly noticed. Under the present heading a few remarks may be useful concerning the whole of them collectively.

Most of the royal ships are built by the government at one or other of the dockyards at Portsmouth, Plymouth, Sheerness, Chatham, and Pembroke. Each of these establishments comprises covered slips on which the ships are built, docks in which they are kept, and all the appliances for rigging them out for sea. Boat-building and mast-making are also carried on; and in some, though not all of the yards, ropemaking, sailmaking, anchor-forging, blockmaking, and other manufacturing operations connected with the finishing and furnishing of ships. There are also arrangements connected with the storing of guns and other munitions of war. The yards at Plymouth, Gosport, and Deptford are limited to large establishments for victualling the navy; while machinery is repaired and constructed in the dockyards proper. To enable ships to be repaired and refitted abroad, there are royal dockyards at Gibraltar, Malta, Halifax, Bermuda, Jamaica, the Cape of Good Hope, Ascension, Trincomalee, Esquimalt, Sydney, and Hong-kong. Since the creation of a steam-navy, and the large substitution of iron for wood in shipbuilding, an increasing proportion of the royal ships are built in private yards. All the royal dockyards are under the Admiralty, and each is governed by a distinct set of officers responsible only to that department. The chief officer, called the superintendent, is always a naval officer —an admiral at the larger yards, a captain at Sheerness and Pembroke; and the office is deemed an honourable recognition of past services. The superintendent controls all the other officers, and all the artificers and labourers employed; examines the accounts, authorises the payments, and is responsible for the stores. When a new ship is to be built, or other work executed, the superintendent receives general instructions from the Admiralty, while special instructions are conveyed to other officers more immediately concerned with the actual working. In yards where steam-machinery is repaired and fitted, engineers form an important part of the establishment. The artisans of the dockyards comprise shipwrights, platers, caulkers, joiners, smiths, millwrights, blockmakers, sailmakers, ropemakers, &c.; while under these is a large body of labourers.

In 1889–90, £1,619,300 was voted for wages in the dockyards at home and abroad. These charges are exclusive of £1,475,500 for materials, and are for the dockyards only, as distinguished from the victualling yards; which latter cost £67,534 in 1889–90. There is a separate vote for stores and materials for building and fitting out vessels for the fleet. Of the total £21,000,000 voted for naval increase in 1889–90, £11,000,000 was to be expended in private yards. The general direction of the royal dockyards is under the superintendence of the Controller of the Navy. See COALING STATIONS.

In the United States, the Bureau of Yards and Docks has charge of the construction of dock buildings, &c., of the naval grounds, and of all civil engineering work for the navy. There are eight navy yards—Portsmouth, Portsmouth, N. H. (164 acres), Charlestown, Boston, Mass. (87 acres), New York, Brooklyn, N. Y. (179 acres), League Island, Philadelphia, Pa. (617 acres), Washington, Washington, D. C. (42 acres), Norfolk, Norfolk, Va. (82 acres), Pensacola, Pensacola, Fla. (83 acres), and Mare Island, San Francisco, Cal. (741 acres). There are also five naval stations—New London, Conn., Port Royal, S. C., Key West, Fla., Sackett's Harbor, N. Y., and Erie, Pa.

The great naval centres of France are Cherbourg, Brest, Lorient, Rochefort, and Toulon. Germany has three ports of war—Kiel, Danzig, and Wilhelmshafen. Trieste and Pola are the Austrian naval harbours. Russia has Cronstadt and Sebastopol at home, and Vladivostok in the Ameer territory. See ARSENAL.

Doctor (Lat. *docēre*, 'to teach'), a teacher. Originally the word doctor was used to signify a teacher in general, and it was not till the 12th century that it became the highest university title of honour for the learned. It had frequently appended to it in those early days some additional expression intended to characterise the peculiar gift of its possessor. Thus, Thomas Aquinas was called the Doctor Angelicus; Bonaventura, the Doctor Seraphicus; Alexander de Hales, the Doctor Irrefragabilis; Duns Scotus, the Doctor Subtilis; Roger Bacon, the Doctor Mirabilis; William Occam, the Doctor Invincibilis or Singularis; Joseph Gerson, the Doctor Christianissimus; Thomas Bradwardine, the Doctor Profundus; and the like. Formal promotions to the university degree of *doctor legum* commenced at Bologna about 1130, and the learned Irnerius, the regenerator of the Roman law at that period, is said to have introduced the ceremonial which was afterwards universally adopted. The university of Paris almost immediately followed in the footsteps of Bologna. In England the doctorate was not introduced till the following century. Originally the degree, which is more modern than those of bachelor and master, was granted only in law and divinity; in medicine it was not granted till the 14th century; in philosophy, science, literature, and music, only quite recently. The doctor's degree is granted either on examination, and after the ancient form, at least, of publicly defending a learned thesis in Latin has been observed, or else it is an honorary degree, conferred in consideration of the general reputation of the recipient for eminence in some particular branch of learning, philosophy, or science. The doctorate of laws (whether in the form of LL.D., *Legum Doctor;* D.C.L., Doctor of Civil Law; or J.U.D., *Doctor Utriusque Juris,* Doctor both of Civil and Canon Law) is especially wont to be conferred on eminent men *honoris causa tantum;* the D.D. is often distinguished rather as a pastor or public man than as a divine; the doctorates of medicine, science, and music are usually for ascertained professional attainment. In Germany, learned ladies have occasionally shared the honours of the doctorate; and now many universities give women doctors' degrees in medicine and science. It was a special honour to Cardinal Cullen that, before he was ordained priest, the pope conferred the doctor's hat on him with his own hand. See DEGREES, WOMEN'S RIGHTS.

Doctors' Commons, formerly the college of the doctors of civil law in London, situated in St Bennet's Hill, St Paul's Churchyard. It was founded by Dr Henry Harvey, Dean of the Arches, in 1568, previous to which time the doctors had lived in Paternoster Row. The original building was burned in the great fire in 1666, when the doctors removed for a time to Exeter House. In 1672 the Commons was rebuilt, and the doctors returned to their former quarters. The college was incorporated by royal charter in 1768. The persons practising in Doctors' Commons were the doctors, called in the ecclesiastical courts advocates, and the proctors,

whose duties were analogous to those of solicitors. Both doctors and proctors were admitted by fiat of the Archbishop, and introduced to the Dean of Arches in court by two persons of their own degree, in their robes. The robe of the doctors was scarlet, with a hood trimmed with taffeta or white minever. In 1857, on the establishment of the Divorce Court and Probate Court, the charter of Doctors' Commons was surrendered, and the corporation was dissolved, the advocates being merged in the general body of the bar, and the proctors becoming solicitors; but the old names are still used to some extent in the ecclesiastical courts. The courts which sat at Doctors' Commons were the Admiralty Courts (q.v.); the Prerogative Court, whose powers were transferred to the Probate Court; the Court of Delegates, whose powers are now exercised by the judicial committee of the Privy-council; and two other ecclesiastical tribunals, the Faculty Court and the Archdeacon's Court. The Court of Arches also sat in the same place. The buildings of the College of Advocates were demolished in 1867; and in 1874 the Doctors' Commons Will Office was removed to Somerset House.

Doctrinaire, a French term used to characterise such political or other views as are pedantic and unpractical, as opposed to a policy based on precedent, prudence, *laissez faire*, or expediency. In this sense it was applied in France, in 1816, by the reactionary court-party to those who supported scientific doctrines of constitutional liberty against the arbitrary will of the monarch. This party, which had its rallying-point in the salon of the Duc de Broglie, was led in the Chamber by Royer-Collard, and supported in the press by De Barante, Guizot, and Villemain. When the revolution of 1830 occurred, they became the advisers and ministers of Louis-Philippe.

Doctrine. See DOGMA.

Dodd, WILLIAM, clergyman and forger, was born 29th May 1729, at Bourne in Lincolnshire; entered Clare College, Cambridge, as a sizar, in 1746, and graduated as fifteenth in the mathematical tripos, 1749-50. Shortly after, he removed to London, married, took orders, and ere long became a popular preacher. His sermons in behalf of public charities were particularly successful; those preached as chaplain of the Magdalen Hospital attracted all the fashionable ladies of London. Dodd next published a series of edifying books, edited the *Christian Magazine*, and became in 1763 one of the king's chaplains, and soon after LL.D., and tutor to Philip Stanhope, nephew to Lord Chesterfield. His habits had always been very expensive, and his large income as a successful preacher and writer did not save him from drifting hopelessly into debt. He purchased Charlotte Chapel in Pimlico, and had all his wonted success, but an anonymous letter of his wife to the Lord Chancellor's wife, offering a large sum for the rich living of St George's, Hanover Square, led to Dr Dodd's name being struck off the list of chaplains (1774), and his wife's being taken off by Foote in a farce as 'Mrs Simony.' Dodd left England for a time, and was well received by his pupil, now Lord Chesterfield, at Geneva, and presented to the living of Wing in Buckinghamshire. After his return he sunk deeper and deeper into financial difficulties. He sold his chapel in 1776, and in the February of the following year offered a stockbroker a bond for £4200 signed by Lord Chesterfield. It was discovered that the signature was a forgery, and Dr Dodd was at once arrested. He refunded great part of the money, but was nevertheless sent to trial, convicted, and sentenced to death. Extraordinary efforts were made to secure a pardon; petitions and pamphlets appeared in profusion, and even Dr Johnson, the most rigid of moralists, if the kindest of men, lent the unhappy man the great influence of his support. The sermon preached to his fellow-prisoners in Newgate and his final appeal to the king were both composed by Johnson, whose final letter to Dr Dodd, when his awful doom was certain, thrills throughout its grave phrases with profoundest pity. The king refused to pardon his former chaplain, and Dr Dodd was hanged, 27th July 1777. Of his numerous writings the *Beauties of Shakespeare* (1752) was long popular, and *Thoughts in Prison* is still interesting. See *A Famous Forgery*, by Percy Fitzgerald (1865).

Dodder (*Cuscuta*), a widely distributed genus of phanerogamous parasites, usually regarded as degenerate Convolvulaceæ, and forming the type of a small sub-order Cuscutaceæ. Being entirely parasitic, they have lost all trace of leaves, even the cotyledons of the embryo being no longer distinguishable, while chlorophyll is almost completely absent. The seed germinates very late in spring, and as the seedling rises from the ground its tip soon begins to show the sweeping movements of circumnutation of a climbing plant. If no host be

Dodder, attached to a Geranium and Ivy-plant.

in the neighbourhood for it to take up its quarters on, it falls to the ground, but retains its vitality for some weeks, by which time a victim may probably have germinated. As soon as it touches a living plant it twines firmly round it, and a series of small wart-like adventitious roots are developed, from the centre of each of which a bundle of suctorial cells force their way through the epidermis and cellular envelope into the bast, and press against the woody tissue of the host. The portion of the dodder stem below this attachment now dies off, and there is then no longer any connection with the ground. The growing point again circumnutates until it finds a new base of attachment upon the same or a different stem of the host, there to repeat the formation of suckers. In this way a tangled skein of threads is formed over which, late in the season, the flowers develop in dense clusters, and the ripened seeds are shaken out of the capsule by the wind, or gathered with the crop. This parasite is often very injurious, particularly in Germany, where the fields of flax, clover, and lucerne sometimes show well-marked

patches completely desolated by the pest; these have simply to be mown down and buried before new seed has set; while pains must be taken to procure clover-seed pure from those of the parasite. The temperate species are all annual, but *C. verrucosa* and other tropical forms are perennial. It is a remarkable circumstance that Cassytha, a totally unrelated oriental genus of Lauraceæ, has not only assumed the same general mode of life and twining, leafless habit, but germinates and penetrates in a precisely similar way.

Doddridge, PHILIP, a great nonconformist divine, was born in London, 26th June 1702, the twentieth child of a well-to-do oilman of good descent. The Duchess of Bedford, to whom his uncle was steward, offered him an education at either university and provision in the church; but though dissuaded by Calamy, he determined to enter the nonconformist ministry on the advice of the famous Samuel Clarke. He was educated at a theological academy at Kibworth in Leicestershire (afterwards removed to Hinckley), presided over by John Jennings, a man not only of great intellect, but of uncommon breadth and toleration. In 1723 Doddridge became pastor of the dissenting congregation at Kibworth. After declining several invitations from congregations whose rigid ideas of orthodoxy he felt would be uncongenial to him, he settled in 1729 at Northampton as minister and president of a theological academy. Here he continued to preach and train young students for the ministry till shortly before his death, which occurred October 26, 1751, at Lisbon, whither he had gone for the benefit of his health. Doddridge was a man of the most amiable character, deep piety, and extensive accomplishments. He was at once liberal and evangelical, and with all his religious earnestness and enthusiasm had humanity enough for such 'levities' as cards and tobacco. His principal work is *The Rise and Progress of Religion in the Soul* (1745), which has been translated into Dutch, German, Danish, French, and even Syriac and Tamil. Besides this, may be mentioned *The Family Expositor* (6 vols. 1739–56); his *Course of Lectures*, delivered to the students under his charge, and published by the Rev. Samuel Clarke (1763); and a great variety of sermons on miscellaneous religious topics. His hymns have carried his name over the English-speaking religious world, perhaps the best known being 'Hark, the glad sound, the Saviour comes,' and 'O God of Bethel, by whose hand.' His works fill 10 vols. (Leeds, 1802–5). His *Correspondence and Diary* was edited by his great-grandson (5 vols. 1829–31). See also Stanford's Memoir (1880).

Dodec'agon, a regular polygon of twelve equal sides and angles.

Dodecahe'dron, one of the five regular solids, is bounded by twelve equal and regular pentagons.

Döderlein, LUDWIG, philologist, born at Jena, 19th December 1791, studied at Munich, Heidelberg, Erlangen, and Berlin, and in 1815 was appointed professor of Philology at the academy of Bern. In 1819 he went as second professor of Philology to Erlangen, where in 1827 he became first professor and also director of the philological seminary. He died there, 9th November 1863. His principal works are *Lateinische Synonymen und Etymologien* (6 vols. 1826–38), *Lateinische Wortbildung* (1838), *Handbuch der lateinischen Etymologie* (1841), and *Homerisches Glossarium* (3 vols. 1850–58). He also edited several classical works, such as the *Iliad*, *Œdipus Coloneus*, and the works of Tacitus.

Dodgson, REV. CHARLES LUTWIDGE, humorist, better known by his pen-name of Lewis Carroll, was born about 1833, and, entering Christ Church, Oxford, graduated B.A. in 1854 with a first-class in mathematics. He was elected a student of his college, took orders in 1861, and from 1855 to 1881 was mathematical lecturer. Under the name of Lewis Carroll he issued in 1865 *Alice's Adventures in Wonderland*, which, with its continuation *Through the Looking-glass* (1872), has become a nursery classic, and has been translated into most of the languages of Europe. He has also published some poems and parodies entitled *Phantasmagoria* (1869), *Hunting of the Snark* (1876), *Doublets* (1879), *Rhyme? and Reason?* (1883), *Euclid and His Modern Rivals* (1879), *A Tangled Tale* (1886), *Game of Logic* (1887), and *Mathematica Curiosa* (1888), the last a valuable contribution to mathematics.

Dodington, GEORGE BUBB, a 'person of importance in his day,' was born plain Bubb in 1691, the son of an Irish fortune-hunter or apothecary, and took the name Dodington in 1720, on inheriting a fine property from his uncle. Resolved 'to make some figure in the world,' he had got into parliament in 1715, and from 1722 to 1754 sat for Bridgwater. Otherwise, he was always changing his place, from Walpole's service to the Prince of Wales's, from his to Argyll's, anon back to the Prince's, and so on: his one good action, that he spoke up for Byng. He was sometimes in office, but oftener out of it; and he had not long reached the goal of his ambition, a peerage with the title Baron Melcombe, when he died at Hammersmith, 28th July 1762. A *soi-disant* Mæcenas, he passed for something of a wit and poet, but is only remembered through Browning's *Parleying*, and by his posthumous Diary (1784), that odd self-revelation of a flunkey.

Dodo (*Didus ineptus*), a large bird which used to inhabit Mauritius, but became extinct some time after 1681. It appears to have been allied to the pigeons, was a little larger than a turkey, and incapable of flight. Our knowledge of the bird is derived from the reports of travellers, from pictures, and above all from the skeletons disentombed in 1866. It appears also to have been sometimes brought alive to Europe. The bill was large, longer than the head, and covered for half its length by soft naked skin. The end of the bill was hooked and turned downwards. The wings and the tail were rudimentary. The feathers seem to have been gray, with yellow on the wings and tail. The legs were short, thick, and scaly. It probably lived in the thick, tropical woods, and fed on vegetable materials.

Supposed figure of the Dodo.

The extermination seems to have rapidly followed the Dutch colonisation of Mauritius. The bird was helpless and stupid, and withal good for eating. The hungry domestic animals brought by man doubtless helped to destroy the hapless dodo. Though a conspicuous example, the dodo is by no means the only bird which has been exterminated,

in part at least, by human carelessness. The solitaire (*Pezophaps solitarius*) of Rodriguez is another well-known case.

There are rude figures of the dodo in several works of the 17th century, and in particular one, evidently superior to the rest, in Bontius (edited by Piso, 1658)—who calls the bird *Dronte* or *Dodaers*—which perfectly corresponds with the descriptions given of it, with a painting preserved in the British Museum, said to have been drawn in Holland from the living bird, and with a representation of it discovered by Professor Owen in 1838 in Savery's picture of Orpheus and the Beasts at the Hague, which he thinks 'must have been copied from a study of the living bird.' The skeleton has been partially reconstructed, and described by Professor Owen. Many bones of this extinct bird were discovered in 1865, when extensive marshes in the island were partially drained. There are bones at Paris, Copenhagen, and Haarlem. A foot of the dodo is amongst the valued treasures of the British Museum. In the Ashmolean Museum at Oxford are a head and foot; but the stuffed specimen to which these belonged was allowed to decay, and finally destroyed in 1755 by order of the curators. See Strickland and Melville, *The Dodo and its Kindred* (1848), and Professor Owen in vol. vi. of *Trans. Zool. Soc.*

Dodo'na, the seat of the oldest Greek oracle, was situated in Epirus, in one of the wildest districts south-west of the Lake of Janina. The Greek and Egyptian accounts of its origin differ. The priests of Egyptian Thebes related that two holy women were carried off from that city by a party of Phœnicians, one of whom was sold in Libya, the other to the Greeks, and that these women founded the oracles at Dodona and Ammon. The inhabitants of Dodona related that two black doves took their flight from the city of Thebes, in Egypt, one of which flew to Libya, the other to Dodona; that the latter perched upon an oak, and with a human voice commanded that an oracle should be founded on the spot. Herodotus thought that if the Phœnicians did actually carry off the two women already alluded to, one of them was probably sold into Greece; that the strange language and dark complexion had caused them to be likened to birds; and that when they became acquainted with the Greek tongue, they were said to have spoken with a human voice. Later authors ascribe the founding of the city to Deucalion. The sanctuary itself was dedicated to Zeus, who made known his will by the wind rustling through the boughs of a grove of lofty oaks or beech trees. This was interpreted by the priests, who were termed *Selloi* or *Helloi*. The goddess Dione, by some said to be Aphrodite, by others Hera, afterwards appeared by the side of Zeus, and the place of the priests was occupied by priestesses (*Peleiades*), who announced the will of the deity. Dodona, though not equal in renown to Delphi, was yet frequently consulted on occasions of importance both by the Spartans and Athenians. Though the city was destroyed in 219 B.C. by the Ætolians, it recovered at a later period, and was in existence in the 6th century A.D. See *Dodone et ses Ruines*, by Carapanos (1878).

Dodsley, ROBERT, author and publisher, was born in 1703 near Mansfield, in Nottinghamshire. His father, who was a schoolmaster, apprenticed him to a stocking-weaver; but the boy was so ill-treated that he ran away, and was afterwards engaged as footman. His leisure he gave to reading, and at length published in 1732 a volume of poems, entitled *A Muse in Livery*, which was patronised by many fashionable ladies. His next production, *The Toy Shop*, a dramatic piece, was submitted in manuscript to Pope, who undertook to recommend it to Rich, the manager of Covent Garden Theatre, under whose management it was acted in 1735 with great success. With his profits, and the interest of Pope, who helped him with £100, Dodsley now commenced business as a bookseller, and was very successful, but still continued to write bright and successful plays, as *The King and the Miller of Mansfield* (1737), *Sir John Cockle at Court* (1738), *The Blind Beggar of Bethnal Green* (1741), and *Rex et Pontifex* (1745), which were republished in a collected edition of his dramatic works with the title of *Trifles* (1748). Meantime, he was conducting his business with such ability and spirit, that in the course of three years after commencement, he was in a position to buy copyrights. In 1738 he bought *London* from the yet unknown Johnson for ten guineas, and among the other famous authors for whom he published were Pope, Young, Akenside, Lord Chesterfield, Horace Walpole, Goldsmith, and Shenstone. Among his schemes were *The Museum* (1742–47), a collection of historical and social essays; *The Preceptor*, a book of instruction for the young; and the *Annual Register*, started in 1759, and long edited by Burke. Dodsley's most successful work was a tragedy called *Cleone* (1758), which was acted at Covent Garden with extraordinary success. With *Cleone* he closed his career of dramatic authorship. Dodsley's name is now chiefly remembered on account of his *Select Collection of Old Plays* (12 vols. 1744; 2d ed. by Isaac Reed, 12 vols. 1780; 3d. ed. by J. P. Collier, 13 vols. 1825–28; 4th ed. by W. C. Hazlitt, 15 vols. 1874–76); and his *Collection of Poems by Several Hands* (3 vols. 1748; 6 vols. 1758). Dodsley died on a visit to Spence at Durham, 25th December 1764. He was not only an honest and able, but an amiable man; Dr Johnson always speaks very kindly of his 'patron.' See Knight's *Shadows of the Old Booksellers* (1865).

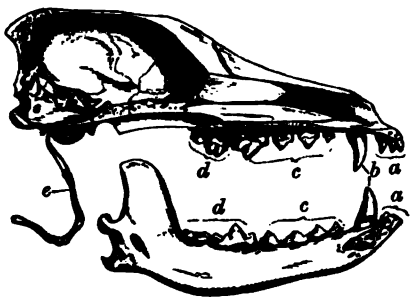
Doe, a female Deer (q.v.), in contrast to buck.

Doe, JOHN, in Law, the fictitious plaintiff in ejectment, whose services (like those of Richard Roe, his opponent) are dispensed with since the abolition of the fiction. See EJECTMENT.

Doesborgh (*Drususburg*), a fortified town in the Netherlands, province of Gelderland, at the confluence of the Old and New Yssel, noted for its manufacture of mustard. Pop. 4484.

Dog, the popular name of the *Canis familiaris* of Linnæus, as well as of several more or less closely allied forms. The word is not co-extensive with any zoological term, but all the animals to which it is applied belong to the family Canidæ (q.v.), which may be defined as digitigrade carnivora, with small head, pointed muzzle, somewhat contracted neck, slightly compressed body, and slender legs; fore-feet bearing five, hinder four toes, claws not retractile, hair thick, tongue smooth, anal glands wanting, a gland often present at the root of the tail. The teeth usually consist of three incisors, one canine, and four premolars (teeth which are preceded by temporary or milk molars) in each jaw. The upper jaw has two, the lower three molars on each side. The last premolar of the upper jaw, and the first molar of the lower jaw are decidedly larger than any of the others, and bite against one another; they are known as the 'carnassials.' The distribution of the Canidæ is universal; many are nocturnal or semi-nocturnal; they run swiftly and persistently, swim well, and climb and leap, though not so well as the cats. Their senses are acute, especially that of smell, and they possess higher mental qualities than those of any other animal. They frequently combine to procure food, and live on other mammals and birds, devouring fresh meat or carrion with equal avidity; some

kinds will also eat reptiles, fish, crabs, insects, and various kinds of vegetable matter. The period of gestation is sixty-three days; usually from four to eight (occasionally as many as twenty) pups are produced at a birth. These are blind for ten or twelve days, and are tended with the greatest



Section of Skull of Dog:
a, incisor teeth; *b*, canines; *c*, premolars; *d*, molars; *e*, hyoid bone.

solicitude by the mother, though the father is sometimes inimical to them. Full growth is attained in about two years, the average term of life being ten or twelve, and very rarely more than twenty years. The oldest fossil form is *Canis parisiensis*, from the upper Eocene period. The creatures thus characterised are separable into three categories: (i.) Wolves (genus *Canis*), characterised by the round pupil of the eye and the tail having dependent hairs. (ii.) Foxes (genus *Vulpes*), characterised by a slit-like pupil and a bushy tail. Certain minor, but constant, differences in the skull have been pointed out by Huxley. (iii.) The Eared-fox (genus *Otocyon* or Megalotis).

I. The category of wolves (*Canis*) comprises (1) The Domestic Dog (*C. familiaris*), which is, to quote the perhaps extravagant words of Cuvier, 'the most complete, the most singular, and the most useful conquest ever made by man.' The origin of this subjugation is shrouded in immemorial antiquity. Almost the earliest human beings of whom we have any record seem to have been accompanied by dogs, which were apparently the first animals domesticated. In the Danish kitchen-middens belonging to the Neolithic period, canine remains accompany those of man. The birds' bones are those of the legs and wings, which dogs cannot eat, and hence it seems likely that the men, after eating the flesh of the birds, gave their remains to the dogs, who devoured what they could. This has led to the further conjecture that these dogs were domesticated. A similar form of dog has been recorded from deposits of the same age in Switzerland. In the bronze age traces of a larger dog appear. The Egyptian monuments of about 3000 B.C. furnish us with pictures of several varieties of domestic dogs—a wolf-dog, a hound, a greyhound, and a kind of terrier. 'The most ancient dog represented on the Egyptian monuments is one of the most singular; it resembles a greyhound, but has long pointed ears and a short curled tail; a closely allied variety exists in Northern Africa, as the Arab boarhound.'

Assyrian sculptures depict two canine forms, a greyhound and a mastiff, described as 'the chained-up, mouth-opening dog' (watch-dog), and several other kinds are alluded to in the cuneiform inscriptions. The first mention of the dog in the Bible occurs in connection with the sojourn of the Israelites in Egypt, and the earliest allusion to it as the companion of man is in the Book of Tobit. The detestation with which the Hebrews regarded the dog was possibly due to its being an object of adoration to the Egyptians. Xenophon records two species of Spartan dogs. Many references are found to their use in battle, for which purpose they were sometimes provided with spiked collars, so that the 'dogs of war' was no mere figure of speech. At Marathon, one of these four-footed warriors gave such assistance to its master, that its effigy was engraved upon his tablet. Among the Romans, we have evidence of their use for many purposes, and their study had so far advanced, that a classification of them was drawn up. Three main divisions are recognised: (1) *Canes villatici* (watch-dogs); (2) *C. pastorales* (sheep-dogs); (3) *C. venatici* (hunting-dogs); which were again subdivided into *pugnaces*, to attack the quarry; *nare sagaces*, to track it out; and *pedibus celeres*, to overtake it. Between the Roman period and the middle ages materials for the history of the dog are scanty, but from this time onwards there is an extensive literature of the subject, more especially in regard to those kinds which were used in various forms of sport.

Dogs still play an important part in folklore everywhere, whether as *revenants* whose intention is merely to warn or foretell, or as hell-hounds of purely malignant nature. They are represented as quick to detect the presence of invisible spirits, and, in connection with this aptitude for seeing into the spirit-world, they are often the outward objects through which devils and demons make their appearance, and they have often been associated with such masters of unhallowed arts as the great Cornelius Agrippa. The Wild Huntsman with his train of hounds is one of the most widespread superstitions in Europe, and in the dim mythological histories of the early world we find many dogs of supernatural strength and courage who give material aid to the heroes in their exploits. Such are Fingal's companions, Bran and Luath, the Gelert of the Welsh story, Arthur's hound Cavall, and Hodain, the hound linked so strangely with the fates of Tristrem and Ysolde. St Eustace was the patron of dogs in the south of Europe, as St Hubert was in the north, and the invocation of the latter was especially efficacious in cases of hydrophobia (see Gaidoz, *La Rage et St Hubert*, 1887). In Egypt, where in ancient times the dog was a sacred animal, his name is the most insulting term of reproach at the present day; yet by some Orientals, as the Parsees, he is held in strange respect; while Kitmer, the dog of the Seven Sleepers, with Balaam's ass and the camel that bore Mohammed in his flight from Mecca, have a place in the Moslem paradise. From the old Argus that first recognised his master in the *Odyssey* down to Pope's Bounce and the Maida of Sir Walter Scott, dogs have been celebrated in the history of letters, and have been depicted in art, by none more admirably than by Velasquez, Veronese, and Landseer. Among famous historical dogs may merely be mentioned the mastiffs of the Knights of Rhodes, who knew a Turk from a Christian by the smell, the Spanish bloodhounds who helped in the conquest of Mexico and Peru, and the spaniel which saved the Dutch republic by waking William the Silent during the night attack on the camp before Mons. Punch's dog Toby, and the famous dog of Montargis that avenged his master's death upon his murderer, are among the best-known animals of Europe. See 'The Dog in History and Folklore' in R. J. King's *Sketches and Studies, Descriptive and Historical* (1874).

The question of the origin of our various domestic dogs may now be considered. Buffon supposed that the sheep-dog was their progenitor; Bell, the

wolf. Neither of these earlier views, however, takes a sufficiently wide survey of the whole subject to be worthy of much consideration. Put very briefly, the principal facts which help us to the solution of this problem are the following: The different breeds are very unlike each other, which would suggest the likelihood, though it would not prove, that they were descended from different ancestors. This variety of breeds obtains even in the earliest domestic dogs of which we have any record. There is no difficulty in imagining that various races of men have domesticated dogs in different places and at different periods. Wild canine species are scattered over the whole world; they are social animals, hunting in packs, and such are most easily tamed. When first in contact with man, too, animals are not as a rule shy. Savages are known to value dogs highly, and it has been suggested that perhaps the sight of their combined pursuit of their prey may have given man the idea of employing them. Furthermore, the dogs of semi-civilised or barbarous peoples often present a very close resemblance to the wild forms surrounding them; thus, the Indian dogs of North America so closely resemble the wolves of that region, that they have been mistaken for them even by well-trained naturalists. The Eskimo dogs are very like the gray Arctic wolves, with which their owners not unfrequently cross them to improve the breed. The dog of the Hare Indians differs but very slightly from the prairie-wolf or coyote (*C. latrans*). The natives of Guiana seem to have partially domesticated two aboriginal forms. Many European varieties approximate closely to the wolf, as, for instance, the Hungarian sheep-dog. The Indian pariah dogs are but little removed from the native wolf, whilst some other breeds show a close affinity to the jackals. These latter, when tamed, wag their tails, crouch to their masters, and behave in other respects like domestic dogs. From these statements, and many others which might be added, it seems fair to conclude that the various domesticated canine forms have arisen from the following separate sources: two well-defined species of wolf (*C. lupus* and *C. latrans*); certain doubtful species, European, Indian, and North African, from several species of jackal, and perhaps also from some extinct forms.

It must not, however, be supposed that the differences between the various breeds are entirely due to this difference of parentage, for there can be no doubt that they are largely the effect of careful breeding and selection. Variations occur in almost every part of the animal's organisation. As regards size some are six times as long as others (the tail being excluded); the ratio of the height to the length varies from 1 : 2 to 1 : 4. The number of caudal vertebræ, the number of teats, and the number and disposition of the teeth, are all subject to modifications. Among peculiarities which are confined to domestic as opposed to wild dogs may be mentioned the drooping ears and the curled up tail; the former correlated with a diminished need for watchfulness; the latter with a decreased use of the tail as a helm. Barking, too, is almost universal in domestic breeds, but does not characterise a single wild form. Certain tame dogs, which were left on the island of Juan Fernandez, were found after thirty years to have quite lost the faculty, and only gradually reacquired it on renewed contact with man.

The systematic arrangement of domestic dogs has been attempted by numerous authors, the latest being the revised scheme of Professor Nehring of Berlin (1889); but no two are agreed upon the same classification. The old Roman method has been alluded to above. Cuvier, relying upon the shape of the head and the length of the jaws, classed the varieties under three heads—Mâtins, Spaniels, and House-dogs. As a contrast to this may be mentioned the elaborate scheme of Fitzinger, in which over 180 different forms are defined. Youatt's arrangement, based on Cuvier, is as follows: Division I.—Head more or less elongated, parietal bones widest at base, and gradually approaching as they ascend; condyles of lower jaw in same line with upper molar teeth. To this division most wild dogs belong—the Dalmatian, Greyhound, Irish Wolf-dog, &c. Division II.—Head moderately elongated, parietals not approaching, rather diverging, so as to enlarge the cerebral cavities. Here are the Spaniel, Poodle, Maltese Dog, St Bernard, Newfoundland, Eskimo, Sheep-dog, Pomeranian, and various kinds of hounds. Division III.—Muzzle shortened, frontal sinuses enlarged, cranium elevated and diminished in capacity. In this group are placed the Bulldog, Mastiff, and Terrier. Special articles upon most of these forms will be found in their appropriate places.

No account of the domestic dog would be complete without an allusion to his mental qualities, which lift him high above all other animals, and pre-eminently fit him to be the companion of man. Anecdotes illustrative of his keenness of sense, reasoning faculties, fidelity, and conscientiousness, might be multiplied indefinitely. For these we may refer our readers to the pages of Jesse, Walsh ('Stonehenge'), and Gordon Stables; for their scientific treatment, to the works of Darwin, Lubbock, and Romanes. See also INSTINCT.

The natural qualities of the dog enable him to be of service to man chiefly in the chase, but he has been utilised also (to say nothing of his consumption by the Chinese and certain barbarians as food) as a guardian and a guide, as a saviour of life from drowning, and a beast of draught; he has ministered to a depraved curiosity in the ancient sports of bull and bear baiting, and has even acted as an instrument of torture and as a minister of justice. Dog-farming is regularly pursued in Manchuria for the sake of the skins, the breed cultivated being remarkable for the length and fine quality of the hair. There are thousands of such dog-farms, keeping from a score to several hundreds of dogs. The dogs are strangled in mid-winter, that the furs may be got in the best condition, but they must be at least eight months old. Eight animals are required for a robe which is sold for about 14s. 6d.

(2) The Wolf (*Canis lupus*) will be considered in a special article.

(3) The Indian Wild Dogs (*C. dukhunensis*, *C. primævus*, *C. rutilans*) are sometimes separated as a distinct genus (*Cuon*). They occur in different parts of India, and are variously known as Kolsun, Buansuh, or Dhole. They are generally reddish-brown in colour, with a moderately long tail, full below, not a round brush like the fox; the pupil is round; and the ears erect, large, and hairy. They hunt in packs of from six to thirty, with such keen scent and pertinacity that competent observers declare that, 'when once a pack of them put up any animal, no matter whether deer or tiger, that animal's doom is sealed; they never leave it.' Certain half-domesticated individuals are employed for coursing and pig-sticking.

(4) The Australian Wild Dog or Dingo (*Canis dingo*) is particularly interesting, as being the only higher mammal found in that country. It was formerly believed that it was sprung from some domestic form which had run wild, but this opinion is now abandoned owing, amongst other reasons, to the discovery of fossil dingoes in the diluvial deposits. It resembles the larger varieties of shepherds' dogs. The forehead is flat, and the

ears short and erect. The body has two kinds of hair, silky and woolly. When running, the head is carried high and the tail horizontally. The earliest settlers in Tasmania suffered much from the loss of their sheep owing to these animals; now the dingoes are almost destroyed. They are sometimes domesticated by the aborigines, who, however, never capture the adults, but secure a litter of pups, which they bring up by hand. They are easily tamed, but almost invariably run wild again when the breeding season comes on. See DINGO.

(5) The Jackals (*Canis anthus*, *C. aureus*, &c.). See JACKAL.

(6) The Pariah Dogs form a nondescript breed of animals, which inhabit the towns and villages of the East, where they act as general scavengers. They associate in bands, each of which has its own allotted territory, beyond whose bounds no member dares to pass.

(7) The Racoon Dog (*Canis procyonoides*) is so called because it presents a superficial likeness to the racoon. It is, however, a true dog, and it is more than doubtful whether the generic name (*Nyctereutes*) proposed for it should be allowed to stand. The body is arched, the legs short and slender, the tail also short but bushy. It is found in Japan and Northern China.

(8) The Hyæna Dog (*Canis* or *Lycaon pictus*) occurs in South Africa. It is about the size of a wolf, with blunt muzzle and sloping back. There are only four toes on each foot. Its colour varies greatly, consisting of very irregular patches of black, white, and yellow. It is partly diurnal, partly nocturnal. Large packs of these animals hunt together, and run with an untiring gallop which will overtake the swiftest antelope. They have three different calls, the most curious of which is a soft and melodious cry, something like the second note of the cuckoo, and appears to serve as a rallying note for the pack.

II. The Foxes (genus Vulpes) will be the subject of a special article (q.v.).

III. The Long-eared Fox (*Otocyon* or *Megalotis lalandii*) is also a native of South Africa. It has a short bushy tail, not more than half the length of the body and head, which measure about two feet. The ears are very large, and the snout short and pointed. It has six more teeth than most of the Canidæ, two in each upper and one in each lower jaw.

Law as to Dogs.—In Britain, dogs cannot be kept without a license, which, for each dog, costs 7s. 6d. Dogs not six months old, dogs for tending sheep and cattle, and dogs for guiding blind men are exempt. Certificates of exemption may be obtained from the Commissioners of Inland Revenue. Any one keeping a dog in the habit of attacking or biting people, is liable to an action of damages at the suit of an injured person; and a court of summary jurisdiction may, on complaint that a dog is dangerous, order it to be destroyed. Owners are also liable for the injuries done by their dogs to sheep and cattle. Dog-stealing; having stolen dogs, or the skins of stolen dogs, in one's possession in the knowledge that they are stolen; taking money to restore a stolen dog under pretence of aiding the owner to recover it; and unlawfully and maliciously killing or wounding or maiming dogs, are offences under various criminal statutes, and are punishable summarily, and by indictment for misdemeanour. A gamekeeper may seize a dog within the limits of a manor, but is not allowed to kill a dog there following game, even although its owner has received notice that trespassing dogs will be shot; and a man is liable in damages if he places on his land traps scented with strong-smelling bait, so as to influence the instinct of another man's dogs, and draw them irresistibly to destruction. Stray dogs may be detained and sold or destroyed by the police. For the employment of dogs to draw carriages or carts, see ANIMALS (CRUELTY TO). See Lupton on *The Law relating to Dogs* (1888).

In the United States, the statutory regulations of most states empower a person to have property in a dog, not only sufficient for the owner to be indemnified for injury done to the dog, but also to make theft of the dog liable to punishment as a crime. Some states require that the dog shall be duly licensed or registered and collared, and therefore subject to taxation, before these results follow. Unless duly authorised by law to kill unlicensed dogs, no citizen may kill a dog belonging to another, unless he, or some one under his protection, or his animal, is in immediate danger of injury from the dog, or the dog is rabid, or has been bitten by a rabid animal. In general, the owner of a dog is liable in damages for injuries done by his dog; neither can the master plead ignorance of the vicious habits of the dog in mitigation of the damages. The owner of a dog is bound to know the character of the dog he keeps. The owner of a vicious dog may be indicted for keeping a nuisance, and compelled to kill or muzzle his dog. Dog-racing is not illegal when for training purposes only, but if chance is the principal element, it becomes a crime within the statutes against gaming.

In some countries it is usual to compel the dogs living in towns to be muzzled; the civic authorities in Britain sometimes, and in the United States generally, issue edicts that all dogs be kept muzzled for a certain number of weeks, and occasionally the police make raids on ownerless dogs and destroy them. It is now not unusual to have homes maintained for stray dogs, the least valuable of the unclaimed ones being ultimately destroyed.

For the various breeds of dogs, see BEAGLE, BLOODHOUND, BULLDOG, COLLIE, GREYHOUND, MASTIFF, NEWFOUNDLAND DOG, TERRIER, &c.; also Walsh, *The Dog in Health and Disease* (new ed. 1879) and *Dogs of the British Islands* (new ed. 1882); Shaw, *Illustrated Book of the Dog* (new ed. 1884); Burges, *American Kennel and Sporting Dogs* (New York, 1876). For the diseases of the dog, see DISTEMPER, MANGE, RABIES, and the works of Mayhew, Steel, or Hill. See also COURSING, HUNTING.

Dogbane (*Apocynum*), a small north temperate genus of Apocynaceæ, perennial herbs or undershrubs. The Dogbane of North America (*A. androsæmifolium*), often called Fly-trap, from the throat appendages of its corolla closing upon the flies which enter it, is of medicinal repute; similarly also its congener *A. cannabinum*, or Canadian Hemp. See APOCYNACEÆ.

Dog-days (*Dies Caniculares*) is a name given by the ancient astronomers to the 20 days before and 20 days after the rising of the *Dog-star* or Sirius (q.v.), at present reckoned from 3d July to 11th August. It is a mere accident that the rising of Sirius falls in the hottest season of the northern year; in time it will be in the dead of winter. But the ancients attributed the heat and the accompanying diseases directly to the influence of the star—as also in Egypt the highest rising of the Nile.

Doge (the Venetian form of the late Lat. *dox*, *docis*, equivalent to *dux*, 'leader,' 'duke') was the name of the chief-magistrate, possessing princely rank, in the republics of Venice and Genoa. For the history of the office and its powers, see GENOA, VENICE; also BUCENTAUR.

Dog-fish, the popular name for a number of cartilaginous (Elasmobranch) fishes in the shark sub-order. They belong to the genera Scyllium, Pristiurus, Acanthias, &c., and have the general characters noted under Cartilaginous Fishes

(q.v.). (1) The 'rough hound,' or Lesser Spotted Dog-fish (*Scyllium canicula*), is common off European coasts, feeding chiefly among rocks at the bottom. It measures from 16 inches to over 2 feet in length; is reddish-gray, with brown spots

Lesser Spotted Dog-fish (*Scyllium canicula*).

above, and dirty yellow below. The eggs, which in the oviparous dog-fishes are large and few in number, are inclosed in pale yellow, horny purses, with long mooring tendrils, and are laid throughout summer and autumn. These envelopes are known as mermaids' purses, sailors' purses, or sea purses. The animals are sometimes cooked for soup, and their flesh even may be eaten. (2) The 'nurse hound,' or Larger Spotted Dog-fish (*S. stellare* or *catulus*), is a larger species, 3 to 4 feet in length, of a reddish-gray colour, with large, round, brown spots. The eggs are laid late in the year. The flesh is too coarse to be edible. The skin of both spotted dog-fishes is studded with tubercles of dentine capped with enamel, and when prepared is used as 'rubskin' for polishing. (3) The Black-mouthed Dog-fish (*Pristiurus melanostomus*) measures a little over 2 feet, and is of a brownish-yellow colour above, and paler below. The dark spots are large, oblong, and disposed in two rows. The snout is longer, and there is a row of small spines on each side of the upper margin of the tail. (4) The Picked Dog-fish (*Acanthias vulgaris*), belonging to a different family (Spinacidæ), is more abundant off British coasts than any of the others. It measures about 3 feet in length, and is a voracious, prolific, hardy animal. It is not oviparous, and is said to produce young almost daily for eight or nine months a year. Its skin is not so rough as that of the spotted dog-fishes. The colour is slaty-gray or reddish-brown above, and whitish beneath. The two dorsal fins are each provided with a strong spine, which the fish uses with great accuracy as weapons. It gets a variety of names, such as bony dog, hoe, &c., and is much and justly hated by the fishermen for the damage it does to nets and lines, and for the voracity with which it attacks the shoals of herring and other food fishes. The names 'dog,' 'hound,' &c. are characteristic of all the set, but are particularly applicable to Acanthias. As many as 20,000 have been caught at a time, and their consequent destructiveness can be readily imagined. The young are born alive, two at a time, but in very rapid succession for prolonged periods. The flesh, though coarse, is sometimes eaten; and the eggs are said to be appreciated. The livers yield oil. To numerous related genera of wide distribution—e.g. Centrophorus, Spinax, Scymnus, the title dog-fish might also be applied. See CARTILAGINOUS FISHES, SHARK.

Dogger (Dutch *dogger-boot*, 'codfish-boat'), a vessel something like a galliot or a ketch, used by the Dutch as a fishing-boat in the German Ocean.

Doggerbank, an extensive flat sand-bank in the German Ocean, between England and Denmark, about 100 miles off the Yorkshire coast. It is about 170 miles long by 65 broad, with an average depth of from 8 to 16 fathoms. Its fisheries are most valuable, some 400,000 tons of fish being gathered from it annually. For an account of its fishing life, see Mather's *Nor'ard of the Dogger* (1888). The south end of the bank was in 1781 the scene of an indecisive naval fight between the Dutch and English fleets, under Admirals Zoutman and Hyde Parker.

Doggett, THOMAS, a capable English actor who died in 1721, but is chiefly kept in remembrance as the founder of a prize—'Doggett's Coat and Badge,' still annually competed for by watermen at a sculling-match on the Thames on the 1st August. The original bequest, made in 1716 in honour of the accession of George I., has been supplemented from other quarters.

Dog-grass. See COUCH-GRASS.

Dogma (Gr.), in the Septuagint and New Testament, signified a decree or precept; by classical Greek writers it is used in the sense of a philosophical tenet. Its general meaning is a principle or maxim laid down in the form of a positive assertion, and hence 'the Dogmatic Method' is the method pursued in such a science as Mathematics, which starts from axioms and postulates, and deduces everything from these by means of proofs. But where the fundamental principles are either unknown or much contested, the Dogmatist is one who assumes certain principles without proof as the foundation of his system. He uses reason, without first investigating its capacity and limits; and in this sense all philosophers may be said to be dogmatists, except those of the sceptical and critical schools.

The name dogma is specially used to signify the whole (or any one) of the doctrinal forms in which the religious experience of the Christian church has from time to time authoritatively expressed itself, as distinguished from the opinions held by church-teachers individually.

HISTORY OF DOGMAS is the scientific exposition of the origin and development of the dogmas in which the beliefs of the Christian church have found their authoritative expression. It is a separate section of Church History (q.v.), and forms as it were the bridge between general church history and doctrinal theology or dogmatic (see THEOLOGY). Between the history of dogmas treated as a separate science and as a constituent part of church history there is merely a formal distinction—as Hase remarks, 'they simply touch the different poles of the one axis;' the former deals rather with dogma as the idea in the course of its development, the latter with dogma in the midst of persons and events. The periods in the development of doctrine do not always coincide with those into which general church history is divided, because that which marks an epoch in the one may be of comparatively little significance for the other. Hagenbach divides the history of dogmas into the following periods: (1) From the close of the Apostolic Age to the death of Origen—the age of apologetics (70–254 A.D.); (2) from the death of Origen to Joannes Damascenus—the age of polemics (254–730); (3) from Joannes Damascenus to the Reformation—the age of scholasticism, taken in its widest sense (730–1517); (4) from the Reformation to the rise of the philosophy of Leibnitz and Wolf in Germany—the age of the conflict of confessions (1517 to about 1720); and (5) from about 1720 to the present day—the age of criticism, of speculation, and of the antagonism between faith and knowledge, philosophy and Christianity, reason and

revelation, including the attempts to reconcile them. Harnack divides the subject into only two parts—(1) the rise, and (2) the development of dogmatic Christianity. In his view the first part of the history appears complete as soon as one logically formulated doctrine has been raised to the position of the 'constitutive article of the church,' and is universally recognised as such by its members. This point was reached at the end of the 3d and beginning of the 4th century, when the doctrine of Christ as the pre-existent and personal Logos of God had come to be everywhere recognised as the fundamental article of revealed truth. The second part has three stages: (1) The eastern development of doctrine according to the standard of its original conception, from the Arian controversy to the image controversy and the seventh General Council in the year 787; (2) the Western or medieval development of doctrine, under the influence of the Christianity of Augustine and the policy of the Roman see; (3) the development of doctrine since the Reformation (*a*) in the churches of the Reformation, and (*b*) in the Roman Catholic Church from the Council of Trent to the Vatican Council in 1870.

Much valuable material for the history of dogmas is contained in the works of the Catholic writers Baronius, Bellarmine, Petavius, and Thomassin; those of the humanists Valla and Erasmus; and those of Luther, Œcolampadius, Melanchthon, Flacius, Hyperius, Chemnitz, and Forbes of Corse. The learned labours of the Benedictine and Maurine fathers on the one side, and of the Protestant scholars Casaubon, Vossius, Pearson, Daillé, Spanheim, Bull, Lardner, Grabe, Basnage, &c. on the other, prepared the way for the work of the 18th century; and the criticisms of the history of doctrine attempted by Gottfried Arnold in Germany, and by the Deists in England, contributed in different ways to the same result. The scientific investigation of the history of dogmas begins with Mosheim, 'the Erasmus of the 18th century,' and disciple of Leibnitz. Mosheim was followed by Walch, Ernesti, Lessing, and Semler. By Lange (1796) the subject is for the first time treated as a separate branch of study. His work was followed by the manuals of Münscher (1811), Baumgarten-Crusius (1831), Meier (1840), and Gieseler (1855). The writings of the celebrated disciple of Hegel, F. C. Baur (q.v.), for the first time presented the whole process of the history of dogmas as a unity. The works on this subject by Strauss (1841) and Marheineke (1849) were also written from a Hegelian point of view; while that of Schleiermacher was represented in those of Neander (1857) and Hagenbach (1840; 5th ed. 1867; Eng. trans. 3 vols. 1883). Dorner endeavours to reconcile both in his *Lehre von der Person Christi* (3 vols. 1846–56; Eng. trans. 5 vols. 1861–63). Of modern Roman Catholic writers on this subject, the chief are Klee (1837–38), Zobl (1865), Schwane (1862–82), and Bach (1875). The histories of dogma by Kliefoth (1839), Thomasius (1876; 1887), Schmid (1859), and Kahnis (1864) are from the standpoint of confessional Lutheranism. Nitzsch's history of the patristic period appeared in 1870. Ritschl's *Christliche Lehre von der Rechtfertigung und Versöhnung* (3 vols. 1870; 2d ed. 1882–83) contains an elaborate critical history of the development of that doctrine (Eng. trans. by Black, vol. i. 1872). Landerer's *Neueste Dogmengeschichte* was edited by Zeller (1881). A useful work is Shedd's *History of Christian Doctrine* (3d ed. 1881). Specially important for the study of the early history are Rothe's *Anfänge der Christlichen Kirche* (1837); Ritschl's *Enstehung der Altkatholischen Kirche* (2d ed. 1857); Renan's *Histoire des Origines du Christianisme* (7 vols. 1863 *et seq.*); Overbeck's *Anfänge der Patristischen Literatur;* Archdeacon Farrar's *Lives of the Fathers* (2 vols. Edin. 1889); and, above all, Harnack's *Lehrbuch der Dogmengeschichte* (2d ed. 2 vols. 1888).

Dogs. See ANDIRON.

Dogs, ISLE OF, or MILLWALL, a low-lying peninsula on the left bank of the Thames, formed by a sudden bend of the river opposite Greenwich. Its isthmus is cut across by the canal of the West India Docks. One explanation derives the name from the king's hounds having formerly been kept here.

Dog's-tail Grass (*Cynosurus*), a small genus of meadow grasses, of which the crested species (*C. cristatus*) is esteemed alike for pastures and lawns. See GRASSES, PASTURE.

Dog-tooth, in Architecture, an ornament or moulding used from late Norman to early Decorated, in the form of a four-leaved flower, with the centre projecting.

Dog-tooth Violet (*Erythronium dens-canis*). This liliaceous plant, which owes its name partly to the colour of its flowers, partly to the tooth-like bulb, is a frequent inmate of the rock-garden or herbaceous border, and presents a characteristic appearance not only in March and April, from its large abundant flowers, but throughout the remainder of the season on account of its peculiarly blotched leaves. In Tartary its bulbs yield starch, and in Russia they are used medicinally.

Dog-whelk. See WHELK.

Dogwood, or DOGBERRY, the name usually given to some of the trees and shrubs of the genus Cornus (see CORNEL, CORNACEÆ). The Common Dogwood of Europe (*C. sanguinea*) is a shrub of

Common Dogwood (*Cornus sanguinea*):
a, flower.

remarkable beauty in autumn from the deep redness of its foliage. The wood makes the very best charcoal for gunpowder. It is very hard, and is made into skewers, cogs for wheels, &c., and in former times it was in request for making arrows. The small bitter fruit yields as much as one-third of its weight of an oil resembling that of olive. The wood of *Rhamnus frangula*, the berry-bearing alder, is also used by gunpowder makers, and called by them dogwood.—The Dogwood of North America (*C. florida*) is a very ornamental little tree with whitish flowers, surrounded by large white bracts, which appear before the leaves in early spring, and scarlet berries in winter. The wood is white and fine grained, and suitable for inlaying, and the

bark, like that of some allied species, is a useful febrifuge.—Jamaica Dogwood is *Piscidia erythrina*, a papilionaceous timber-tree; the cortex of the root is powerfully narcotic, used for stupefying fish or deadening the pain of toothache. See also SUMACH.

Dohrn, ANTON, zoologist, was born at Stettin in 1840, studied at Königsberg, Bonn, Jena, and Berlin, lectured for a time on Zoology at Jena, and in 1870 founded the great zoological station at Naples. As an embryologist, he has devoted himself mainly to the development of insects and crustaceans; and besides reports, he has published works on the origin of the vertebrates.

Doit, a small copper coin current in Scotland during the reigns of the Stuarts. It was a Dutch coin (*duit*), in value equal to the eighth of an English penny, or half a farthing.

Dol, an antique walled town in the French department of Ille-et-Vilaine, 10 miles SE. of St Malo by rail. Its former cathedral is a striking granite building of the 13th century. To the north is the isolated Mont Dol (213 feet). Pop. 3619.

Dolabella, PUBLIUS CORNELIUS, Cicero's profligate son-in-law, was born about 70 B.C., and in 49 had to seek a refuge from his creditors in the camp of Cæsar. In the following year he obtained the tribuneship, and at once brought forward a bill, cancelling all debts, which led to bitter and bloody struggles in Rome. He accompanied Cæsar to Africa and Spain, but on his leader's death promptly usurped the consular insignia, approved of the murder, and made a great display of republican sentiments, which he professed until Antony gave him the province of Syria. At Smyrna he murdered C. Trebonius, the proconsul, in February 43, and proceeded to wring money and troops from the towns of Asia with a recklessness that speedily brought about his outlawry. Within the year, Laodicea, in which he had shut himself up, was taken by Cassius, and Dolabella, to escape his enemies, ordered one of his own soldiers to kill him, 43 B.C.

Dol'ce, an Italian term in music, meaning softly and with tenderness.

Dolci, CARLO or CARLINO, a celebrated painter of the Florentine school, was born at Florence in 1616. He received his first instructions in art from Jacopo Vignali, a pupil of Roselli, and a remarkably skilful teacher. After an uneventful life spent entirely in his native city, Dolci died January 17, 1686. His works, which consist chiefly of madonnas and saints, exhibit the character attributed to him. The faces are full of a pleasing and tender softness, which, however, is often carried so far as to rob them of all character. Dolci's drawing is generally correct, his colouring exquisitely delicate and transparent, and in the nicety and laborious care of his finish he approaches the most characteristic examples of the Dutch school. His works are numerous, and scattered over all Europe. Besides his madonnas, the most famous are his 'St Cecilia,' 'Christ Blessing the Bread and Wine,' and 'Herodias with the Head of John the Baptist,' in Dresden.

Doldrums. See WIND.

Dôle, a town in the French department of Jura, on the Doubs, 29 miles SE. of Dijon by rail. It contains a Gothic cathedral, a college, and a library; and it has vineyards, quarries, foundries, and manufactures of fire-engines and tools, besides a trade in Gruyère cheese. Pop. (1872) 10,845; (1891) 11,498. Dôle is the *Dola Sequanorum* of the Romans, of whose presence many traces remain. It was in the 15–17th centuries a strong and oft-disputed fortress, and the capital of the Franche-Comté (q.v.), with a university and a parliament.

Dolerite. See BASALT.

Dolet, ETIENNE, 'the martyr of the Renaissance,' was born at Orleans, in France, in 1509. The circumstances of his birth were somewhat mysterious, and it was even asserted that he was the natural son of Francis I. But this story is rejected by all his trustworthy biographers. At the age of twelve Dolet went to the university of Paris, where his attention was directed to the study which became the chief interest of his life—the writings of Cicero. Proceeding to Italy in 1526, he continued his studies at Padua and Venice, and after six years returned to France, settling in Toulouse. Here Dolet's troubles began. In Italy he had thoroughly imbibed the spirit of humanism, with its zeal for the study of the classics, and its indifference to the teaching of the church. As orator of the French 'nation' in the university of Toulouse, he delivered a harangue 'which laid the first fagot of the pile that consumed him.' On this occasion he was punished with three days' imprisonment. In 1534 Dolet left Toulouse for Lyons, where, under circumstances that have not been explained, he killed a person of the name of Compaing. Having received the royal pardon, he still continued to reside in Lyons, always under strong suspicion of heresy. In 1542 he received the royal permission to set up a printing-press, but soon brought himself into trouble on account of the heretical books he published. He was arrested more than once on this charge, but always succeeded in escaping the last penalty of the law. At length, in 1544, he was found guilty of heresy on a charge mainly based on an alleged mistranslation of Plato, in which he was accused of denying the immortality of the soul. After two years' imprisonment, Dolet was burned in the Place Maubert, Paris, 3d August 1546. Dolet's fate has given him an interest and importance he would not otherwise have had. At the same time, by his indefatigable industry as a writer and printer, he did valuable service to the cause of learning in the 16th century. His most important work is his *Commentaries on the Latin Language*. See Richard C. Christie's *Etienne Dolet* (1880; French trans. with 'appendix bibliographique,' 1885).

Dolgelly ('dale of hazels'), the capital of Merioneth, North Wales, on the Wnion, 62 miles SW. of Chester by rail. It lies in a rich and picturesque valley, at the foot of Cader Idris, and during the summer months is much frequented by tourists. It has manufactures of coarse woollens and flannels; its Welsh tweed is in great repute. Pop. (1851) 2041; (1891) 2467. Here, in 1404, Owen Glendower held a parliament, and signed a treaty of alliance with Charles VI. of France.

Dolgoruky, KATHARINA, PRINCESS, the favourite of the Russian Czar, Alexander II., who married her in July 1880, after the death of his first wife, Marie. After the Czar's tragical death she lived abroad, and published at Geneva in 1882, under the pseudonym of Victor Laferté, *Alexander II., Détailes inédites sur sa vie intime et sa mort.*

Dolichocephalic. See SKULL.

Dolichos, a large genus of Leguminosæ, sub-order Papilionaceæ, closely allied to Phaseolus (see KIDNEY-BEAN), annual or perennial. Some are cultivated on account of their seeds or pods, notably *D. Lablab* of India and Egypt, *D. soya* (or *Soja hispida*), the Soy-bean of China and Japan, and many others.

Doll, an imitation-baby used as a toy by girls. The word doll is of doubtful derivation; possibly from *idol;* in French, the name is *poupée;* in German, *puppe*, from Lat. *pupa*, 'a girl,' 'a doll.' The use of dolls as an assistance to the operations

of the young mind dates from the most remote times, and is common in all countries, barbarous as well as civilised, springing from the early mental process which requires some object to increase the definiteness of the child's ideas. Thus, however roughly made the doll may be, it answers a purpose—setting the child's brain to work, and enabling it, by the association of ideas, to form a mental picture of what it is intended to resemble. Precisely as a child in a mansion in England fondles a finely-dressed doll worth a guinea, so does the child of an African or Eskimo take delight in a piece of wood or bone carved rudely in the form of a baby. Accordingly, the keeping of a doll virtually becomes a part of the home-education of girls, and is recognised to be so by the universality of the practice. But with many uncultured tribes the doll is not confined to children. Among the Bechuanas, married women carry a doll with them till they have a child, when it is discarded; a similar practice being observed by Basuto women. In many parts of Africa, whenever twin children are born, one of them is killed; and among the Wanyamwezi, it is usual for the mother 'to wrap a gourd or calabash in skins, to place it to sleep with, and feed it like the survivor.' Even the European child's love for the doll by no means depends on its artistic excellence; a bit of stick dressed with a few rags is often hugged as heartily as the finest toy-baby. See Tylor's *Early History of Mankind*, chap. vi.

Roman Ivory Doll.

As in the case of most other Toys (q.v.), dolls were at one time imported into Great Britain chiefly from the Netherlands; and hence not an unusual name for a doll was a Flanders baby. These old Flemish or Dutch dolls were made of wood, with neatly formed faces and flashy dresses, the cheaper kinds having slender wooden legs. Of late years there have been great improvements in the making of dolls, and in England it has assumed the character of a manufacture; but there are still large importations from the countries on the Rhine, France, and Switzerland, where women and children are mostly engaged in the manufacture, largely in their own houses. Some carve the heads and bodies, others paint the faces and necks, others prepare legs and arms, and a different class cut out, sew, and put on the dresses. These operations are seldom executed by one person. Usually, dealers buy the fragments so far prepared by villagers, and get them put together in a wholesale way. As the time employed in the preparatory processes is scarcely of any marketable value, the prices of fragments are most insignificant. Hence, as regards all the cheap kinds, with painted faces and ringlets, dolls can be imported at a cost below that at which they could be executed by hand-labour in England. When, however, we come to dolls of a superior kind, with moulded wax or composition faces, arms, and feet, glass-eyes, stuffed bodies, flaxen ringlets, and gauze dresses, the English, by their machinery and capital, carry off the trade. In London there are about forty doll manufacturers, and about as many in New York and the New England states, who in this as in other trades make an economic division of labour; there being dolls' head-makers, dolls' leg and arm makers, doll sewers, doll stuffers, dolls' wig-makers, dolls' eye-makers, and doll dressers. For some dresses, remnants of calico, gauze, silk, and other materials, are procured from shops; but for fashionably dressed dolls, much in demand, it is necessary to buy goods on a large scale. The extent to which dolls' glass-eyes are manufactured is surprising. Some years ago a glass manufacturer at Birmingham stated before a committee of the House of Commons that he had received, at one time, an order for £500 worth of dolls' eyes. The cheaper dolls' eyes are simply small hollow glass-beads, made of white enamel, and coloured with black or blue, but without any attempt at variety or effect; while those eyes of a higher quality have a ring of colour to represent the iris. The introduction of wires and mechanism to make the eyes move or wink at pleasure, and also to cause the doll to utter the sounds 'papa' and 'mamma,' have been successive improvements, with a corresponding rise in prices. It is stated in the experience of the trade, that during the present reign blue eyes for dolls have been in the ascendant in England, but that black eyes find the best market on the Continent, especially for Spanish dolls. Black dolls are made for export to America, where they are in request by girls of negro parentage, and the introduction of gutta-percha is favourable for this branch of the trade. Composition-heads are usually made of *papier-mâché*, cast in a mould, and waxed and painted to represent the features.

One of the most attractive stalls at the Great Exhibition in 1851 was that which contained the dolls of Madame Montanari, a London manufacturer. Referring to this stall, the Jury Report said: 'It consists of a series of dolls, representing all ages, from infancy to womanhood, arranged in several family groups, with suitable and elegant model furniture. These dolls have the hair, eyelashes, and eyelids separately inserted in the wax, and are, in other respects, modelled with lifelike truthfulness. Much skill is also evinced in the variety of expression which is given to these figures, in regard to the ages and stations which they are intended to represent.' Some of those dolls were sold at five guineas undressed, and at a greatly increased price when richly attired. The same exhibition showed how much skill could be exercised in making rag-dolls, in which almost every part is formed of textile materials. But, compared with these dolls of the middle of the century, those displayed in the various exhibitions that have recently been held show what a great advance has been made in their manufacture, their artistic appearance being as graceful as it is lifelike.

Dollar, a pleasant town of Clackmannanshire, at the foot of the Ochils, and near the Devon's right bank, 6 miles NE. of Alloa, and 12 ENE. of Stirling. It has bleachfields, but owes its chief well-being to its academy, a domed Grecian edifice (1818–67), which, founded under the will of Captain John M'Nab (1732–1802), a Dollar herdboy and London shipowner, gives higher and secondary education to 800 pupils of both sexes. A mile north of Dollar are the noble ruins of Castle Campbell or Castle Gloom, crowning an almost insulated knoll, amid mountain-rivulets and bosky woods, with King's Seat (2111 feet) rising behind. It belonged to the family of Argyll from 1465 till 1805, in 1556 sheltered John Knox, and in 1645 was burned by Montrose. At Dollar in 877 the Danes won a victory; and in 1538, its 'good vicar,' Thomas Forrest, was burned at Edinburgh for heresy. Pop. (1881) 2014; (1891) 1807. See Beveridge's *Between the Ochils and the Forth* (1888).

Dollar, a coin, the unit of the monetary system of the United States, as well as of Canada, Mexico, Liberia, and other countries. The name *dollar* is a variant of the German *thaler*, and Danish *daler*. The name arose about the year 1600 in Germany. The Counts of Schlick were then coining ounce-

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pieces from silver obtained in their mines at Joachimsthal (Joachim's Dale) in Bohemia, which gained such high repute as to become standard coins; whence the name *Joachims-thaler*, which finally, for shortness, took the form of *thaler*—literally, a 'valley-piece.' The name was soon extended to other coins of similar size—notably to the old Spanish 'piece of eight,' the *peso* of eight reals. From 1873 to 1878 the gold dollar was the sole standard of value in the United States. This coin contains 25·8 grains of gold of the United States standard of fineness—namely $\frac{9}{10}$ pure gold; the British standard being $\frac{11}{12}$ pure gold. The gold dollar is thus worth about 4s. 2d. sterling. In 1878 the United States government remonetised silver, since which time the United States have had a double standard. The standard silver dollar contains 412½ grains troy of silver, of which $\frac{1}{10}$ is alloy. The silver dollar (like a paper dollar) is exchangeable anywhere in the United States for a gold dollar; although the bullion value of the silver contained in it has come to be considerably less, varying, in fact, with the market price of silver. The dollar is divided into 100 cents; there are silver half and quarter dollars, dimes (10 cents), and half-dimes; and formerly there were also, in paper currency, other fractional denominations. The United States trade-dollar of 420 grains (not now coined) is not a legal tender. It was only coined for export to China and other Asiatic regions. It is nearly equivalent in intrinsic value to the Mexican dollar, so long recognised as the standard of values in the Chinese trade. The British at Hong-kong and the Japanese government coin trade-dollars also. The Canadian dollar is about equivalent in value to that of the United States. Among other coins that are, or may be, called dollars from their approximation in value to the United States standards, are the *boliviano* of Bolivia (silver, about 72 cents); the *peso* of Spain (97 cents), of Chili (78 cents), of Cuba (92 cents), of the Central American Republics, and of Colombia (80 cents); the *sucré* of Ecuador (72 cents); the *gourde* of Haiti (80 cents); the *yen* of Japan (gold, one dollar; silver, 80 cents); the dollar of Liberia (worth one American dollar); the Mexican *peso* (75 cents); and the *sol* of Peru (80 cents); all of them of silver, except when otherwise stated. The *thaler*, equalling 3 marks, or 71 cents, till 1875 formed the standard of value of almost all northern Germany. The double florin of Great Britain (first struck in 1887) has a value of 4s., and is approximately a dollar.—The derivation of the *dollar mark* ($) has been variously ascribed to (1) a combination of the initials U.S.; (2) a modification of the figure 8, a piece of eight being formerly indicated by the character 8-8; (3) a form of HS., which marked the Roman unit; (4) the contraction of P and S employed in Spanish accounts to indicate *peso;* (5) a device formerly seen on the reverse of the Spanish dollar, and again, since 1848, on the *peso duro*, representing the Pillars of Hercules, and round each a scroll displaying the inscription *Plus ultra*.

Dollart, THE, a gulf of the German Ocean, at the mouth of the river Ems, between Hanover and Holland. It is 8 miles long by 7 broad, and was formed by inundations of the sea (1277–1362), which submerged 50 villages and several towns. Of late years much territory, especially on the flat German coast, has been won back from the sea.

Döllinger, JOHANN JOSEPH IGNAZ, one of the most scholarly and eminent of recent German Catholic theologians, was born at Bamberg on 28th February 1799. After teaching for three years in the Lyceum at Aschaffenburg, he was appointed (1826) professor of Ecclesiastical History and Law in the university of Munich, a chair which he held, with the exception of a short interval (1847–49), down to 1871, when he was elected rector of his university. He also represented the same university in the Bavarian chamber from 1845 to 1847, and onwards from 1849, and was elected by a Bavarian constituency to the Frankfort parliament of 1848–49. His life and labours may be conveniently divided into three periods. During the first of these, which extended from 1826 to 1857, he was one of the most energetic defenders of Ultramontanism in Germany, the champion of the independence of the church from the state, and an enemy of Protestantism, formidable not only on account of his energy and indefatigable zeal, but also on account of his learning, his eloquence, and his skill as a writer. The views which he held at this period of his life find expression in his public acts, especially as leader of the Ultramontane party at Frankfort, and in two works, *Die Reformation, ihre innere Entwickelung und ihre Wirkungen* (Ratisbon, 3 vols. 1846–48); and *Luther, eine Skizze* (1851). In 1857 Döllinger visited Rome, and what he saw there, together with the outbreak of the Italian war of 1859, produced a change in his opinions, which he first announced publicly in two addresses delivered at Munich in 1861, in which he propounded his belief that the temporal sovereignty of the pope was not essential to the continuance and progress of the Roman Catholic Church. The enunciation of this view brought down upon his head several fierce attacks from the writers of the Ultramontane party, to which he replied in *Kirche und Kirchen, Papsttum und Kirchenstaat* (1861); and this was followed, two years afterwards, by *Vergangenheit und Gegenwart der katholischen Theologie* (addressed to a conference of Roman Catholic divines at Munich), and by *Die Papstfabeln des Mittelalters*. Whilst the Vatican Council was being summoned to deliberate on the dogma of papal infallibility, Döllinger, along with his colleagues, Professors Friedrich and Huber, assailed the new doctrine in the anonymous *Janus* (1869). In July 1870 the council, in spite of all opposition, proceeded to promulgate the decree of papal infallibility; and in the following March Döllinger published a letter, withholding his submission, alike as 'a Christian, a theologian, an historical student, and a citizen.' Excommunicated three weeks afterwards, he took a leading part in the summoning of the congress which met at Munich in September, and out of which arose the Old Catholics (q.v.). The year 1872 marks the beginning of the third period in the learned theologian's career. The position he now took up was indicative of a desire to bring about the union of the various Christian churches, a cause which he advocated, not only in a series of lectures (1872), but also by the active part he took in the Old Catholic conference at Bonn (1874–76). He never officiated as a priest of the new communion, though he defended its position. With Reusch he edited Cardinal Bellarmine's autobiography (1887), and a work on moral controversies in the Catholic Church since the 16th century (1888). In 1888 he published academic lectures (Eng. trans. of first series, *Studies in European History*, 1890), and in 1889 materials for a history of sects. Besides works already named, Döllinger wrote *Hippolytus und Kallistus* (1853), *Heidentum und Judentum* (1857), a treatise on Christianity and the Church in the earliest period (1860), and a collection of documents illustrating the history of the Council of Trent. In 1873 he was made president of the Munich Academy. In 1889 his ninetieth birthday was celebrated by the university with great éclat. He died at Munich, 10th January 1890.

Dollond, JOHN, a distinguished optician, inventor of the achromatic telescope, was descended

from a French refugee family of Dutch extraction, and was born in London, June 10, 1706. Brought up to his father's occupation of silk-weaving, and engaged at the loom all day, he devoted great part of the night to his favourite studies of mathematics, optics, and astronomy; and even made himself acquainted with anatomy, theology, Greek, Latin, French, German, and Italian. In 1752 he joined his eldest son, Peter (1730–1820), who had started as an optician, and devoted himself to the improvement of the dioptric telescope, in which he was encouraged by the most distinguished scientific men of the time. After a series of well-contrived experiments and researches, carried on for several years, he succeeded in constructing lenses that produced images without any coloured fringe (see ACHROMATISM). This was undoubtedly the greatest improvement that the telescope had received since its first invention, though it came out in action for infringement of patent, that in 1733 it had been anticipated by Chester More Hall, who had not, however, made his invention public. The Memoir (published in the *Philosophical Transactions* for 1758) in which he gave an account of his investigations was rewarded by the council of the Royal Society with the Copley Medal. In 1761 Dollond was elected an F.R.S.; he died 30th November of the same year. His two sons continued to carry on the business with great reputation and success. See Kelly's privately printed Life, reproduced in the *Philosophical Magazine* (1804).

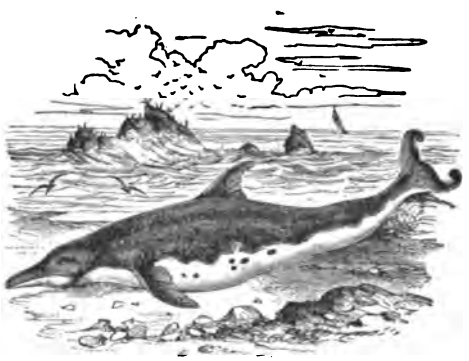
Dolmen (from the Celtic words *daul*, 'a table,' and *maen*, 'a stone') is a modern term applied in archæology to the megalithic framework of the chambers of chambered cairns, which often survive the removal of the covering mounds of stones and earth for agricultural or other utilitarian purposes, or which may never have been completely enveloped in such a covering. In England, such constructions, consisting of three or more stone props supporting a massive roof stone, were formerly styled Cromlechs (q.v.), but this use of the term is now obsolete. The best-known English dolmen is that known as Kits Coity House, near Aylesford, in Kent. The term dolmen is almost universally employed on the Continent to designate not only the denuded megaliths of a sepulchral chamber, but the whole construction, inclusive of the covering mound or cairn. It is thus synonymous with the descriptive appellation of chambered Cairn (q.v.), and may be taken as a generic name for such sepulchral constructions of the stone age. In France there are no less than 3410 more or less complete dolmens in the wider sense of the term, many of these in Brittany.

Dolomite, or BITTER SPAR, a mineral consisting of double calcium and magnesium carbonate. The proportions of the two carbonates are very variable, and occasionally the mineral contains a considerable percentage of ferrous carbonate. It crystallises in rhombohedral forms, the faces of the crystals being often curved; its lustre is somewhat pearly or vitreous, and its colour usually white, but variously coloured kinds are not uncommon, such as reddish, brown, green, gray, and black. It effervesces feebly with cold acid. The pure crystallised varieties are known as Pearl Spar. Those which contain a notable proportion of ferrous carbonate are called Brown Spar (q.v.) or Ankerite. Besides these, columnar fibrous and granular or saccharoid varieties are known. Magnesian limestone—a rock occurring abundantly in the Permian System (q.v.)—is composed essentially of bitter spar, and hence is often called dolomite. It is usually white, gray, or yellow in colour, and finely crystalline. In some varieties cellular spaces occur which are often lined with crystals of dolomite. Other varieties are composed of botryoidal or irregularly-shaped concretionary masses. Most limestones contain some magnesium carbonate, but it is only when the percentage of this salt is considerable that they are called magnesian limestones or dolomites. Magnesian limestone is often used as a building-stone; and it is also burned and made into mortar, but the lime obtained from it remains much longer caustic than lime from common limestone, and is considered of less value for agricultural purposes. In some districts, however, this lime is preferred to purer limes for application to hill-pastures.—Dolomite is named after the geologist Deodat Guy de Dolomieu (1750–1801), who was born at Dolomieu in Dauphiné.

Dolomite Mountains. The distinctive peculiarities of dolomite mountain-scenery, with its jagged outlines and isolated peaks, may be seen on the grandest scale in the south-east of Tyrol and in the Carinthian Alp masses. When the Dolomites *par excellence* are spoken of, it is the Dolomite Mountains of this region that are meant. See Gilbert's *Dolomite Mountains* (1864); *Zigzagging Amongst the Dolomites* (1870); Amelia B. Edwards, *Untrodden Peaks and Unfrequented Valleys* (1870; 2d ed. 1889).

Dolphin, a name applied to various members of the Cetacean family Delphinidæ, but especially to the species of the genus Delphinus. This genus is large and heterogeneous, and is split up by some naturalists. The snout is more or less elongated and pointed; the teeth are very numerous, uniform, close-set, and sharp; the fore-limbs are narrow and pointed; there is usually a conspicuous dorsal fin. Like other toothed Cetaceans, the dolphins have a somewhat unsymmetrical skull with many peculiarities, and a single crescentic blow-hole (nostril) on the top of the head. They occur in all seas, and sometimes in rivers, such as the Amazon. None exceed 10 feet in length. They feed principally on fish, but some do not disdain lower animals, such as molluscs, crustaceans, medusæ. In habit they are active, and usually occur in gregarious 'schools.'

The Common Dolphin (*Delphinus delphis*) occurs in the Mediterranean and North Atlantic, and is probably identical with forms from the North Pacific and Australia distinguished as separate



Common Dolphin (*Delphinus delphis*).

species. It is usually not more than 6 to 8 feet in length, of a gray or greenish-black colour above, and white below. The moderately long snout is separated by a transverse pad from the slightly arched forehead. The jaws bear on each side twenty-five to fifty small, conical, sharp teeth, curved slightly backwards. The crescent-shaped tail is keeled above and below. The dolphin feeds chiefly on fishes, which it pursues with graceful gambolings. One young one is born at a time, and tended

with much affection. The animals have a peculiar lowing cry. Their agile evolutions are much observed and admired by voyagers. The flesh is sometimes eaten by sailors. Like other dolphins, it is often called a 'porpoise,' and the French give it the names of *Bec d'Oie* (goose-beak) or *Oie de Mer* (goose of the sea). In ancient times the dolphins were sacred to Apollo, and invested with numerous kindly and marvellous attributes. They drew the car of Amphitrite, and carried Arion upon their willing backs. Its image has been often used as a symbol, from the 'shield of Ulysses' to that of the heir-apparent or Dauphin (q.v.) of France. The anchor and dolphin, the printer's device of Aldo Manuzio, with the motto, '*Festina lente*,' was adopted by him, at Erasmus' suggestion, from a silver coin of Vespasian I. The flesh of the dolphin was formerly esteemed for food. The name has been curiously transferred to the little Coryphenes (q.v.); and it is these scomberoids that are meant when reference is made to the 'dying dolphin's changing hues.'

A rarer species off British coasts is the much larger and heavier Tursio (*D. tursio*), the nesarnak of the Greenlanders. In the North Atlantic, *D. albirostris* and *D. leucopleurus* also occur. There is a pure white dolphin (*D. sinensis*) in the Chinese seas, and a South Sea form (*D. peronii*) without the usual dorsal fin.

In the same family as the dolphin are many well-known forms: the Narwhal (*Monoceros*), the Beluga (*Delphinapterus*), the Porpoise (*Phocæna*), the Grampus (*Orca*, &c.), the Caaing Whale (*Globicephalus*), &c. See these articles.

Dolphin, BLACK (*Aphis fabæ*). See APHIDES and BEAN.

Domboc (book of dooms or sentences), the code of laws compiled by King Alfred, who made few if any original laws, but contented himself with restoring, renovating, and improving those which he found already in existence. Alfred's peculiarly Christian character is strongly impressed on his code, which begins with extracts from the Bible, 'The Lord spake all these words, saying, I am the Lord thy God.' Then follow the ten commandments, the part of the Mosaic law relating to criminal offences, and passages from the New Testament, including the golden rule. The code was ratified by the Witan, as Alfred expressly informs us. Thorpe gives it in his *Diplomatarium Anglicanum ævi Saxonici* (1865).

Dombrowski, JOHN HENRY, a distinguished Polish general, was born near Cracow in 1755, and, after serving under the Elector of Saxony, returned to take part in the Polish campaigns against Russia and Prussia in 1792–94. Next entering the French service, he organised a Polish Legion at Milan; and in the campaigns which followed, Dombrowski and his Poles took a distinguished part. After the fall of Napoleon, he returned to Poland, and was appointed by the Emperor Alexander a general of cavalry and Polish senator. He died 6th June 1818.

Dome (Ital. *duomo*). Since the time of the Renaissance this term is commonly applied to the external part of the spherical or polygonal roof, of which the cupola (*cupo*, or cup) is the internal part. In Italian usage, however, it has a wider signification than even the first, being used to denote the cathedral or chief church of a town, *the house* (domus) *par excellence*, or house of God; and in Germany, *dom* or *domkirche* is a cathedral. In tracing the historical origin of the dome, we are usually in the habit of regarding it as originating with the architecture of the Eastern empire, because it was at Constantinople and in the Byzantine provinces that its use in ecclesiastical structures was principally adopted. But it was the Romans who developed the dome, as well as all the other applications of the semicircular arch. Of their success in applying it to large buildings, we have abundant proof in the ancient domes still to be seen in Rome and its neighbourhood. The dome of the Pantheon is still probably the most magnificent dome in existence, and others of smaller size are to be seen in the temples of Bacchus, Vesta, Romulus, Hercules, &c. From Rome it went to Constantinople, and from the same source, also, according to Fergusson, came the few insignificant attempts at domes in the Western empire. The external form of the dome of the church of St Sophia at Constantinople, which became the typical Christian structure of the kind, will be seen in the illustration appended to BYZANTINE ARCHITECTURE (see also ARABIAN ARCHITECTURE, and the illustration of the Taj Mahal at AGRA). The dome of San Vitale, at Ravenna (q.v.), is said to be still more ancient than that of St Sophia, and is a very remarkable structure of the same class. On the church of St Mark, at Venice, there are no less than five domes, the centre one, as is usual in Eastern structures, being much larger than the others. The interior of these domes is covered with Mosaics (q.v.). So far from being peculiar to the few churches we have mentioned, domes occur in those of almost every town along the western shore of the Adriatic, and form, in fact, the chief architectural feature of that side of Italy. From St Mark's the dome was introduced in the 11th century into Périgueux in the south of France, and thus influenced the architecture of a considerable part of that country. The construction of domes in modern times was revived in Rome, by the building of that of Our Lady of Loretto in 1507. But the three most celebrated modern domes are those of St Peter's at Rome, of St Paul's in London, and of the Pantheon in Paris. The following are the dimensions of some of the most important existing domes:

	Feet diam.	Feet high.
Pantheon at Rome	142	143
Baths of Caracalla, Rome	112	116
St Sophia, Constantinople	115	201
St Maria delle Fiore, Florence	139	310
St Peter's, Rome	139	330
St Paul's, London	112	215
St Geneviève, Paris	67	190

In modern times, domes have been constructed with iron of still larger dimensions. Thus that of the Great Exhibition in Vienna was 360 feet in width, and that of the Albert Memorial Hall in London, which is oval, measures 219 by 185 feet in diameter. For a class of ancient dome-roofed structures, see BEEHIVE HOUSES.

Domenichi'no, or DOMENICO ZAMPIERI, a celebrated painter of the Bolognese school, was born at Bologna in 1581. He began his studies under Denis Calvaert, and completed them under the Caracci. During the whole of his career, Domenichino had much to suffer from the jealousy of rivals, who are not free from the suspicion of having caused his death by poison (1641). Though his artistic fame has greatly diminished during recent years, it must be admitted that his works are distinguished by correctness of design, that the heads of his figures in particular are expressive and forcible, and that his draperies are rich and varied in arrangement. The masterpiece of Domenichino, the 'Communion of St Jerome,' 1614 (an easel-picture in the Vatican), though suggested by Agostino Caracci's rendering of the subject, is an accomplished and powerful production. His 'Diana and her Nymphs,' 'Guardian Angel,' 'St John,' and 'St Sebastian,'

also rank among his finer productions, and the 'Cure of the Demoniac Boy,' at Grotta Ferrata, is one of the most admired of his frescoes. Out of Italy, the museum of the Louvre possesses the largest number of Domenichino's works.

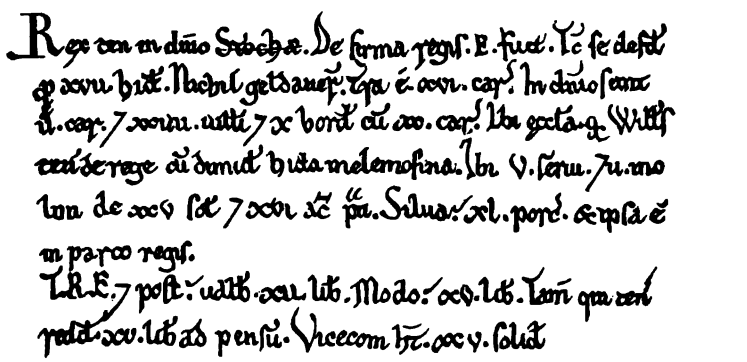
Domesday Book, or DOOMSDAY BOOK, one of the oldest and most valuable records of England, contains the results of a statistical survey of that country made by William the Conqueror in 1085–86. The Anglo-saxon name, *Dómes Dæg*, 'day of judgment,' has obvious reference to the supreme authority of the book in doom or judgment on the matters contained in it. It was also anciently known as the *Liber de Wintonia*, or Book of Winchester; the *Rotulus Wintoniæ*, or Roll of Winchester; the *Liber Regis*, or King's Book; the *Scriptura Thesauri Regis*, or Record of the King's Treasury (where it was long kept, together with the king's seal, under three locks and keys); also the *Liber Censualis Angliæ*, or Rate-book of England; and the *Liber Judiciarius*, or Book of Judgment.

The way in which the survey was made will be best described in the words of the contemporary writer in the Anglo-Saxon Chronicle. At midwinter in 1085, when the king was at Gloucester, 'he had a great consultation, and spoke very deeply with his witan [i.e. great council or parliament] concerning the land, how it was held, and what were its tenantry. He then sent his men all over England, into every shire, and caused them to ascertain how many hundred hides of land it contained, and what lands the king had in it, what cattle there were in the several counties, and how much revenue he ought to get yearly from each. He also caused them write down how much land belonged to his archbishops, bishops, abbots, and earls, what property every inhabitant of all England possessed in land or in cattle, and how much money this was worth. So strictly did he cause the survey to be made, that there was not a single hide, nor a yardland of ground, nor—it is shameful to say what he thought no shame to do—was there an ox, or a cow, or a pig passed by, that was not set down in the accounts; all these writings were brought to him.'

The survey was made by commissioners called the king's justiciaries, who had the help of the chief men of every shire. By a sworn assize or jury of the sheriffs, lords of manors, presbyters of churches, reeves (i.e. grieves or overseers) of hundreds, bailiffs, and six villeins (i.e. servile tenants) of every village, they made inquest as to the name of the place; who held it in the time of King Edward (1041–66); who was its present possessor; how many hides there were in the manor; how many ploughgates in demesne (i.e. reserved in the lord's own hand); how many homagers or vassals; how many villeins; how many cottars; how many serfs; what freemen; how many tenants in socage (i.e. tenants who rendered services of husbandry); how much wood; how much meadow and pasture; what mills and fish-ponds; how much had been added or taken away; what was the gross value in Edward's time; what the present value; and how much each freeman or socman has or had. They were also to state the value of the land (1) as held in Edward's days; (2) as it had been given by William; (3) as it stood at the time of this survey; and (4) if its value could now be raised.

The returns thus gathered in the several shires, and their hundreds and other subdivisions, were arranged and digested in the record which is now called the Great or Exchequer Domesday. The enumeration of the cattle and swine, which so moved the indignation of the Anglo-Saxon chronicler, though regularly made, was in some cases omitted from the record, because of its ever-fluctuating quantity. By this valuable census there was provided not only exact information of the land and its inhabitants, but also a trustworthy register of appeal for litigious proprietors, a reliable guide for military service, and a practical basis for regulating taxation. The taxes were levied according to the divisions of the country given in the Domesday Book, until 1522, when a new survey, popularly called the *New Domesday Book*, was made.

This great English record was published at the national cost in 1783, in two folio volumes, printed with types cast for the purpose, so as to represent the contractions of the original manuscript; it was ten years in passing through the press. In 1816 two supplementary volumes were published, one containing an excellent general introduction, by Sir Henry Ellis of the British Museum, with indices to the places and persons mentioned in the work; the other containing four other records of the same nature: (1) The Exon or Exeter Domesday, being a transcript of the Exchequer Domesday for the counties of Wilts, Dorset, Somerset, Devon, and Cornwall; (2) the Inquisitio Eliensis, a transcript of the survey of the lands of the monastery of Ely, in the counties of Cambridge, Hertford, Essex, Norfolk, Suffolk, and Huntingdon; (3) the Winton Domesday, containing two surveys of the city of Winchester, one made between 1107 and 1128, the other in 1148; and (4) the Boldon Book, a survey of the possessions of the see of Durham, made in 1183. This fourth record is especially valuable, as partially supplying a deficiency in the domesday survey, which did not extend to the counties of Durham, Northumberland, Westmoreland, and Cumberland, either, it would seem, because they had been lately laid waste by the Conqueror, or because his dominion was not fully established in them. A new and better edition of the Boldon Book was issued in 1852 by the Surtees Society, which, in 1857, printed



Specimen of Domesday Book.

The reading, freed from contractions, runs as follows:

Rex tenet in dominio Stochæ. De firma regis Edwardi fuit. Tunc se defendebat pro xvij hidis. Nichil geldaverunt. Terra est xvj carucatæ. In dominio sunt ij carucatæ & xxiv villani & x bordarij cum xx carucatis. Ibi ecclesia quam Willelmus tenet de rege cum dimidia hida in elemosina. Ibi v servi & ii molini de xxv sol. & xvi acræ prati. Silva xl porcorum & ipsa est in parco regis.

Tempore Regis Edwardi & post valebat xij lib. Modo xv lib. Tamen qui tenet reddit xv lib. ad pensum. Vicecomes habet xxv solid.

Bishop Hatfield's Survey, another record of the possessions of the see of Durham, compiled between 1345 and 1381. A new and enlarged edition of Sir Henry Ellis's *General Introduction to Domesday Book* was published in 1833, in 2 vols. 8vo. See also Stubb's *Select Charters*, and Freeman's *Norman Conquest* (vol. v. 1876). In 1861 a fac-simile copy of that part of Domesday Book which relates to Cornwall, was published by the Ordnance Survey, by photozincography; and since then, government has gone on publishing the rest of the Domesday Book, county by county, in the same way. In 1872 government ordered a general return of owners of lands, to be prepared by the Local Government Board. This modern 'Domesday Book' was published in 1874–76. Of minor books on Domesday there are not a few. A little work by Walter de Gray Birch, *Domesday Book* (1887), gives a succinct and popular account of this Record. In 1886 the Royal Historical Society celebrated the octo-centenary of the completion of Domesday, and, as a memorial, undertook a work entitled *Domesday Studies*, in two volumes. A *Key to Domesday*, so far as regards the counties of Dorset, Somerset, and Stafford, was issued by the Rev. R. W. Eyton in 1877–81 (4 vols.).

Domestic Architecture. The variety of requirements to be fulfilled by the architecture of the house, whether as regards the climate, habits, or employments of different countries, is very great, and the designs and arrangements must therefore throughout the world's history have been infinitely varied. But the construction is generally much less substantial than that of temples and public buildings, and the remains of ancient houses are in consequence comparatively scarce. Of the dwellings of the ancient world there exist almost none, but some idea of those of the Egyptians and Etruscans may be obtained from the arrangement of their tombs. Greek and Roman houses were generally only one story in height, and contained an open atrium with small chambers around it. Beyond this was the peristyle or private department, surrounded with a colonnade, and opening on a garden. In connection with the peristyle were dining-rooms and family apartments. The preservation of the houses of Herculaneum and Pompeii brings before us with great vividness all the domestic arrangements of the classic period.

The Roman dispositions were followed during a great part of the middle ages, but became modified about the 11th century. Thus the peristyle was imitated in the cloister of the medieval monastery, and the Roman 'villa' or country-house became the model of the early castles of southern Gaul. In the villa the large outer courtyard was called the *villa rustica*, containing the granaries, stables, &c., while an inner court formed the *villa urbana*, or residence of the proprietor. The castles were on the same plan, the courts being surrounded with a ditch and palisaded mound, and the owner's house being a wooden redoubt on the top of an artificial mound in the inner inclosure.

During the middle ages and up to the 17th century, the greater part of the houses of the people, including those in the towns, were constructed with wood, the corbelled-out and overhanging upper floors of which are amongst the most picturesque features of medieval architecture both in England and on the Continent. The Normans were the first to introduce stone and mortar construction into castle-building in the 11th century. The well-known Norman keeps were the residences of the nobility in Normandy and England till the 13th century. There are still, however, remains of smaller manors in England dating from that period. These consisted of a two-story plain block, the ground-floor being vaulted, and the upper floor, which contained the living-rooms, entering by a separate outside stair. In the following centuries additions were made to the accommodation to suit the enlarged requirements of the times, until the buildings came finally to surround a courtyard and form a quadrangle. Most of the great castles and mansions of the 15th and 16th centuries were erected on this plan, and those built in the time of Queen Elizabeth were often on a great scale, and contained nearly all the accommodation required at the present day. Smaller mansions and houses were on various plans, and in town-houses the interior court, surrounded with projecting balconies or galleries, was common.

Under the Renaissance, town-houses in streets lost their distinctive qualities, being all designed so as to form as it were one flank of an extensive palace or single edifice. This monotonous arrangement is now being gradually departed from, and each house is beginning to be designed, as it should be, independently.

The domestic architecture of modern times has this peculiarity, that it extends its influence so as to include all classes of dwellings, even the humblest; and the houses of farm-servants and town artisans now receive as much care in their design, in order to render them comfortable and sanitary abodes, as the palaces and mansions of the wealthier classes.

See the articles BUILDING, CASTLE, GOTHIC ARCHITECTURE, ELIZABETHAN ARCHITECTURE, QUEEN ANNE STYLE, and other articles cited at ARCHITECTURE in this work; also Fergusson's *Handbook of Architecture*; Viollet le Duc, *Dictionnaire de l'Architecture*, *Histoire d'une Maison*, *&c.*; John Henry Parker, *Some Account of Domestic Architecture in England*; T. Hudson Turner, *Domestic Architecture of the Middle Ages*; D. MacGibbon and T. Ross, *Castellated and Domestic Architecture of Scotland*.

Domestication, the modification of animals by deliberate human interference with their food and surroundings, with the work or functions they perform, but especially with their breeding. The influence of man on animals extends, however, far beyond those usually regarded as domesticated, and it is not possible to draw a perfectly hard and fast boundary line. Man has exterminated some animals—e.g. birds, and propagated others—e.g. fishes; he has made many become rare, shy, and cunning, while others (e.g. crickets) find shelter in his dwellings; he has kept some captive, like the fish in the pond; tamed others individually for his service, like falcons and cheetahs; he has preserved some artificially from their enemies, because of their rarity, and others because of their utility, but without in any of these cases much modifying them. None of these are in the strict sense domesticated. It is only when a distinct breed has been produced by human interference, in most cases deliberately by artificial selection, that we are justified in calling the result domestication. Strictly 'domesticated animals' correspond to strictly 'cultivated plants;' in both cases the organisms have been modified, more or less fixedly, from their natural or wild state, by changes in food and environment, function and breeding.

Domestication began long before the dawn of history (see AGRICULTURE, Vol. I. p. 98; ANTHROPOLOGY, p. 312; DOG, Vol. IV. p. 36). The domestic animals are discussed under separate articles; but a list of representative forms may be given here. Among lower animals, Silk-moths (see SILK) and hive Bees (q.v.) have been for long controlled, and to a limited extent modified. Among fishes, Gold-fish (q.v.) may certainly be regarded as domesticated for decorative purposes. Birds include many illustrations of domestication—pigeons, fowls, ducks, geese, peacocks, turkeys, guinea-fowls, canary-birds, &c. Among mammals, dogs and

cats, horses and asses, cattle, sheep and goats, elephants, camels, reindeer, pigs and rabbits, &c., have been domesticated, and have given rise to many different breeds. The complete list is not a long one, though it will probably be increased. To admit of domestication, animals must generally be social and docile in their habits, and must be capable of retaining fertility under changed conditions.

The process of domestication, as far as deliberate control is concerned, is for the most part equivalent to selective breeding. Forms with useful varieties are isolated from the mass, and allowed to breed together, the most desirable results are again selected for breeding, and so on, till a domesticated breed of the same animal is established (see BREED). Different breeds differ from natural species in being usually mutually fertile. In other words, while two domestic races may be externally more different than are two nearly related species in nature, the reproductive elements in the first case cannot differ as they must do in the second. Thus crossing is usually successful between domestic breeds, only rarely between adjacent natural species. When we pass beyond selective breeding to inquire into the conditions of variation, a much more difficult problem is raised. In regard to some changes which crop up in domestic animals, we cannot do more at present than refer them to variations in the unstable germ-cells, and to the intermingling of sexual reproduction. Where the intercrossing is regulated, the importance of the latter is especially obvious. These germinal changes may, however, as the organism grows, find expression in the continually variable rhythm between nutrition and reproduction, between growth and multiplication—the great antithesis of organic life. But while considering this internal aspect, we have at the same time to recognise the importance of external influences, especially of altered climate and diet. These hinder or abet the constitutional or inherited tendencies, and may in course of time bring about important new results. Lastly, it must be remembered how much the habit of life, the normal functions, the daily work of the organisms are often altered under domestication. Some parts are more used, others less; and this is also a source of change (see EVOLUTION). Domesticated forms are more variable than their wild relatives; the males are more variable than the females; and the offspring of hybrids are more unstable than the hybrids themselves.

The results of domestication are very varied. Sometimes the changes induced and cultivated have been comparatively slight, in other cases they have amounted to the evolution of new species. Superficial alterations of colour and skin, hair, and feathers; deeper changes in the less plastic skeletal, muscular, alimentary, and other systems; increased fertility on the one hand, sterility on the other; alteration in mental and emotional characters; the perfecting of a racial characteristic in one case, its loss in another; general progress in some forms, utilitarian degeneration or extraordinary abnormality in others, are abundantly illustrated in Darwin's classic work on variation under domestication. The constant tendency to Atavism (q.v.) or reversion; the danger of carrying selection of a given character too far; the limits of successful close breeding (see BREED); the bearing of the facts of domestication on the problems of Heredity (q.v.) and Evolution (q.v.), are discussed elsewhere. See ACCLIMATISATION, CULTIVATED PLANTS, VARIATION; and Darwin, *The Variation of Animals and Plants under Domestication* (1868).

Domestic Economy is a tautological but convenient expression. *Oikonomia*, the Greek word from which *economy* is directly derived, means simply household management. But the reference to the household having gradually been lost, the art of managing domestic affairs in the best and thriftiest manner was, as *Domestic* Economy, distinguished from *Political* Economy. As a subject of education in schools, the term is made to cover many matters treated separately in this work—food, the value of the various kinds, the functions of food, and its preparation; clothing, its various kinds, the making and repairing of it; washing; domestic utensils; the lighting, warming, ventilation, and sanitation of houses; hygiene, the laws of health, sickness, and nursing; as well as thrift, the more especial subject of domestic economy. Information on most of these subjects will be found in very many articles throughout the work: see amongst others those on FOOD, DIET, DIGESTION, COOKERY, BREAD, INDIGESTION, NURSING, BUILDING, SEWAGE, VENTILATION, WARMING; while in actual life the proper adjustment of income to expenditure is of the first importance. See also FRIENDLY SOCIETIES, INSURANCE, SAVINGS-BANKS.

Domicile, a man's legal place of abode, or the place which the law will hold to be his residence. In determining questions of domicile, the law endeavours to follow the facts of each case, and, consequently, the legal as well as the natural view of the matter is expressed in that definition of a domicile in the *Corpus Juris*, which says 'Every man has his domicile where he has placed his hearth, and centred his fortunes and affairs; whence he goes not forth without an occasion; from which, when he is absent, he is said to be abroad; and to which, when he returns, he is said to cease to be abroad.'—Cod. 10, tit. 39, s. 7. Even in Rome, questions of domicile were not without importance, for the empire was divided for purposes of domestic government, and the inhabitant of one province was not subject to the magistrates of another. But it was in modern times, when Europe was divided into many independent kingdoms, and America was formed out of states having different local customs and laws, that the law of domicile assumed its full importance. It now constitutes one of the most difficult branches of private International Law (q.v.). The following are its most general rules: (1) The place of birth is the original domicile of every one, provided that, at the time of his birth, it was the domicile of his parents; but if his parents were then on a visit or on a journey, the home of the parents will be the domicile of birth, nativity, or origin (*domicilium originis*). (2) If the child is illegitimate, it follows the domicile of its mother. (3) The domicile originally obtained continues till a new one is acquired. (4) Minors are generally deemed incapable of changing their domicile of their own accord, but it may be changed by a change in the domicile of the parents, which it follows. (5) If the father dies, his last domicile is that of his widow and children. (6) A wife follows the domicile of her husband. (7) The place where a man lives, if there be no ground for entertaining an opposite presumption, is his domicile. (8) If a person of full age, having a right to change his domicile, takes up his abode in a new place, with the acknowledged intention of remaining permanently fixed there (*animo manendi*), that place immediately becomes, and that which he has quitted ceases to be, his domicile. Questions as to what amounts to intention, or what circumstances constitute sufficient proof of intention of remaining, or quitting a place of residence, are amongst the most difficult in the law of domicile. Most persons who are resident abroad have a sort of floating intention that, in certain conceivable circum-

stances, they will return to their native country, and to these vague feelings they give expression in a manner more or less vague.

One of the most important effects of the law of domicile, which formerly gave room for litigation, was as to the validity of the will which a deceased person leaves—the English rule being, that it must be according to the law of the domicile, wherever the will was made, though the law of Scotland allowed a will also to be good if it was executed according to the law of the country where it was made. A statute, however, was passed in 1861, by which the law was made uniform, so that the will of a British subject, as regards personal estate, made out of the United Kingdom, is now deemed valid, wherever his domicile may be, if the will is conformable to the law of the country where made, or to the law of the domicile of origin. And by a later statute passed in 1868, it has been provided that even as regards real or heritable estate, an English will is to have effect given to it as regards property situated in Scotland. In each case the presumed intention of the testator will determine by which law the will is to be construed. It is impossible here to enumerate the various other effects of the law of domicile. Generally, it may be stated that it regulates the succession to property. As regards personal or movable property, this is universally conceded. It is said to follow the person (*mobilia inhærent ossibus*). Accordingly, such property is everywhere distributed after death according to the law of the country of which the deceased died a domiciled citizen. In the case of heritable or real property, however, the same rule is not universally applied. By the legal systems of the Continent, domicile as a rule governs the succession, but in Great Britain and the United States, real property descends in accordance with the law of the land in which it is situated (*lex rei sitæ*). The transmission of a debtor's estate upon divestiture by bankruptcy stands in a similar position to that of succession by death—British and American laws making the same distinction as regards distribution between movable and heritable estate.

Besides domicile proper, of which we have just been treating, the term is sometimes applied in a special and restricted sense. Thus the expression 'Matrimonial Domicile' is occasionally used to express the character of residence supposed to be sufficient to constitute jurisdiction in questions of marriage and divorce. Although the courts have in one or two cases sustained their jurisdiction where the evidence of domicile was slender, it is doubtful how far these cases are authoritative, and the use of the term 'Matrimonial Domicile' has been rather discountenanced by recent authorities (see MARRIAGE). Another common expression is 'Domicile of Citation,' which simply signifies residence for forty days within the territory of a particular court. Such residence is sufficient to constitute jurisdiction for citation of a defender in all personal actions. Under the poor-law statutes, again, the term domicile is often used to describe the kind of residence required for the purposes of parish relief in Scotland (see POOR LAWS; SETTLEMENT; HUSBAND AND WIFE). But the rules for determining such residence have little bearing upon questions of domicile proper. See Dicey on *Domicile*; and notes to the French translation of Dicey by M. Stocquart.

Dominant, in Music, the fifth above the tonic: the ruling or governing tone of the key. See MUSIC.

Dominic, ST. See DOMINICANS.

Dominica (Fr. *Dominique*), the largest and most southerly British island in the Leeward group of the Lesser Antilles, lies in 15° 20′—15° 45′ N. lat., and 61° 13′—61° 30′ W. long., midway between the French islands of Martinique and Guadeloupe, and has an area of 291 sq. m. The population (in 1881, 28,211) is mostly negro, but includes 309 Caribs and 370 whites; in 1891 it was 26,841. The Caribs, who occupy a large reserve on the Windward side of the island, are gradually becoming so intermixed with the negroes that the pure Carib, the 'Franc Carib,' will soon be non-existent. They are very peaceable and retiring, and live on fish, and vegetables and fruits which they cultivate. Dominica is of volcanic origin, with many hot and sulphureous springs. In 1880 there was a great eruption of volcanic ash from the 'Boiling Lake' at the southern extremity of the island. The temperature is cool and even chilly in the mountains, but sultry on the coast, where the yearly mean is 89° F.; rain falls nearly every month, and the annual rainfall is 83 inches. Nearly one-half of the surface consists of wooded mountains and deep ravines, and at one point the surface attains an elevation of 6234 feet. Attractive as it is to the artist and traveller, the rugged, broken, and precipitous character of Dominica is very disadvantageous to the settler, and has confined agriculture to a narrow strip along the coast. The pathless forests of the interior are practically as much a *terra incognita* to-day as when Columbus first sighted the island. The principal product is sugar, but fruit, cocoa, and timber also are exported, and the fisheries are valuable. The annual value of imports and of exports has decreased, and is now, in either case, about £50,000. The capital of the island is Roseau, a port on the west coast, with a pop. of 4500. Dominica is a member of the Leeward Islands colony, and sends representatives to the general legislative council; but it has its own president, treasury, and local legislature. The majority of the inhabitants are Roman Catholics; religious equality now prevails, but till recently the clergymen of the Church of England were paid from the public funds. Dominica was discovered by Columbus, on his second voyage, on Sunday (whence its name Dominica—i.e. 'the Lord's Day'), 3d November 1493. It was a source of strife to French and English until 1648, when it was formally declared by the treaty of Aix-la-Chapelle a neutral island; but in 1759 it was captured by England, and in 1763 ceded by France, who, however, held it again in 1778–83, and in 1802–14, when it was finally restored to England. See Froude, *The English in the West Indies* (1888).

Dominical Letter, or SUNDAY LETTER, is one of the seven letters A, B, C, D, E, F, G, used in almanacs, &c., to mark the Sundays throughout the year. The first seven days of the year being marked in their order by the above letters in their order, then the following seven, and all consecutive sets of seven days to the end of the year, are similarly marked; so that the 1st, 8th, 15th, 22d, &c. days of the year are all marked by A; and the 2d, 9th, 16th, 23d, &c., by B; and so on. The days being thus marked, it is evident that on whatever day the first Sunday of the year falls, the letter which marks it will mark all the other Sundays in the year, as the number of the letters and of the days in the week is the same.

As the common year consists of fifty-two weeks and one day over, the dominical letters go backwards one day every common year. If the dominical letter of a common year be G, F will be the dominical letter for the next year. As a leap-year consists of fifty-two weeks and two days, the letters go backwards two days every leap-year. If in the beginning of a leap-year the dominical letter be G, E will be the dominical letter for the next year. This extraordinary retrocession, however, is made

to take place at the intercalary day (the 29th February) by the artifice of marking it by the same letter as the day preceding it, and thus the next Sunday is marked by the letter preceding that which marked the Sundays before the intercalary day. Suppose the 28th February in a leap-year to be a Sunday, and marked by F, it is evident that the dominical letter for the rest of the year will be E. As every fourth year is a leap-year, and the letters are seven in number, it is clear that the same order of letters must return in four times seven, or twenty-eight years, which would, but for the leap-years, recur in seven years, and hence the Solar Cycle (see PERIOD). The dominical letters were first introduced into the calendar by the early Christians, to displace the nundinal letters in the Roman calendar. They are of use as a means of discovering on what day of the week any day of the month falls in a given year (see EASTER). Rules and tables for finding them are given in prayer-books, breviaries, &c., as well as in works on dates. See CALENDAR, CHRONOLOGY.

Dominican Republic, or SANTO (commonly SAN) DOMINGO, a state formed of the eastern portion of Haiti (q.v.), and embracing 20,587 sq. m., or over two-thirds of the whole island. The pop. was officially estimated in 1888 at 610,000; most of these are negroes or mulattoes, but the whites are comparatively more numerous and influential than in the Haitian Republic. The state religion is Roman Catholic, others being tolerated; the prevailing dialect is Spanish. Civilisation has not reached a high level; primary instruction, however, is now gratuitous and obligatory, and of late years the country has made considerable progress under the impulse of American enterprise. Large sugar plantations and factories have been developed in the south and west; the culture of tobacco, coffee, and cocoa has been greatly increased; and the export of mahogany, dye-woods, and guano has been revived. Gold, silver, quicksilver, iron, and coal have been found; and a railway of 72 miles was reported open in December 1888. The imports in 1892 reached $1,951,400, the exports $2,944,600; the commerce is mainly with the United States, England, France, and Germany. The revenue for 1890 was $3,824,329, and the expenditure $3,837,300. The indebtedness in 1890 was $2,031,960. It was returned in 1888 at $3,165,626; and in August of that year a loan of £700,000, at 83½, was concluded in Amsterdam. The executive of the republic is vested in a president, chosen by universal suffrage for a term of four years, and the legislative power in a congress of twenty-two deputies, elected in the ratio of two for each of the provinces and maritime districts, which, however, are under their own governors. The capital is San Domingo (q.v.).—The early history of this portion of the island, which remained Spanish when the western part was ceded to France in 1697, and which was united with the neighbouring state in 1795–1808 and 1822–43, properly belongs to that of Haiti (q.v.). In 1843 it assumed a separate standing as the Dominican Republic, the anarchy and misrule of which it exchanged in 1861 for the despotism of its former masters. But the harsh Spanish rule brought on a revolt in 1863, and the republic, reconstituted in 1865, has since maintained a troubled existence, under a succession of governments generally placed in power by more or less exciting revolutions. See Kimball, *Life in San Domingo;* Keim, *San Domingo* (Phila. 1870); and Hazard, *Santo Domingo, Past and Present* (New York, 1873).

Dominicans, an order of preaching friars founded at Toulouse in 1215 by Dominic de Guzman. Dominic was born in 1170 at Calahorra in Old Castile, and studied at Palencia. Here he acquired a great name for piety and learning; so much so that in his twenty-fourth year his diocesan, the Bishop of Osma, made him a canon of his cathedral, and relied mainly on Dominic's aid in his design of reforming the whole chapter according to the rule of St Augustine. The young man led a life of rigorous asceticism, and devoted himself at the same time to missionary labours among Mohammedans and 'heretics.' In 1204 he accompanied his bishop on a political mission, and had to pass three times through the south of France. That part of the country was almost entirely peopled by Albigenses (q.v.), and the labours of papal legates and Cistercian abbots for their conversion had been all in vain. The turning-point of Dominic's life had come. He undertook the care of the work; he substituted poverty for the prelatic pomp, love for force. He travelled from place to place on foot, bearing St Paul's epistles in his hands and preaching everywhere. He continued his labours for ten years, gathered like-minded companions round him, whom he trained after his own heart, and for whom he founded the first house of his order at Toulouse. He also set up an asylum for women who had been heretics or were in danger from heretical influence, and this institution developed into an order of nuns. Unhappily, events occurred which have left a deep stain on the memory of the saint, and which have had an evil influence on the history of his order. Innocent III., incensed by the murder of his legate, Peter of Castelnau, called the barons of northern France, led by Simon of Montfort, to a crusade against the 'heretics.' Dominic in an evil hour became a consenting party to these cruelties, and lent himself to the degrading occupation of proving heresy against the poor victims of the crusade. In 1215 Dominic, now in high favour with ecclesiastical authority, went with Fulbo, Bishop of Toulouse, to the fourth Lateran Council. The council was averse to the foundation of new orders. Still Innocent III. promised approval, on condition that the new order adopted an old rule. Accordingly, Dominic chose the rule of St Augustine, borrowing some additional statutes from the Premonstratensians, and the required authorisation was given in the following year by Honorius III. A little later he became 'Master of the Sacred Palace,' an office which has continued hereditary in the order, as has happened also in the case of that association with the Inquisition which began with Dominic's stay at Toulouse. In 1220 the Dominicans, in imitation of their Franciscan brethren, adopted a poverty so rigid that not even the order as a corporation could hold houses or lands, and thus they forced themselves to become mendicants or beggars. Next year Dominic died. He had lived to see his order occupying sixty houses and divided into eight provinces. It had spread to England, where the first foundation was at Oxford, and where from their dress they were called Black Friars; to northern France, where their house of St James earned for them the name of Jacobins; to Italy, to Spain, to Austria. He was canonised in 1233 by his friend Gregory IX.; his festival falls on 4th August.

We have identified the Dominicans in general with the friars, and this is justified by ordinary language, but strictly speaking the friars are only the first order of St Dominic. They are bound by the usual solemn vows of poverty, chastity, and obedience; they are forbidden ever to eat flesh-meat; they rise in the middle of the night for prayer. They are subject to a general, elected, according to a recent enactment, for twelve years. Under him are the provincials, each of whom rules in a province; lastly, there are the priors of the

individual houses. All these officers are elected by popular vote and for a limited term. Their constitutions were put into shape by Raymond of Pennafort, third general; but even since then great changes have been made, among which the permission to hold immovable property, initiated by Martin V., and extended by Sixtus IV. to the whole order in 1477, is especially noteworthy. The function of the order is indicated by their name, 'the order of preachers.' They are therefore missionaries in foreign lands and missionaries at home, and everywhere they have made the rosary, that somewhat mechanical devotion which was employed by Dominic among the Albigenses, popular in the Catholic world. They are the order which has concerned itself specially with the guardianship of the faith. The scholastic theology is almost the creation of great Dominicans, such as Albertus Magnus and Aquinas, and among their illustrious preachers was the martyr, Savonarola. They have been the favourite inquisitors, and a Dominican always presided over the infamies of the Spanish Inquisition. But their influence is now a thing of the past, except for the power still exerted by their great writers of the middle ages. The Jesuits have displaced them as teachers and preachers; though the fame of the order was revived for a time by the genius, the eloquence, and noble character of Lacordaire, who restored it to France. At present the order is chiefly engaged in preaching missions and retreats. They have several houses in the United Kingdom—e.g. at London, Newcastle, Woodchester, &c. They wear a dress of white wool, with a black mantle and pointed hood.

The second order consists of nuns, bound by solemn vows, and engaged to strict inclosure, perpetual abstinence from flesh-meat, &c. They were, as we have seen, instituted by St Dominic.

The Tertiaries or third order are said to have arisen from the 'militia of Jesus Christ,' drawn together by St Dominic to assist in resisting and persecuting the Albigenses. In their present form they are an imitation of a similar institution among the Franciscans. They are either people in the world, free to marry, but following certain ascetical rules; or else are women living as nuns in community under simple vows. They are also known as the Brothers and Sisters of Penance. See the *Life of St Dominic, with Sketch of Dominican Order*, by Archbishop Alemany; Dr Jessopp, *The Coming of the Friars* (1888); and D'Anzas, *Études sur l'Ordre de St Dominique* (Poitiers, 3 vols. 1874–75).

Dominie. See DOMINUS.

Dominion. See CANADA.

Dominis, MARCO ANTONIO DE, an ecclesiastic whose career was both singular and chequered. He was born in 1566 in the Dalmatian island of Arbe, and was carefully educated by the Jesuits. From Bishop of Segni he had become Archbishop of Spalatro, when getting involved in the great quarrel between the papacy and the Republic of Venice, he found it expedient to resign his see. His reasons he gave in his *Consilium Profectionis* (1616). In 1616 he came to England, where he was hospitably received, and next year was by James I. appointed Dean of Windsor and Master of the Savoy. Here in 1617 he published the first part of his *De Republica Ecclesiastica*, a work in which he endeavoured to show that the pope had no supremacy over other bishops, but was only *primus inter pares*. In 1619 he published without authority Sarpi's famous *History of the Council of Trent*. His enemy Paul V. died in 1620, and was succeeded by Gregory XV., a relative and fellow-countryman of De Dominis, who moreover began to find himself unpopular from his avarice, his pretentiousness, and his corpulence, and from interest, much more than conscience, began to intrigue with Rome for a return to the bosom of the church. These negotiations had to be carefully kept secret from the king, but at length in the January of 1622 De Dominis wrote to James expressing his intention to leave England. The king was indignant, and when the negotiations of the ecclesiastics whom he sent to reason with him failed, De Dominis was commanded to leave the kingdom within twenty days. While waiting at Brussels for the pope's permission to go to Rome, he published his *Consilium Reditus*, in which he frankly gave the lie to every statement in his former tract, and denounced the Church of England as a wretched schism. His tract was replied to by Crakenthorpe in his *Defensio Ecclesiæ Anglicanæ*. De Dominis now went on to Rome, but was at once seized by the Inquisition, and flung into prison, where he soon died in 1624. Being subsequently condemned as a heretic, his body was exhumed and burned. While yet a professor of Mathematics at Padua, De Dominis wrote his *De Radiis Visus et Lucis in Vitris Perspectivis et Iride* (Venice, 1611). He was the first to point out that in the phenomenon of the rainbow the light undergoes in each rain-drop two refractions and an intermediate reflection.

Dominium, a Roman law term, which has been received into the technical language of most of the legal systems of Europe. It may be described as a full legal right in and to an object—as the right from which alone legal possession could flow, but which actual possession alone could never confer, unless such possession had endured for the period of legal prescription. The right to possess is thus distinguished from the right arising from possession, which is the usufruct.

Domino, the name formerly given to the hood or cape worn in winter by priests while officiating in cold edifices. It is now used to signify a masquerade costume, consisting of an ample cloak with wide sleeves and a hood. See MASQUERADE.

Dominoes, the name of a game, usually played with 28 oblong, flat pieces of ivory or bone, &c., called *cards*, each of which bears two numbers marked by points from blank to six. The player wins who has first played out his cards, or, if this has been found impossible, who has the fewest points on the tablets still remaining. Regular domino players recognise only the two-handed games—viz. the *draw* game, and its variation the *matador* game, for a description of which a manual of games should be consulted. The game is seemingly of Italian origin, and has spread into all countries of the world; but nowhere is it so popular as in the cafés of France and Belgium.

Dominus, the Latin word which we commonly render by 'lord,' but which more properly signifies the master of a house, and his eldest son, as opposed to slave (*servus*). The term is applied by Christians to God and to Jesus as himself God. The Scottish 'dominie,' in the sense of schoolmaster, is of course taken from it, as is the same term in America, where in some places it is the title of a minister of the Dutch Reformed Church, and in others is applied to Protestant clergymen generally. Don (q.v.) also is a derivative.

Domitianus, T. FLAVIUS, emperor of Rome from 81 to 96 A.D., was the son of Vespasian, and younger brother of Titus, whom he succeeded on the throne. The earlier years of his reign were on the whole advantageously occupied for the public benefit. Many good laws were passed, the provinces carefully governed, and justice rigidly administered. As he grew older, however, his ambition, his jealousy, and his pride, wounded by the failure of his campaigns against the Dacians and the Marcomanni, in 87, began to instigate him to

the most atrocious cruelties. By murder or banishment, he deprived Rome of nearly every citizen conspicuous for talent, learning, or wealth. It was his jealousy that recalled Agricola from his career of conquest in Britain, and most likely caused his death. The horror of the time is reflected in the pages of Tacitus and Juvenal. To win the army, he greatly increased the pay of the soldiers, and secured the favour of the people by prodigal largesses and gladiatorial shows and games, in which he sometimes took part in person. His cruelties became at length so intolerable, that a conspiracy—encouraged, if not organised—by his wife Domitia, whom he had doomed to death, was formed against him, and the tyrant fell under the dagger of the assassin, 18th September 96.

Domo d'Os'sola, a charming little town in the extreme north of Piedmont, at the foot of the Simplon, near the right bank of the Toce. It has a cathedral, and is a starting-point for tourists in the southern Alps. Pop. 2300.

Domremy-la-Pucelle, a village in the French department of Vosges, on the Meuse, 8 miles N. of Neufchâtean, interesting as the birthplace of Joan of Arc (q.v.), of whom there is a statue, and whose house contains relics. Pop. 288.

Don, a river of the West Riding of Yorkshire, rising in the Penistone moors on the borders of Derbyshire and Cheshire, and running 70 miles south-eastward and north-eastward past Sheffield, Rotherham, Doncaster, and Thorne, till it falls into the Ouse at Goole. It is navigable below Sheffield by the aid of artificial cuts and canals.

Don, a river of Aberdeenshire, rising close to the Banffshire boundary in a peat-moss 1980 feet above sea-level, and winding 82 miles eastward till it falls into the German Ocean, 1 mile NE. of Old Aberdeen, and not far below the 'Auld Brig o' Balgownie' (*circa* 1320), commemorated in Byron's *Don Juan*. Its chief affluent is the Ury. The Don is a capital salmon river.

Don (ancient *Tanais*), a river of Russia, having its source in a small lake in the government of Tula. It flows in a general southerly direction through the governments of Tula, Riazan, Tambov, Voronej, and the country of the Don Cossacks, and enters the Sea of Azov by several mouths, of which the Aksai is the most considerable. The Don has a length of 1125 miles, and drains an area of 165,500 sq. m.; its numerous affluents include the navigable Voronej, Donetz, Khoper, and Medvieditza, and the Vasovka, the Sosna, and the Manytch. The course of the main stream is obstructed by frequent sand-banks; and when the ice melts it overflows its banks for miles, so that in many places the village houses are raised on piles. The Don is navigable for large boats below Voronej, and in its upper course is connected by canal and railway with the Volga, by which means the produce and manufactures of the interior are conveyed to the southern provinces of Russia. A great canal from the Don to the Volga, at the point where the lower courses of the two rivers most closely converge, has recently been proposed. The waters of the Don abound in fish; but a monopoly of the fisheries has been enjoyed since 1637 by those dwelling on the river's banks.

Don, or Dom (Lat. *dominus*, 'lord'), a title originally assumed by the popes, from whom it descended to bishops and other dignitaries, and finally to monks. In France, the title *dom* was conferred on the Carlovingian kings; in Portugal and Brazil it is now the universal title of the higher classes. The Spanish *don* was originally confined to the nobility, but is now bestowed by courtesy as indiscriminately as the English *Mr* or *Esq.* The feminine is *doña* (Ital. *donna*). The *Dan* in 'Dan Chaucer' is a form of the same word, and we still speak of 'college dons.'

Donabyú, a town of British Burma, on the right bank of the Irawadi, 35 miles S. of Henzada, with 3273 inhabitants.

Dona Francisca, a German colony in the Brazilian state of Santa Catharina, lying between the Serra do Mar and the ocean, 14 miles inland from the port of São Francisco. Area, 97 sq. m.; pop. (1868) 5237; (1883) 18,000. Chief town, Joinville, with 2000 inhabitants.

Donaghadee, a seaport and bathing-place in the north of County Down, on the Irish Channel, 19 miles ENE. of Belfast, and 21½ miles across from Portpatrick in Scotland, with which it is connected by a submarine telegraph cable. It lies in a crescent round the harbour, and exports cattle and farm-produce. Its fine lighthouse shows a fixed light visible 12 miles; a conical mound near (140 feet high) commands a fine prospect. Pop. about 1500.

Donaldson, James (1751–1830), an Edinburgh newspaper proprietor and bookseller. His father, Alexander Donaldson, took a leading part in the issuing of cheap editions of works newly out of copyright, which led to a famous litigation, decided in his favour by the House of Lords in 1774. James Donaldson added largely to the wealth acquired by his father, and left about £240,000 to found a hospital or school for 300 poor children, many of whom from the beginning were taken from the class of the deaf and dumb. The hospital was built in 1842–51 from designs by Playfair, at a cost of about £120,000.

Donaldson, John William, D.D., philologist, was born in London, 7th June 1811. A merchant's son, of Scottish ancestry, he was articled as a boy to his uncle, a solicitor; but his success in an examination at University College, London (1830), changed his plans, and next year he went up to Trinity College, Cambridge. He graduated in 1834 as second classic and senior optime, and was elected a fellow and tutor of his college. From 1841 to 1855 he was head-master of Bury St Edmunds grammar-school (he almost emptied it); thereafter he tutored at Cambridge with great success, till his death, from overwork, in London, 10th February 1861. Donaldson's *New Cratylus, or Contributions towards a Knowledge of the Greek Language* (1839), is a work remarkable for research, erudition, and boldness, and as being the first attempt on a large scale to familiarise Englishmen with the principles of comparative philology, established by the great scholars of Germany. In *Varronianus* (1844) he undertook to accomplish for Latin what in the *New Cratylus* he had done for Greek. Unluckily, Professor Key had here in a measure forestalled him. *Jashar; Fragmenta Archetypa Carminum Hebraicorum* (Berlin, 1854) sought to distinguish by critical tests the fragments of the lost Book of Jashar (q.v.), imbedded in the Hebrew Pentateuch. It is a clever, too clever, piece of rash and ingenious speculation, which not only roused much 'odium theologicum,' but was severely handled by Ewald; nor did Donaldson better his position by his *Christian Orthodoxy reconciled with the Conclusion of Modern Biblical Learning* (1857). The *Theatre of the Greeks*, though originally by Buckham, was so recast by Donaldson as to be practically his; to him, too, belongs the completion of K. O. Müller's *History of Greek Literature;* and his Latin and Greek grammars claim mention. Crabb Robinson, in his Diary, gives a vivid conception of Dr Donaldson's kindliness, ready wit, and great conversational powers.—His youngest brother was the Australian

statesman, Sir Stuart Alexander Donaldson (1812–67).

Donatello (properly called DONATO DI BETTO BARDI), the greatest of the early Tuscan sculptors, was born at Florence in 1386, the son of a wool-merchant, and was apprenticed to a goldsmith, probably Bartolo, the stepfather of Ghiberti. He became the friend of Brunelleschi, ten years his senior, who directed and influenced his art. At the age of fifteen he visited Rome in his company, and for several years the pair supported themselves as goldsmiths, and so were enabled to study the remains of antiquity in sculpture and architecture. Among the works probably executed before he left Florence are the wooden crucifix in Santa Croce; the wooden statue of the Magdalene, in the Baptistery; and the marble St John at the Bargello; while among the earliest of his productions after his return are the marble figures of the prophets for the cathedral, and an Annunciation in the Cavalcanti Chapel in Santa Croce. A higher level was reached in the marble statues of Saints Peter, Mark, and George, on the exterior of San Michele (1408–16). These were followed by the tombs of Pope John XXIII. in the Baptistery (1426), of Cardinal Brancacci in St Angelo a Nilo in Naples (1427), and of Bartolomeo Aragazzi at Montepulciano (1427–29), works in which he was aided by Michelozzi. The influence of his study of the antique is very visible in his bronze statue of David, now in the Bargello Museum, Florence, where also are his celebrated marble bas-reliefs of singing and dancing children, originally designed as a balustrade for the organ of the cathedral; while the bronze statue of the Condottiere, Erasmo da Nari, called Gattamelata, at Padua, is a noble example of his equestrian portraiture. He died at Florence, 13th March 1466, and was buried in San Lorenzo, where his last works, two bronze pulpits, were completed by his pupil Bertoldo. The life of Donatello marks an epoch of art. He may be regarded as the founder of sculpture in its modern sense, as the first producer, since classic times, of statues, complete and independent in themselves, and not mere adjuncts of their architectural surroundings. He was also a perfect master of work in relief, admirable in the gradation of tone which he attained, and in his beautiful treatment of various planes. The distinction which marks his work was caught from the antique; but all that he did is stamped with his individuality, and vivified by his powerful grasp of character and expression. See Müntz, *Donatello* (Paris, 1885).

Donati, GIAMBATTISTA, astronomer, born at Pisa in 1826, was appointed in 1852 assistant at the observatory in Florence, of which he became director in 1864. Here he discovered, *inter alia*, the brilliant comet of 1858, which is known as Donati's comet (see COMET). He afterwards was instrumental in erecting the fine observatory at Arcetri, near Florence, and constructed a spectroscope of twenty-five prisms. He died 20th September 1873.

Donation. See GIFT.

Donation of Constantine. See CONSTANTINE.

Donatists, a sect of North Africa which took its rise in 311, on the election of Cæcilian as Bishop of Carthage. Already as an archdeacon he had become obnoxious to the admirers of the fanatical zealots for martyrdom in the Diocletian persecution. To be beforehand with these rigorists, who, under the influence of a rich and bigoted widow, named Lucilla, were anxious to prevent his succession to Mensurius as Bishop of Carthage, the moderate party elected Cæcilian without waiting for the arrival of the Numidian bishops, and he was hurriedly consecrated by Felix, Bishop of Aptunga. Secundus, Bishop of Tigisis, coming afterwards to Carthage with seventy other bishops, a synod of North Africa was held, which excommunicated Cæcilian for the illegality of his appointment, and for contumacy in refusing to appear before it. The *lector* Majorinus was elected in his place, and on his death in 313 was succeeded by Donatus (called the Great), from whom the sect derived its name, and who is to be distinguished from Donatus of Casæ Nigræ, another of its leaders. The schism quickly spread over all Northern Africa. A commission of five Gallic bishops under Melchiades, Bishop of Rome, being charged by the Emperor Constantine to investigate the matter in dispute, repelled the charge against Cæcilian, and the general synod at Arles, in 314, came to a similar finding. Völter has disproved the later Catholic charge that the Donatists were the first to appeal to the intervention of the civil government. The memorial which they now addressed to Constantine was simply in self-defence, the state, in the person of the emperor, having already pronounced a judgment in the controversy, and that under the influence of their ecclesiastical opponents. He has also shown that neither at Rome nor at Arles had the question of rebaptism of Catholic Christians by Donatists yet arisen; though at Arles the reproach of being a *traditor* was first brought against the consecrator of Cæcilian, and it was decided that ordination by a *traditor* was really valid, and that the African practice of rebaptising heretics should thenceforth cease.

The party of Cæcilian, acquiescing in these decisions, thus gave up the established practice of the provincial church of Africa, and from that time the schism became one of principle, for the Donatists now came forward as the champions of use and wont. Their belief that ordination by a *traditor* was invalid was but a consequence of part of those theories of the church and of the communication of grace which had been advocated by Cyprian (q.v.). A further development of the principle was the rebaptism by the Donatists of such Catholics as came over to them, and at this stage the schism was complete. Constantine having dismissed their appeal to him at Milan in 316, the Donatists then raised the further question—'What has the emperor to do with the church?' and the emperor's answer was the closing of their churches and the banishment of their bishops. After having tried every means to make them unite with the Catholics, Constantine from 321 pursued the policy of ignoring them; but a new and more rigorous persecution under Constans again roused the party to fanaticism. It was reinforced by roving bands of ascetics who called themselves 'Soldiers of Christ,' or '*Agonistici*,' and by the Catholics were called *Circumcelliones*, from their habit of wandering about among the houses of the peasants (*circum cellas*). To these joined themselves numbers of fugitive slaves and overtaxed peasants, and the Donatist movement took the form of an intermittent political insurrection, which was repeatedly quelled by imperial troops (from 345). There were now Donatist as well as Catholic bishops in nearly every city of the province. From about 400 Augustine made energetic efforts to persuade the Donatists to return to the Catholic communion. On their failure he justified a resort to violence by Christ's command in Luke, xiv. 23. A public disputation was held by imperial command at Carthage in 411, attended by 279 Donatist and 286 Catholic bishops. The former were led by Petilian and Primian, the latter by Augustine and Aurelius; and Marcellinus, the imperial commissary, awarded the victory to the Catholics. In 414 the Donatists were deprived

of civil rights, and in 415 attendance at their religious assemblies was forbidden on pain of death. Along with the Catholics, they were in the 5th century decimated by the Vandals, and in the 7th century annihilated by the Saracens.

See the works referred to under AUGUSTINE, and Neander's History, vol. ii.; also Optatus of Milevi, *De Schismate Donatistarum adversus Parmenianum* (written about end of 4th century; ed. by Dupin, Paris, 1700); Walch, *Historie der Ketzereien*, vol. iv. (1768); Ribbeck, *Donatus und Augustinus* (Elberfeld, 1858); and Völter, *Der Ursprung des Donatismus* (Freiburg, 1883).

Donative. See ADVOWSON.

Donatus, ÆLIUS, a well-known grammarian and commentator, who taught grammar and rhetoric at Rome about the middle of the 4th century, and was the instructor of St Jerome. He wrote treatises, *De Literis, Syllabis, Pedibus et Tonis, De Octo Partibus Orationis*, and *De Barbarismo, Solecismo*, &c., which are collected by Keil in vols. iv. and v. of the *Grammatici Latini* (1864–65). These writings form together a pretty complete course of Latin grammar, and in the middle ages formed the only text-book used in the schools, so that Donat came, in the west of Europe, to be synonymous with grammar, or with the elements of any science. *The Donat into Religion* is the title of a book by an English bishop, and there was an old French proverb, *Les diables estoient encore à leur Donat* ('The devils were yet in their grammar'). The Latin grammar of Donatus has formed the groundwork of the elementary treatises on that subject to the present day. Donatus was one of the first books on which the art of printing by means of letters cut on wooden blocks was tried, and copies of these are reckoned among the greatest of bibliographical curiosities. The author also wrote a commentary on Terence, of which we possess only a part extending to five comedies, to be found in many editions of Terence.—From him must be carefully distinguished a later grammarian, TIBERIUS CLAUDIUS DONATUS (about 400), from whom we have a very worthless life of Virgil, prefixed to many editions of that poet, and fragments of a commentary on the *Æneid*.

Donauwörth, an ancient town of Bavaria, situated at the confluence of the Wörnitz and the Danube, 25 miles NNW. of Augsburg by rail. It was formerly a free imperial city of considerable importance, but it has now sunk into an insignificant place of 4000 inhabitants. In 1606 the inhabitants, who had adopted the Reformed doctrines, attacked a Roman Catholic procession of the Host, for which in 1607 the town was placed under the ban of the empire, and severely punished in consequence. In the Thirty Years' War that followed it was twice stormed, by the Swedes and by the Bavarians. It is likewise associated with the name of Marlborough, who carried the intrenched camp of the French and Bavarians near here in 1704; and, on the 6th October 1805, the French, under Soult, obtained a victory here over the Austrians, under Mack.

Don Benito, a town of Spain, near the left bank of the Guadiana, 69 miles E. of Badajoz by rail, in a district rich in grain and fruit. Pop. about 15,000.

Don Carlos. See CARLOS.

Doncaster, a municipal borough in the West Riding of Yorkshire, and an important railway junction, on the right bank of the Don, and on the Great North Road, 33 miles S. of York, and 156 NNW. of London. The country around is flat, but beautiful. Fine old elms line the broad and level road from the town to the racecourse, about a mile to the south. Doncaster is well built, and the High Street is a mile long. The parish church of St George was rebuilt by Sir G. G. Scott, after destruction by fire, in 1853–58, at a cost of £43,128. Its noble tower is 170 feet high. Doncaster possesses an elegant market and guild-hall, a corn exchange, a wool-market, and a cattle-market. The foundation-stone of a new library and school of art was laid in 1888. The water-works, constructed in 1880, were opened at a cost of £180,000. The town has manufactures of iron, brass, sacking, linen, and agricultural machines. The locomotive and carriage works of the Great Northern Railway are at Doncaster. The agricultural trade is large, and there is a corn-market. Pop. (1851) 12,042; (1881) 21,130; (1891) 25,936. Doncaster was the ancient *Danum*, and lay on the Roman road from York to Lincoln. Roman coins, urns, and a votive altar have been found. It was the *Dona Castre* of the Saxons. The Saxon Northumbrian kings had a palace here. Doncaster was burned by lightning in 759, and frequently ravaged by the Danes. During the Civil War it was for some time the headquarters of the Earl of Manchester after the battle of Marston Moor. It has long been famous for its annual races, begun in 1703, and held a mile south-east of the town in the second week of September. Colonel St Leger, in 1776, founded stakes which have been yearly run for by the best horses in England. On an eminence 5 miles WSW. of Doncaster are the ruins of Conisborough Castle, the stronghold of Athelstan in Scott's *Ivanhoe*. A Norman-Saxon round tower, it is 37 feet in diameter and 86 feet high, with walls 15 feet thick, strengthened by square buttresses reaching the whole height. The door is arrived at by an external flight of 37 steps. See Tomlinson's *History of Doncaster* (1887).

Donders, FRANZ CORNELIUS (1818–1889), oculist and professor of physiology at Utrecht. See EYE.

Dondra Head. See CEYLON.

Donegal (*Dun-nan-G'al*, 'the fort of the stranger'), a seaport in the south of Donegal county, at the mouth of the Eske, on a shallow creek of Donegal Bay (a valuable fishing-ground, especially for herrings), 157 miles NW. of Dublin. It lies in a rich alluvial tract, surrounded on three sides by hills, behind which rise lofty picturesque mountains. Pop. (1851) 1580; (1881) 1416. Donegal exports corn and butter. A railway connects the town with Stranorlar, thence to the city and port of Londonderry. On the river is Donegal Castle, formerly belonging to the O'Donnels of Tyrconnel. The remains extant are those of the castle as rebuilt in 1601, on the former foundations, by Sir Basil Brooke. On the shore are the ruins of a Franciscan monastery, founded in 1474 by Hugh O'Donnel. Here was compiled the *Annals* of the Four Masters (q.v.). Near Donegal is a frequented sulphureo-chalybeate spa.

Donegal, a maritime county in Ulster province, washed by the Atlantic on the north and west. Its greatest length is 84 miles, its greatest breadth, 41; area, 1870 sq. m. The bold and rugged coast-line (166 miles long) is indented by many deep bays and loughs; and there are numerous islands and islets off the coast, many of them inhabited. The surface generally is mountainous, moory, and boggy, with many small lakes and rivers, associated with endless fairy tales and traditions; here is excellent fishing. The highest hill, Erigal, rises 2462 feet, and several other hills exceed 2000 feet. The largest stream is the Foyle, running 16 miles north-east into Lough Foyle. Lough Derg is the largest lake. There is enormous wealth in beautiful granites, prior to 1889 almost unworked; and at Mountcharles there is a freestone unsurpassed

by any other, of which the new Science and Art Buildings in Dublin are built. White marble occurs at Dunlewy. The climate in most parts is moist, raw, and boisterous from violent west and north-west winds. There are manufactures of woollens, worsted stockings, worked muslins, and kelp (now greatly depreciated), and extensive fisheries. Within recent years successful efforts have been made by philanthropists to revive and extend home industries. Trade is chiefly through Londonderry. Railway communication, though still much restricted, has of late developed encouragingly. Pop. (1851) 255,160; (1871) 218,334; (1881) 206,035; (1891) 185,211, over 76 per cent. of whom are Roman Catholics. Donegal sends four members to parliament. The towns are small, the chief being Lifford, the county town, Ballyshannon, Letterkenny, Rathmelton, Donegal, Glenties, Raphoe, Ballybofey and Stranorlar (twin towns), and Killybegs. Substantial farmers and artisans occupy the low fertile tracts, the home of the 'planted' race. The population of the mountain districts, said to be the remnant of the old Irish septs or clans, has been much diminished by emigration. Till 1612, when James I. planted Ulster with English and Scotch settlers, the south part of Donegal was called Tyrconnel, and belonged to the O'Donnels, who, from the 12th century, were inaugurated as Princes of Tyrconnel on Doune Rock, near Kilmacrenan. Donegal has many ruins and traces of forts, of religious houses and castles, and of the palace of the North Irish kings on a hill near Lough Swilly. Near Derry is the coronation-stone of the ancient Irish kings. Donegal contains many memorials of St Columba. Off Tory Isle, towards the entrance to Lough Swilly, which contains the remains of seven churches, two stone crosses, and a round tower, Warren, in 1798, captured a French fleet. Amongst the prisoners of war was Theobald Wolfe Tone, who had been involved in the recently suppressed rebellion. St Patrick's Purgatory, a famous place of pilgrimage, is on an isle in Lough Derg.

Dongarpur (*Dingarpur*), a town of Rajputana, Central India, 340 miles N. of Bombay. It is the capital of a protected state of the same name, with an area of 1000 sq. m., and a pop. (1881) of 153,381, nearly 44 per cent. Bhils.

Don'gola, New, called by its inhabitants Ordé, a town of Nubia, on the left bank of the Nile, above the third cataract, and about 750 miles S. of Cairo, with a citadel, and a population of about 10,000. Under Egyptian rule it became the capital of a province of the same name, embracing a district which had from early in the Christian era formed an independent kingdom; the population of the province was estimated at 250,000. In the operations against the Mahdi, in 1884–85, the town was employed by the British as a base; in March 1886 the British forces were withdrawn, and Dongola, with all Nubia, fell into the possession of the Sudanese. The disturbed state of the country greatly crippled its trade, which was formerly considerable, and principally dealt in slaves.—**Old Dongola** is a ruined town on the right bank of the Nile, 75 miles SSE. of New Dongola. It was the capital of the kingdom of Dongola, and was destroyed by the Mamelukes in 1820.

Donizetti, Gaetano, a famous Italian composer, was born at Bergamo, in Lombardy, 29th November 1797. He studied music first under Simon Mayr, the head of the then recently founded Conservatorio of Bergamo, and subsequently for three years at that of Bologna, where he had been preceded only a few years by Rossini. Though educated in the composition of the more scholarly church music, he at length determined to devote himself to the precarious career of a dramatic composer, and to carry this out, entered the military service of Austria. His first opera, *Enrico di Borgogna*, was produced in 1818 in Venice, with some success, and was followed by numerous others in rapid succession. *Zoräide di Granata*, brought out in 1822 at Rome, gained him freedom from military service. But the first work which carried his fame beyond his own country was *Anna Bolena*, produced at Milan in 1830, when Pasta and Rubini took leading parts. On his first visit to Paris, in 1835, his *Marino Faliero* met with little success, but immediately afterwards, *Lucia di Lammermoor*, which he wrote in six weeks, took the Neapolitan public by storm. In 1840 he returned to Paris, and produced, among others, *La Fille du Regiment*, at first with comparatively little effect, *Lucrezia Borgia*, and *La Favorita*, the last act of which is considered to be his masterpiece, and was written in from three to four hours. Leaving Paris, he visited Rome, Milan, and Vienna, returning to Paris in 1843, when were produced his comic opera *Don Pasquale*, and *Dom Sebastien*, whose gloomy theme almost precluded its success, and the anxious work upon which helped to bring on an attack of cerebral disease, from which he never completely recovered. His last opera, *Catarina Cornaro*, given at Naples in 1844, was a failure. Stricken by paralysis in that year, he fell into a condition of mental imbecility; and he returned to his native town in 1848, only to die (1st April). His music was at first modelled after that of Rossini, and subsequently of Bellini, and is only second to theirs in the flow of beautiful and expressive melody, which is his principal source of effect, the orchestra being treated as little more than a 'big guitar.' Some of his concerted pieces, however, are very skilfully constructed, and he often anticipates the strong passion of Verdi. He had pre-eminent skill in suiting the voices for which he wrote, and penetration as to their capabilities. His nervousness as to the success of his works compelled him always to absent himself from the first three representations. His operas are over sixty in number; of these comparatively few are known here, but their melodious character is likely for long to preserve to them their great popularity.

Donjon, or **Dungeon**, the principal tower or keep of a Castle (q.v.) or fortress. It was probably so called because, from its position, it dominated (Low Lat. *domnio*) or commanded the other parts of the fortress. From the circumstance that the lower or underground story of the donjon was used as a prison has come the modern meaning of the word.

Don Juan, a celebrated dramatic figure, the hero of a Spanish story, who stands as the southern realisation of the same subordination of the whole nature to self-gratification which under the colder northern skies has found expression in the conception of Faust. In Faust the development of the idea proceeds in the region of the intellectual as contrasted with the sensuous in Don Juan; and accordingly the former has found its highest expression in poetry, the latter in music. The ideal of the Don Juan legend is presented in the life of a profligate who gives himself up so entirely to the gratification of sense, especially to the most powerful of all the impulses, that of love, that he acknowledges no higher consideration; and partly in wanton daring, partly to allay all uneasy misgiving, he then challenges that Spirit in which he disbelieves to demonstrate to him its existence in the only way he holds valid—through the senses.

This ideal career is aptly enough localised in one of the most luxurious cities of the once world-monarchy of the Saracens—Seville, and the char-

acters wear the names of the ancient noble families of the place. The hero of the story, Don Juan, is described as a member of the celebrated family Tenorio, and is sometimes represented as living contemporary with Peter the Cruel, sometimes with Charles V. His chief aim is the seduction of the daughter of a governor of Seville, or of a nobleman of the family of the Ulloas. Being opposed by the father, he stabs him in a duel. He then forces his way into the family tomb of the murdered man, within the convent of San Francisco, causes a feast to be prepared there, and invites the statue which had been erected to his victim to be his guest. The stone guest appears at table as invited, compels Don Juan to follow him, and, the measure of his sins being full, delivers him over to hell. At a later period the legend came to be mixed up with the story of a similar profligate, Juan de Marana, who had in like manner sold himself to the devil, but was at last converted, and died as a penitent monk in the odour of sanctity.

The story is probably a very old one. It is said that a poem with the like moral, *El Ateista Fulminado*, by an unknown author, was familiar in the monasteries long ere, in the first half of the 17th century, the legend of Don Juan was put into form by the monk Gabriel Tellez (Tirso de Molina), in *El Burlador de Sevilla y Convivado de Piedra*. This drama was transplanted to the Italian stage, and soon found its way to Paris, where numerous versions of it, among others Molière's *Don Juan, ou le Festin de Pierre* (first acted 1665), made their appearance. The latter provoked virulent criticism, and its full text was not printed for many years. It was put on the English stage by Shadwell under the title of *The Libertine* (1676). In the end of the 17th century, a new Spanish version of Tellez's play was prepared by Antonio de Zamora, and brought out on the stage. It is this version that forms the groundwork of the later Italian versions and of Mozart's opera. It was first put into an operatic form by Vincenzo Righini (1777); the text of Mozart's *Don Giovanni* was written by Lorenza da Ponte (1787). Through this famous opera the story became popular all over Europe, and has since furnished a theme for numbers of poets, playwrights, and writers of romance. Alexander Dumas has a drama, *Don Juan de Marana;* Byron's *Don Juan* follows only the name, and to some extent the character, of the original; and Prosper Mérimée's novel *Les Ames du Purgatoire, ou les Deux Don Juan*, is founded upon it. See vol. iii. abt. 2 of Scheible's *Kloster* (1846).

Donkey, a word of doubtful etymology, confined to slang dictionaries until so late as 1821, but now in current use as a synonym for Ass (q.v.). A *donkey-engine* is a small engine used for some subsidiary purpose, as for raising weights on board steam-vessels.

Donne, JOHN, a striking figure among English poets, was born in London in 1573. His mother was daughter of John Heywood, the epigrammatist, himself related to Sir Thomas More; his father, who belonged to a good old Welsh family, was a prosperous London ironmonger, who died early in 1576, leaving a widow and six children. Young Donne was brought up a Catholic, as his mother and her family were resolute adherents of that faith. In 1584 he was admitted at Hart Hall, Oxford, and here began his life-long friendship with Sir Henry Wotton. There seems to be no evidence for Izaak Walton's statement that he migrated to Cambridge; certainly he took no degree, and appears to have spent some years in foreign travel, returning to be admitted at Lincoln's Inn in 1592. After a careful examination of the points at issue betwixt the Roman and Anglican churches, he ultimately joined the latter communion. In 1596 he accompanied the famous Cadiz expedition of Essex, and after his return was appointed secretary to the lord-keeper, Sir Thomas Egerton, who set the highest value upon his services. Here Donne made the acquaintance of many of the chief men of his day, and wrote, without printing it, great part of his poetry. His wit, his personal beauty, and the charm of his personality brought him the warmest friendships, and the passionate love withal of Anne, the young daughter of Sir George More, brother of the lord-keeper's wife. The pair were secretly married about the close of 1600, the bride being but sixteen years old. Sir George More was violently enraged, at once caused Donne and his confidants to be committed to prison, and persuaded the lord-keeper into dismissing him from his office. The young couple were, however, befriended by other of the wife's relatives, and ere long Donne found a footing at court, where the disputatious king listened to his opinion, but for years put off doing anything for him. His *Pseudo-Martyr* (1610) was written in compliance with a royal command to buttress the royal argument about the attitude of Catholics to the oath of allegiance. During this period also Donne wrote much verse. His *Divine Poems* he sent in 1607 to George Herbert's mother. The first poem that he printed was his famous elegy on Sir Robert Drury's daughter (1611), which procured him the friendship of a powerful patron, who carried Donne abroad with him for some months. It was at Paris that he saw pass twice before him the famous vision of his wife with a dead child in her arms, which was verified by a messenger twelve days later. His friend Morton, afterwards Bishop of Durham, had long urged Donne to take holy orders, and after his fresh disappointment at not obtaining any state employment through the help of Somerset, he devoted himself seriously to the study of theology, and was at length ordained early in 1615. The king at once appointed him a royal chaplain, and as many as fourteen country livings were offered him within a year. He accepted in 1616 the rectory of Keyston, in Huntingdonshire, as well as that of Sevenoaks, keeping the latter until his death. As reader also at Lincoln's Inn, he quickly took the front rank among the preachers of the time, 'weeping,' says Izaak Walton, 'sometimes for his auditory, sometimes with them; always preaching to himself like an angel from a cloud, but in none; carrying some, as St Paul was, to heaven in holy raptures, and enticing others by a sacred art and courtship to amend their lives: here picturing a vice so as to make it ugly to those that practised it; and a virtue so as to make it beloved, even by those that loved it not; and all this with a most particular grace and an unexpressible addition of comeliness.' In the August of 1617 the death of his much-loved wife, the mother of his seven living and five buried children, left him almost detached from the world, his soul 'elemented of nothing but sadness;' yet he continued to preach with saint-like fervour for ten years after his elevation to the deanery of St Paul's in 1621. He died 31st March 1631, and was buried in St Paul's, under a monument representing him wrapped in his shroud, which fortunately survived the great fire.

Ben Jonson told Drummond that he esteemed Donne 'the first poet in the world in some things,' but that he would perish 'for not being understood;' and Dryden's judgment was that he was 'the greatest wit though not the best poet of our nation.' His poems were assiduously handed about among his contemporaries, with whom his influence was supreme, but Ben Jonson's prophecy has come true, except of a few readers who have eyes

to discern poetry of rare quality, hidden like precious jewels in the midst of a dross of distressing obscurities of thought and imagery, elaborate ingenuity or rather fantasticality, and the most perversely far-fetched allusiveness, shallow philosophising, and laborious unrhythmical wit. His early amatory poems are lava-streams aglow with passion at white-heat, which cannot flow freely for the cinders that obstruct the current, although ever and anon revealing with startling unexpectedness the purity and intensity beneath. Peculiarly characteristic of Donne's poetry is that swift transition at will from the fleeting images of voluptuous pleasure to the abiding mystery of death, which sometimes recalls strangely the master-touch of the much greater Rossetti. Amid much that is hardly poetical at all, Donne's saving grace as a poet is, in Mr Saintebury's phrase, his 'fiery imagination shining in dark places, the magical illumination of obscure and shadowy thoughts with the lightning of fancy.'

Donne's poems were first collected by his son in 1633. Of these the best edition is that of Dr Grosart, in two volumes of his 'Fuller Worthies Library' (1872). Alford's edition of his works in six volumes (1839) is far from satisfactory. It includes most of the sermons, of which Dr Jessopp accounts for no less than 180, written and preached within sixteen years, but its pious editor thought fit to leave out many of the earlier poems—Donne's real claim to a permanent place in English letters—although indeed he could claim for countenance the fact, as Walton tells us, that the dean himself in later life 'wished they had been abortive, or so shortlived that his own eyes had witnessed their funerals.' For his life may be read the inimitable masterpiece of Izaak Walton (see especially H. K. Causton's edition), and the admirable article by Dr Augustus Jessopp, in vol. xv. (1888) of Leslie Stephen's *Dictionary of National Biography*.

Donnybrook, a former village and parish, now mostly embraced in the borough of Dublin, at one time celebrated for a fair notorious for fighting, which was granted by King John, and abolished in 1855.

Don Quixote. See CERVANTES.

Doo, GEORGE THOMAS, one of the best modern English line-engravers, was born in the parish of Christ Church, Surrey, January 6, 1800. From an early age he practised as an engraver in London, and in 1825 he proceeded to Paris, where he studied under Suisse. He has made himself best known by his famous plates of 'Knox Preaching,' after Wilkie; of Eastlake's 'Italian Pilgrims coming in Sight of Rome;' by his exquisitely finished heads of women and children, after Lawrence; and by his engravings from Raffaelle, Correggio, and others. His plate of the Calmady Children, titled 'Nature,' after Lawrence, produced in 1830, ranks as his masterpiece. In 1851 he was elected a Fellow of the Royal Society; in 1857 an Academician. He was appointed chairman of the Engravings Committee of the London International Exhibition of 1862. About 1853–55 he painted in oils, his works of this class being mainly portraits. In 1864 he completed, after eight years' work, a large engraving of the 'Raising of Lazarus,' by Sebastian del Piombo, his last important work. He died 13th November 1886.

Doom, the old name given to the last judgment, and to those representations of it in churches which have a religious rather than an artistic object. Many of the dooms are executed in distemper. In the reign of Edward VI. most of them were washed over, or otherwise obliterated, as superstitious.

Doom, or DUM PALM (*Hyphæne crinita*, *H. thebaïca*), is a palm allied to the fan-palm (Chamærops), but remarkable for the repeated fork-like branching of its stem. It is abundant in Upper Egypt and Central Africa, sometimes growing amidst the very sands of the desert. The spongy

Doom Palm (*Hyphæne crinita*).

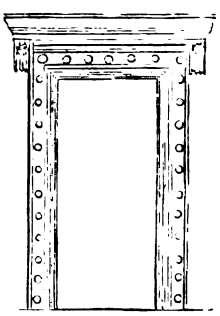
tissue of the pericarp is eatable, and resembles gingerbread in flavour.

Doomsday Book. See DOMESDAY BOOK.

Doomster. See DEEMSTER.

Doon, a famous river of Scotland, rising in the south-east of Ayrshire in Loch Enoch. It runs north-west through Loch Doon, a gloomy sheet of water, 6 miles long by ¾ of a mile wide, surrounded by bare treeless mountains, past Dalmellington, Burns's Monument, and Alloway Kirk, to join the Firth of Clyde 2 miles S. of Ayr. Its whole length is about 30 miles. On leaving Loch Doon, the river flows through the picturesque Glen Ness, a rocky and beautifully wooded ravine. On an islet in the loch are the ruins of a castle. Burns has made this one of the world's most classic streams: the 'banks and braes o' bonny Doon' will be sung when Alpheus and Eurotas are forgotten.

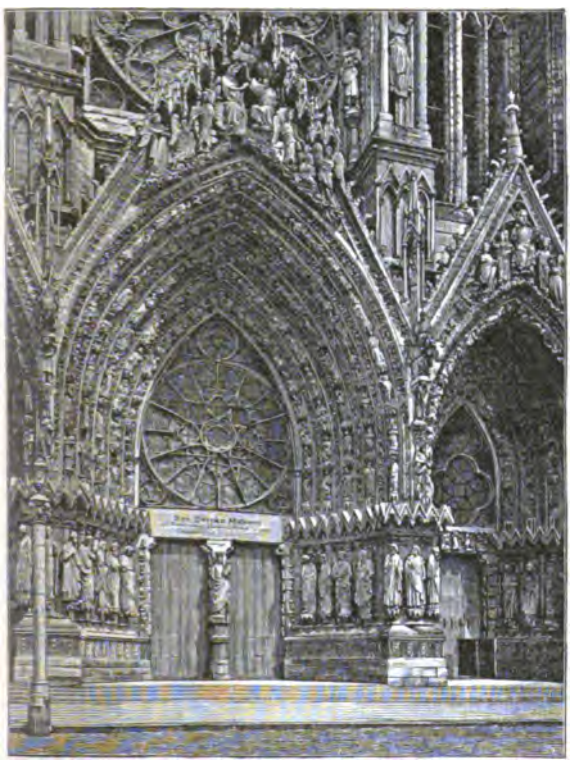
Door. The doorway has always been regarded in all countries as a most important feature of any structure, and is therefore generally made more or less ornamental. The doorways of the Egyptian and Assyrian temples and palaces were of great size and magnificence, and were adorned with colossal statues. Those of the Greek and Roman temples were likewise large, and in the Roman were often the only aperture for the admission of light. Classic doorways are invariably surrounded with mouldings, which form the architrave. In the doorways of the Pelasgians and Greeks the jambs generally incline inwards towards the top, and the lintel juts out at the ends—the mouldings being returned round it. Over the architrave there is frequently a frieze and cornice supported on trusses, which serve to give dignity and to protect the door from the weather. In the later Roman architecture, when the arch became an admitted element in the style, doorways were naturally treated with an arched head. The medieval styles derived from the Roman, such as the Byzantine, Romanesque, and Gothic, as well as the Saracenic, followed the same course,



Doorway of Erechtheum.

and the arched doorways were amongst their most characteristic features. In Romanesque architecture the doorway is always semicircular, and the arched head is enriched with mouldings springing from shafts in the jambs. The derivation of the mouldings, and ornamentation of the arch and of the caps of the pillars is, in the earlier examples, clearly traceable to their classic prototypes; but the Roman details gradually give place to Teutonic features. The arched head is frequently filled in with a flat stone, so as to reduce the height of the doorway to that of the caps and give it a square head, which is a more convenient form for the door. The flat stone or tympanum is usually ornamented with sculpture representing our Saviour, or some Scripture subject. When the doorway was wide it was generally divided into two openings with a central pilaster.

In the various Gothic styles the doorway is invariably a prominent object. This is especially the case in French architecture, in which the portals of the cathedrals and churches are of great



Portal, Rheims Cathedral.

size, and richly ornamented with large sculptured figures and bas-reliefs. One of the most notable of these is the majestic deeply-recessed triple portal of Rheims Cathedral. Those of the English edifices, although highly ornamented, are not on so great a scale. A favourite decoration of all periods is a series of niches filled with figures carried round the jambs and archway. In early Gothic the doorways are pointed and surmounted with a gable, in the later periods the pointed arch is often inclosed with square mouldings or labels, and in the Flamboyant and Tudor styles the four-centred arch and the ogee or reversed arch are commonly employed. Of course in all periods the mouldings and enrichments of the doorway are those of the time, and in late examples become very attenuated.

The doors themselves are generally of timber—the early ones having the frame covered on the outside with plain lining and ornamented with iron-work, the scrolls of which sometimes extended over the whole surface. In later examples the doors were usually panelled, and often partly covered with tracery—especially in perpendicular work. Doors of chambers were also sometimes beautifully carved with bas-reliefs in the panels. Doors were occasionally made of metal, the bronze gates of the Baptistery of Florence and Pisa Cathedral being well-known examples.

Doora. See DURRA.

Doornboom (*Acacia horrida*), a common tree in the wastes of South Africa. The name 'thorn-tree,' given to it by the Dutch colonists, and the botanical specific name, are due to the number and sharpness of its spines. It seldom much exceeds 30 feet in height, but its timber is hard and tough, and is much used for house-carpentry, &c. See ACACIA.

Doquet. See DOCKET.

Dor, or MONT DORE (often written less properly Mont d'Or), a chain of mountains in France comprised in the great group of the Auvergne (q.v.) Mountains in the department of Puy-de-Dôme. They are clearly of volcanic formation, and rise in the Puy-de-Sancy, which is the highest peak of Central France, to the height of 6190 feet.

Dor, a negro people of Central Africa, also called Bongo, between 6° and 8° N. lat., and bordering on the Dinka and Niam-Niam stocks.

Dor. See DUNG-BEETLE.

Dora, SISTER. See PATTISON.

Dora d'Istria. See GHIKA.

Dorak-el-Atek, a town of Persia, in the province of Khuzistan, situated in a marshy plain on the Jerrahi, 55 miles E. of Basra. Pop. 8000. It is the seat of the sheikh of Dorakistan or Kaban.

Doran, JOHN, Ph.D., a copious contributor to miscellaneous literature, descended from an old Irish family of Drogheda, was born in London on 11th March 1807. His thorough mastery of the French language led to his appointment as tutor in 1823 to George Murray, afterwards Duke of Athole, with whom he travelled on the Continent for five years; and he acted in this capacity to the sons of other noblemen (1828–37). In 1824 his melodrama *Justice, or the Venetian Jew*, was produced at the Surrey Theatre. A volume of his contributions to the periodical press—*Sketches and Reminiscences*—appeared in 1828. In 1835 he wrote a history of Reading. In 1854 he published *Habits and Men*, followed by *Table Traits, Queens of England of the House of Hanover* (1855), *Knights and their Days* (1856), *Monarchs retired from Business* (1857), *History of Court Fools* (1858), *New Pictures and Old Pane s* (1859), *The Princes of Wales* (1860), and a *Memoir of Queen Adelaide* (1861). In 1864 he produced *Their Majesties' Servants*, a history of the stage from Betterton to Kean (new ed. by Lowe, 1887); in 1868 *Saints and Sinners;* and in 1873 his most interesting work, an account of Mrs Montague and the 'blue-stockings' of her day, under the title of *A Lady of Last Century*. In 1876 he published

Mann and Manners, the letters of Sir Horace Mann to Horace Walpole; in 1877 *London in Jacobite Times*, and in 1878 *Memories of Our Great Towns*. His *In and About Drury Lane* (1885) was posthumous. Besides being a large contributor to miscellaneous literature, Dr Doran was repeatedly acting-editor of the *Athenæum*; edited the *Church and State Gazette* (1841–52); and at his death, 25th January 1878, was editor of *Notes and Queries*.

Dorat. See DAURAT.

Dorcas Society, the name given to an association of ladies who make or provide clothes for necessitous families. The name is taken from Acts, ix. 39: 'And all the widows stood by him weeping, and showing the coats and garments which Dorcas made while she was with them.'

Dorchester, a municipal borough, the county town of Dorsetshire, on the Frome, 8 miles N. of Weymouth, and 110 by rail (by road 119) WSW. of London. Till 1867 it returned two members to parliament, till 1885 one. It has a trade in ale and beer, a large agricultural market of cattle and cereals on Saturdays, and sends much butter to London. It is the headquarters of the 39th Regimental district, and has also barracks for a battery of Royal Horse Artillery. The free grammar-school founded in 1579 has been rebuilt and reorganised under a scheme approved by the Charity Commissioners. The county museum is rich in geological specimens found in the county, including the fore-paddle of a Pleiosaurus 6 feet 3 inches in length, discovered at Kimmeridge. The museum also contains a fine piece of Roman pavement (almost perfect) found on the site of the old Dorchester Castle, when the county prison was built in 1793. Pop. (1841) 3249; (1891) 7946. Dorchester was the Roman *Durnovaria* or *Durinum*, a walled town with a fosse, and a chief Roman British station. Part of the wall, 6 feet thick, still remains and is carefully preserved. Near Dorchester are the remains of the most perfect Roman amphitheatre in England, 218 by 163 feet, and 30 feet deep, the seats rising from the arena, cut in the chalk, and capable of holding 13,000 spectators. There is also a Roman camp with a ditch and high vallum. Near Dorchester is a large British station with three earthen ramparts, a mile and a half in circuit, and pierced by intricate passages, and inclosing barrows. The inner rampart is 60 feet high. It is supposed that this great camp, one of the largest in the kingdom, was the *Dunium* of Ptolemy and the origin of Dorchester. In March 1645 Cromwell held the town as his headquarters with 4000 men, and in 1685 Judge Jeffreys held his 'bloody assize' here, when 292 received sentence of death as being implicated in Monmouth's rebellion. In the porch of St Peter's Church the Rev. John White is buried. A leading Puritan, and known as 'the Patriarch of Dorchester,' he was the projector of the colony of Massachusetts, in New England, but did not join the expedition. He was a member of the Westminster Assembly and minister in Dorchester, with a short interruption from 1606 till his death in 1648. The original edition of Case's *Guide to Dorchester* was written by the Dorsetshire pastoral poet, William Barnes (q.v.), a bronze statue of whom was erected in 1889 in the centre of the town.

Dorchester, now an unimportant village of Oxfordshire, 9 miles SE. of Oxford, was the seat of the Mercian bishops from the 7th century till 1073, when the see was transferred to Lincoln. The Augustinian abbey church (mainly 13th century; recently restored) is lavishly ornamented, and has an interesting 'Jesse' window. Pop. of township, 813. See J. H. Parker's *History of Dorchester* (1882).

Dorchester, formerly a separate town of Massachusetts, 4 miles S. of Boston, was in 1869 annexed to that city. The fortification of Dorchester Heights by Washington, in March 1776, compelled the evacuation of Boston by the British.

Dordogne, a department in the south-west of France, formed of the ancient Guiennese district of Périgord, with small portions of Agenais, Limousin, and Angoumois. Area, 3530 sq. m. Pop. (1861) 501,687; (1891) 478,471. The department derives its name from the river Dordogne, which, after a course of 305 miles, 185 of them navigable, unites with the Garonne to form the large estuary of the Gironde. The climate is mild and healthy, except in the west. The soil is generally poor, the surface for the most part hilly, and covered with forests or, more frequently, heath and underwood; but here and there is a valley of extraordinary beauty and fertility, inclosed with hills, the sides of which are usually clothed with vineyards. The corn produced is not yet sufficient for the wants of the inhabitants, and chestnuts and potatoes are the chief items of food. Among the most noted productions are the truffles of Périgord. The iron industry is the most important in the department. Other manufactures are paper, woollens, and glassware, and there is an active trade in wine, brandy, oil, fruits, hams, and fattened cattle. Dordogne has five arrondissements—Bergerac, Nontron, Périgueux, Ribérac, and Sarlat. The capital is Périgueux.

Dordrecht. See DORT.

Doré, GUSTAVE, painter and illustrator of books, was born at Strasburg, 6th January 1833. In 1845 he came to Paris, at the age of fifteen began to exhibit landscape subjects in pen and ink in the Salon; in 1848 he became a contributor to the *Journal pour rire*, and he was afterwards on the staff of the *Journal pour tous*. He first made his mark by his illustrations to Rabelais (1854), and to *The Wandering Jew* and the *Contes Drolatiques* of Balzac (1856), which fully displayed his facility of execution and his fantastic power of invention. These were followed by innumerable illustrated editions of other well-known works; in 1861 by Dante's *Inferno*, in 1863 by the *Contes* of Perrault, in 1863 by *Don Quixote*, in 1868 by the *Purgatorio* and *Paradiso* of Dante, in 1865–66 by the Bible, in 1866 by *Paradise Lost*, in 1867–68 by Tennyson's *Idylls of the King*, in 1867 by La Fontaine's *Fables*, and many other series of designs, the latest of which became poor and feeble in character, the artist having exhausted himself by incessant over-production. Doré was also ambitious of ranking as an historical painter, and he executed much in colour. He himself said that between 1850 and 1870 he earned £280,000 by his pencil. Among the earliest of his pictures are 'The Battle of the Alma,' and 'The Battle of Inkermann,' shown in the Salons of 1855 and 1857. Two of his most successful oil-pictures are 'Paolo and Francesca da Rimini' (1863), and 'The Neophyte' (1868). His 'Tobit and the Angel' is in the Luxembourg Gallery. For many years there was a Doré gallery in London, filled with his works, which were more popular there than in France, among which the enormous canvases of 'Christ leaving the Prætorium' (1867–72) and 'Christ's Entry into Jerusalem' figured prominently. He is, however, seen at his best in his book-illustrations, for his colouring is unreal and wanting in delicacy and harmoniousness, and he had no technical mastery over the methods of oil-painting. He is most successful in subjects of a weirdly humorous or grotesque class; but he fails completely in the religious scenes which he so often set himself to depict. He displayed

some ability as a sculptor. He exhibited a colossal vase decorated with figures at the Exposition Universelle, Paris, 1878; and at the time of his death, 23d January 1883, he was engaged upon a monument to the elder Dumas. See his Life by Miss Roosevelt (Lond. 1886).

Doria, ANDREA, a Genoese of noble family, and admiral of the Emperor Charles V., was born of comparatively poor parents, in November 1466 or 1468, at Oneglia, where his ancestors had been princes for centuries. The Dorias had long held a foremost place in the republic; they had again and again led the fleets of Genoa to victory over Pisa and Venice. Andrea took to the profession of arms at the age of nineteen, when he entered the pope's guards, in which his uncle held a command. On the accession of Alexander VI. he took service with the Duke of Urbino (whose son he subsequently saved from the Borgia), and then with Alfonso of Naples, on whose departure Doria went to the Holy Land till the troubles should be over. On his return he joined the Prince of Sinigaglia in resisting the Spaniards, who were then triumphing over Italy. Doria dreaded the extinction of the Genoese state before the overmastering tide of imperial conquest, and devoted himself with all his energy to restoring the ancient naval renown of his countrymen. He returned to Genoa in 1503, his military exploits procuring him immediate employment; in 1513 he was appointed commander of the galleys of the republic, and soon his name was a terror to the Turkish corsairs, who were now beginning their ravages in the Mediterranean. In 1519, with six ships, he captured thirteen of their galleots off Pianosa; but his connection with Genoa was suddenly broken by a revolution, which in 1522 restored the faction of the Adorni, who favoured the imperial interest. Doria transferred his allegiance to Francis I., as much to save his country from Charles V. as to serve his personal ambition. The French fleet rode the seas supreme so long as Doria commanded, and Charles V. sustained several defeats. Doria blockaded Genoa, turned out the Adorni, and proclaimed the independence of the republic, where he was hailed as the liberator of his country. Once more he changed sides in 1529, and fearing the predominance of Francis, or thinking himself slighted, went over with his twenty private galleys to Charles V. The imperial fleet soon felt his influence, and now it was not France but the empire that held the seas. Genoa welcomed him as its father: he peacefully entered the city, and, refusing the title of sovereign, established a form of popular government, with a strong aristocratic element, which lasted to the end of the republic. The emperor gave him the order of the Golden Fleece and the princeship of Melfi. Doria's career now became one long duel with his great rival the corsair Khair-ed-din Barbarossa (q.v.). In 1531 the Genoese admiral descended upon the latter's stronghold at Shershel on the Barbary coast, but lost many of his men without holding the place. In 1532 he sailed with a great fleet to the Ionian waters, and took Coron and Patras from the Turks; one of his most brilliant feats was the revictualling of Coron in the teeth of the Turkish navy in the following spring. (See Jurien de la Gravière, *Doria et Barberousse.*) In 1535 he accompanied Charles V. to Tunis, where his galleys took a prominent part in the bombardment of the Goletta forts and the destruction of Barbarossa's fleet, but failed to capture the corsair himself. Barbarossa now commanded, as Kapudan Pasha, the navy of Turkey; collecting a fleet of 150 sail, he ravaged the islands about Greece, which chiefly belonged to Venice; and in 1538, meeting the combined fleets of the emperor, the pope, and the Venetians, off Prevesa, he offered battle. Doria's conduct in manœuvring out of range, not without the loss of his heavier sailing-vessels, was severely criticised, and Barbarossa came off decisively with the honours of war. Thenceforward, for a quarter of a century, the Turks were masters of the Mediterranean, and the power of Venice was crippled. Doria's expedition to Algiers with Charles V. in 1541 was a disastrous failure, and in 1560 he suffered a terrible reverse at Jerba, near Tunis, at the hands of one of Barbarossa's pupils, the renegade Ochiali (Uluj Ali). On the whole, Doria was outmatched by the corsairs. His later years had been disturbed by the conspiracy of Fieschi, and stained by the savage revenge he took upon those who were associated with the murder of his favourite nephew Gianettino. Prince Andrea Doria died at Genoa without issue, 25th November 1560, in his ninety-third or ninety-fifth year. He was the idol of his people, and the honoured counsellor of Charles V. and his son Philip, a born adventurer, personally very valorous, a man of great heart, a great admiral, but a greater soldier. See Richer, *Vie d'Andrea Doria;* Sandoræ; Capelloni; Brantôme; Celesia, *Conspiracy of Fieschi.*

Dorians, one of the great Hellenic races who took their name from the mythical Dorus, the son of Hellen, who settled in Doris; but Herodotus says that in the time of King Deucalion they inhabited the district Phthiotis; and in the time of Dorus, the son of Hellen, the country called Histiæotis, at the foot of Ossa and Olympus. But the statement of Apollodorus is more probable, according to which they would appear to have occupied the whole country along the northern shore of the Corinthian Gulf. Indeed, Doris Proper was far too small and insignificant a district to furnish a sufficient number of men for a victorious invasion of the Peloponnesus. In this remarkable achievement they were conjoined with the Heracleidæ, and ruled in Sparta. Doric colonies were then founded in Italy, Sicily, and Asia Minor. Strikingly as all the four nations of Greece differed from each other in language, manners, and form of government, the Dorians in particular differed from the Ionians. They preserved a certain primitive solidity and earnestness, in contrast with the effeminacy and grace of the latter.—The *Doric dialect* bore the same character; it was archaic, deliberate, emphatic, broad, and rough, while the Ionian was soft and polished; yet the former had a venerable character from its antiquity, and was employed in hymns and in the choruses of dramas themselves written in Attic. It is easy, therefore, to understand how the Scottish dialect has come, in contrast to literary English, to be called Doric. Barnes called the Dorset dialect 'the bold and broad Doric of England.' In philosophy, the influence of the Doric character was particularly visible in the Pythagorean school and its attachment to the idea of an aristocracy. It is no less traceable in architecture in the strong unadorned Doric pillars, which form so marked a contrast to the slender and decorated Ionian columns. For the Dorian mode, see SCALE.

Doric Order. The oldest and simplest of the three orders of Greek architecture. See COLUMN, GREEK ARCHITECTURE.

Doris, a small mountainous district of ancient Hellas, between Phocis, Ætolia, Locris, and Thessalia, was the home of the Dorians (q.v.). It is now a part of the modern government of Phocis.—Doris was also the name of a district in Asia Minor on the coasts of Caria, inhabited by colonists from the Peloponnesus.

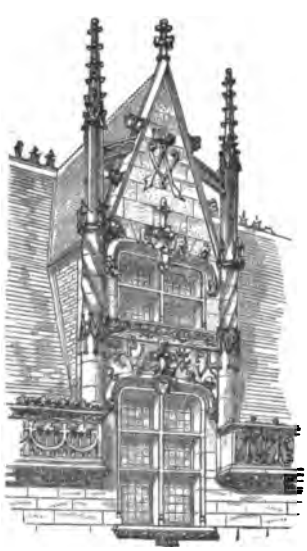
Doris, a genus of gasteropod molluscs in the sub-order Nudibranchiata, the type of a family called Doridæ, and sometimes popularly Sea-

lemons. The body has an elongated oval form, a flat ventral and more or less arched dorsal surface, a whitish, yellowish, or brownish colour, and usually a warty skin. Two retractile club-shaped tentacles on the back of the head, and feathery respiratory processes, sometimes retractile, round the anus, are also marked characteristics. There is no distinct mantle or adult-shell, but the skin of the back is slightly broadened out over head and 'foot,' and limy particles occur in the skin. The radula is broad, and many-toothed. Numerous species occur in British and other seas, but more abundantly in the southern hemisphere. Some of them attain a considerable size. Few of them inhabit deep water. They crawl on rocks, seaweeds, &c., where they are often left by the tide; or swim in a reversed position, the foot, made concave by muscular action, serving to buoy them up. Some of them are pretty and interesting inmates of the aquarium.

Doris: *a*, gills.

Dorislaus, ISAAC, born in 1595 at Alkmaar, in Holland, came about 1627 to England, where for some time he held a history lectureship at Cambridge, and afterwards was appointed judge-advocate. He sided with the parliament, helped to bring Charles I. to his doom, and in the spring of 1649 was sent back to his native land to bring about an alliance between the republic and England. He had just reached the Hague, when on 12th May he was assassinated by a Scottish colonel and eleven more royalist conspirators. His body was brought to England, and buried in Westminster Abbey, whence in 1661 it was transferred to St Margaret's Churchyard.

Dorking, a pleasant old-fashioned market-town of Surrey, stands in a picturesque valley near the base of Box Hill (590 feet), 24 miles SSW. of London. Its new church, with a spire 210 feet high, is a memorial to Bishop Wilberforce, who met his death riding over the Downs near Dorking (1873). Deepdene, the lovely seat of 'Anastasius' Hope, where Beaconsfield wrote *Coningsby*, is close to the town. The battle of Dorking, vividly described by General Chesney in 1871, is happily still unfought. Pop. (1851) 3490; (1891) 7132. There is a *History of Dorking* by J. S. Bright (1885).—For Dorking Fowls, see POULTRY.


Dormer Window.
(From the Château de Josselin, Brittany, end of the 15th century.)

Dormant (Fr., 'sleeping'). See COUCHANT.

Dormant Vitality. See DESICCATION, HIBERNATION, LATENT LIFE, MUDFISH, ROTATORIA, SUSPENDED ANIMATION, TRANCE.

Dormer, or DORMER WINDOW, is a window placed in a small gable rising out of a sloping roof, often made use of for the purpose of enlarging and lighting the attic or garret-rooms of modern houses. It is also popularly known as a storm-window. *Dormers* do not appear to have been in use before the middle of the 14th century. After that date they were greatly employed, especially in the later domestic Gothic edifices. Those of the Hôtel de Ville at Rouen are amongst the most splendid examples.

Dormitory (Fr. *dormitoire*, from Lat. *dormire*, 'to sleep'), a sleeping apartment in a monastery, or other similar establishment. Dormitories are usually of considerable size, sometimes having a range of cells or 'cubicles' partitioned off on each side. In schools, the dormitories are bedrooms.

Dormouse (Lat. *dormire*, 'to sleep'), a common name applicable to any member of the rodent family Myoxidæ, but especially used with reference to various species of Myoxus and Muscardinus. The dormice may be described as arboreal rodents, squirrel-like in form and habit, but are classified in the mouse-like or Myomorph section of the order Rodentia. They have long hairy tails, short fore-limbs, tolerably large eyes, and large, almost naked ears. The head is narrow, the upper lip cleft, the body compressed, the thumb rudimentary, the molars with more or less marked transverse enamel folds. They live among trees and bushes, are principally twilight animals, and as their name (sleeping-mice) implies, hibernate. In their distribution they are confined to the Old World, in its palæarctic and Ethiopian regions. The family includes four genera—Myoxus, Muscardinus, Eliomys, and Graphiurus. Remains of dormice are found in Miocene strata.

The Common Dormouse (*Muscardinus avellanarius*) is a pretty little animal, about three inches in length, not including the bushy tail, which is almost as long as the body. The general colour is a beautiful tawny yellow, but there is white on throat and breast. It is widely distributed from Britain and Scandinavia to Tuscany and Turkey, and is especially fond of hazel-copses. It feeds on nuts, seeds, berries, buds, &c., grows very fat in autumn, sleeps intermittently through the winter in a round grassy nest a little above the ground. It breeds in spring, but, in some cases at least, also in autumn. It is the only British dormouse.—The Loir or Fat Dormouse (*Myoxus glis*)

Dormouse (*Muscardinus avellanarius*).

is about twice the size of the common dormouse, and has the hairs of the tail in two rows, as in squirrels. It is ashen-gray, sometimes brownish above and white below. In its distribution the loir is restricted to the south. The favourite haunts are in oak and beech woods. It is very fond of fruit, and is said even to become carnivorous. The Roman epicures esteemed its flesh, and fattened it in their *gliraria*. It is still cooked by the Italians.

—The Garden Dormouse (*Eliomys nitela*) is a destructive thief, smaller and more active than the last, common in Central and Western Europe. It is justly persecuted for the damage it does in orchards, where it is said to destroy much more than it eats.—In the genus Graphiurus the tail is shorter and ends in a brush-like tuft of hairs. The molar teeth are very small, and the cross enamel folds are hardly developed. See RODENTIA.

Dornbirn, a town in the Austrian district of Vorarlberg, on a small affluent of the Lake of Constance, 7 miles S. of Bregenz by rail, with important cotton-factories, and large iron and brass foundries, brick and lime kilns, and sawmills. Pop. (1880) of the four villages which form the town, 9307; (1890) 10,678.

Dorner, ISAAK AUGUST, a great Protestant theologian, born 20th June 1809, near Tuttlingen, in Würtemberg, studied theology and philosophy at Tübingen, next travelled in England and Holland, and had already filled chairs at Tübingen, Kiel, Königsberg, Bonn, and Göttingen, when in 1861 he was called to be professor at Berlin. Here he died, 8th July 1884. Dorner for many years took an active share in the administration of the church, but was saved from ever becoming a partisan by a singularly fair and well-balanced mind, and by his strong grasp of a real historical spirit, which he has done much to impress on modern German theology. His greatest work is the *History of the Development of the Doctrine of the Person of Christ* (Eng. trans. 5 vols. 1861–63). Besides this, his *History of Protestant Theology* (1867), his *System of Christian Doctrine* (1880–81), and his *Christian Ethics* (1885), through their English translations, have become handbooks in England and America.

Dornick, a species of figured linen, named from Tournay or Doornik in Flanders. The 'mystery,' introduced into England, was long confined by law to inhabitants of Norwich and Pulham.

Dornoch, the county town of Sutherland, 7 miles SSE. of the Mound station, and 40 NNE. of Inverness, stands near the entrance to Dornoch Firth, which, running 22 miles inland, separates Sutherland from Ross-shire. It has splendid golf-links, a tower of the old bishop's palace, handsome county buildings, and the former cathedral of the see of Caithness (1245), which, burned in 1570, was rebuilt for the parish church in 1837, and contains a statue by Chantrey of the first Duke of Sutherland. The last witch burned in Scotland suffered at Dornoch in 1722. It was made a royal burgh in 1628, and with Wick and four other towns returns one member to parliament. Pop. (1861) 647; (1881) 497; (1891) 514.

Dorogoi (*Dorohoi*), a town of Roumania, in the extreme north of Moldavia, on the Shishja, 70 miles NW. of Jassy. Pop. 14,000, nearly half Jews.

Dorp, a former town of Rhenish Prussia, on the Wupper, 15 miles ESE. of Düsseldorf, was united with Solingen in 1889. Here are manufactures of paper, and of iron and steel wares.

Dorpat, or DERPT (Old Russian *Jurieff*, Esthonian *Tartolin*), a town of Russia, in Livonia, on the Embach, here crossed by a fine granite bridge, 165 miles (247 by rail) SW. of St Petersburg. It consists of a town proper, with two suburbs. The Domberg Hill, on the right bank of the river, was during the middle ages occupied by the citadel, cathedral, and bishop's palace, on whose site now rise an observatory, the university library, schools of anatomy, &c., with tasteful gardens and promenades; and close by are the other university buildings and the town-house. The university, founded in 1632 by Gustavus Adolphus, was re-established by Alexander I. in 1802, and since May 1887 has been thoroughly Russianised, the final reorganisation of the law faculty taking effect in 1889. It has five faculties, above 70 professors and lecturers, and about 2000 students. There is a notable botanical garden. Dorpat was a Hanse town in the 14th and 15th centuries, and was alternately captured by Swedes, Poles, and Russians until 1704, since when it has remained in Russia's possession. Thrice was a great part of the town levelled to the ground; on the last occasion, in 1708, it was practically destroyed. But both from these calamities and from the great fires of 1763 and 1775 it has recovered, and it is now, after Riga, the handsomest and best-built town in the province. It possesses large printing establishments, breweries, manufactories of cigars, tiles, and pianofortes, and has a considerable trade in wood, corn, and flax. Dorpat has long been a centre and hearth of Germanism in the Baltic provinces, in spite of official measures of Russification. Pop. 40,884, mostly German.

D'Orsay, ALFRED GUILLAUME GABRIEL, COUNT, the last of the 'dandies,' was born in Paris, 4th September 1801. The son of General D'Orsay, a distinguished French soldier, he early entered the service of Louis XVIII. as a lieutenant in the Garde du Corps. It was while his regiment was stationed at Valence on the Rhône in 1822 that he made the acquaintance of Lady Blessington (q.v.), who was travelling on the Continent with her husband. An intimacy soon sprang up between the brilliant countess and the still more brilliant Frenchman, and D'Orsay resigned his commission, and attached himself to the Blessingtons, with whom he travelled in Italy and elsewhere, until 1827, when as if to 'regularise' his irregular position in the family, he was married to Lady Harriet Gardiner, Lord Blessington's fifteen-year-old daughter by a former wife—a marriage which, as may be supposed, turned out unhappily. In 1829 Lord Blessington died, and D'Orsay separated formally from his wife, and took up his residence at Lady Blessington's, in Mayfair first, and then at Kensington, where for twenty years they defied the conventions in the midst of a society of authors, artists, and men of fashion. D'Orsay was not only one of the handsomest men of his time, well bred, well dressed, the mirror of fashion and the mould of form; but he was an accomplished painter and sculptor, an author of no mean power, an excellent talker, and a genial companion. An intimate friend and constant supporter of Louis Napoleon, he naturally looked for a position when the exile became prince-president and the host a bankrupt; but the office for which he was so admirably fitted, that of Director of Fine Arts in Paris, was conferred upon him only a few days before his death on 4th August 1852.

Dorse, a small variety of Cod (q.v.).

Dorset, EARL OF. See SACKVILLE.

Dorsetshire, or DORSET, a maritime county in the south of England, on the English Channel, between Hampshire on the E. and Devonshire on the W. Its greatest length is 58 miles; greatest breadth, 40; average, 21; and area, 998 sq. m., or 627,265 acres, of which a third is arable, a ninth waste, and the rest pasture. The coast-line is 75 miles long, with fine cliffs and headlands. St Alban's Head (354 feet high) and Golden Cap (619 feet high) are among the highest coast points between Dover and the Land's End. Off Swanage was fought the first naval battle in English history, that of Alfred the Great against the Danes in 876, when 120 of the Danish fleet were driven on the rocks and destroyed. About midway in the coast-line is Portland, an island, so called, but connected

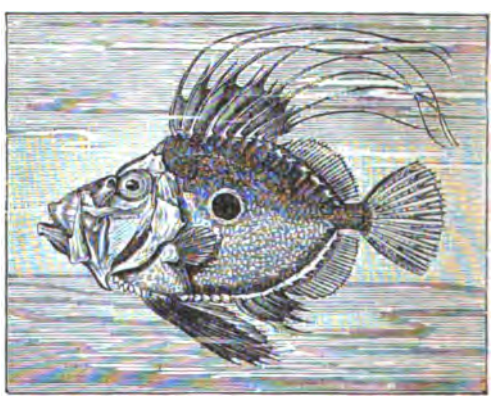
with the mainland by a remarkable formation known as Chesil Bank (q.v.), which, extending 10 miles towards Abbotsbury, incloses a narrow tidal inlet, called the Fleet, with decoy ponds, and a fine swannery of about 1000 swans at Abbotsbury. There is a dangerous sea called 'The Race,' about a mile to the south of Portland, formed by the meeting of the tides. There are two lighthouses at the end of Portland, also one of more recent erection at Anvil Point near Swanage. Portland (q.v.) contains a large convict establishment, a fine breakwater, harbour of refuge, coaling station for ships of war, and extensive fortifications. Chalk downs run along the south coast, and through the middle of the county nearly from east to west. The highest point is Pillesden Pen (934 feet). The chief rivers are the Stour and the Frome. Geologically, Dorsetshire consists of strata of plastic clay, chalk, oolite, lias, with some weald and greensand. Remains of colossal reptiles have been found at Lyme Regis and near Swanage. The chief mineral productions are the celebrated Purbeck and Portland building-stones, and white china and pipe clays. At Swanage is found the celebrated Purbeck marble, seen in many English cathedrals. The climate is mild. The chalk hills or downs are covered with short fine pasture, on which countless numbers of Southdown sheep are fed. The soil is chiefly sand, gravel, clay, and chalk. Dorsetshire is mainly a pastoral county, producing sheep, cattle, cheese, and butter; but some wheat, barley, hemp, linseed, hops, &c. are raised. Sainfoin is grown on the chalk hills. There are small manufactures of linen, silk, woollens, flax, hemp, buttons, stockings, and ale and cider. Pop. (1801) 114,452; (1841) 175,054; (1881) 190,979; (1891) 194,487. Since 1885 the county sends four members to parliament; the towns of Dorchester, Bridport, Poole, Weymouth and Melcombe Regis, Shaftesbury, and Wareham, formerly sending up ten members, ceased to be separate constituencies in that year. The London and South-Western, Great Western, and Midland Railways run through Dorsetshire. Dorsetshire has ancient British and Roman remains, as stone circles, cromlechs, barrows, camps, an amphitheatre, and three Roman stations; and a chambered long barrow, known as Gray Mare and Colts, near Gorwell, was included in the Protection of the Ancient Monuments Act (1888). There are some remains of 40 abbacies, priories, hospitals, &c. The ruins of Corfe Castle (q.v.), a seat of the Saxon kings of Wessex, are among the grandest in England. The scenery of Dorsetshire has been rendered familiar to many outside the county by the works of Barnes and Hardy. For the speech of the people, see DIALECT; and see Hutchins' *History of the County of Dorset* (2 vols. 1774; 3d ed. 4 vols. 1861–73), and Worth's *Dorsetshire* (1882), with other books cited in C. H. Mayo's *Bibliotheca Dorsetiensis* (1885).

Dorstenia. See CONTRAYERVA.

Dort, or DORDRECHT, a town of the Netherlands, in the province of South Holland, is situated on an island formed by the Maas, 10 miles SE. of Rotterdam by rail. An inundation in 1421, in which upwards of 70 villages were destroyed and 100,000 people drowned, separated the site upon which Dort stands from the mainland. It is one of the oldest, as in the middle ages it was the richest of the trading towns of Holland; and its trade is still considerable. Among its chief buildings are a Gothic cathedral (1363) and a handsome town-hall (1339). The town is traversed by canals, and the largest East-Indiamen, and gigantic wood-rafts which come down the Rhine from the Black Forest and Switzerland, are accommodated in its roomy harbour. Close by are a large number of shipyards, corn and saw mills, and manufactories of oil, sugar, ironwares, and machinery. Pop. (1874) 25,577; (1892) 34,125. Dort was founded in 1013. Here in 1572, the States of Holland, after the revolt from Spain, held their first assembly; and sat from 13th November 1618 to 19th May 1619, the conclave of Protestant divines known as the Synod of Dort, which condemned the doctrines of Arminius as heretical, and affirmed those of Calvin (see ARMINIUS). The house in which the synod sat has been demolished. Dort is the birthplace of the brothers De Witt, of Cuyp, and Ary Scheffer; to the last a statue was erected in the market-place in 1862.

Dortmund, the most important town of Westphalia, lies in the fertile Hellweg plain, near the Emscher, 74 miles NNE. of Cologne by rail. In 1846 its inhabitants numbered only 8732, and it owes its subsequent increase to the development of the Westphalian coal-mines. It is the headquarters of the mining authorities of Westphalia, and an important railway centre; and it has numerous iron and steel works, and manufactures of mining material, nail-making and other machines, safes, thread, bricks, timber, and flour. In the town there are also more than 30 breweries, most of the beer being exported. The history of Dortmund goes back into the earliest middle-age traditions, figuring from the 8th century under the names of *Therotmanni*, *Theromanni*, *Trutmanni*, and *Dorpmunde*. Subsequently it became a free Hanse town, but was ceded to Prussia in 1815 at the Congress of Vienna. It still possesses several old churches, and an aged linden marks the site of the famous free court of the Vehmgericht (q.v.); but since the walls were removed in 1863, the general aspect of the town has become quite modern. Pop. (1885) 78,435; (1890) 89,663.

Dory (*Zeus*), a genus of bony fishes in the mackerel family (Scombridæ). The body is high and laterally compressed; the scales are very small or absent; the dorsal fin bears nine or ten spines; and there are bony plates at the root of the dorsal and anal fins, and on the ventral surface. The best known of the six species is the John Dory (*Z. faber*), found in the Mediterranean and off the



John Dory (*Zeus faber*).

Atlantic coasts of Europe. The name is possibly a corruption of *jaune dorée* (yellow-gilt), which well describes the prevalent yellowish colour and metallic sheen. According, however, to Skeat, the 'John' is merely the ordinary English name (cf. '*jack*-snipe'). The colour is sometimes olive-brown, and there are two dark patches on the sides, which are (as in the haddock) fancifully interpreted as the marks of the apostle Peter's

fingers. Others have referred the marks to St Christopher. The John Dory disputes with the Chimæra the title of 'king of the herrings.' It follows rather than leads shoals of herring and other fishes. The body is greatly compressed, and the numerous bony plates bear spines; the head is very large, and the gape wide; the teeth are feeble; the membrane between the long spines of the dorsal fin is prolonged into beautiful waving filaments. The dory is on the whole sluggish, but feeds voraciously on pilchards, breams, and other fishes, &c. It has been known to attain a length of 22 inches, and a weight of 18 lb. It has for long been greatly esteemed for the table. The other species are widely distributed; one is known in Australian seas. On the British coasts, other fishes, such as the Silver Haddock, are erroneously called by the name.

Dôseh, an Arabic word meaning 'treading,' denotes a remarkable ceremony, which, until its suppression in 1884, used to take place in Cairo annually on the feast of the prophet's birth, in the third month of the Mohammedan year. A party of dervishes of the Sa'di order, to the number of a hundred or more, lay down on their faces, side by side, with their arms doubled under their foreheads. A dozen more ran along upon their comrades' prostrate backs, beating drums, and shouting 'Allah!' Then the sheikh of the order, mounted on a good-sized horse, which ambled with a fine action, rode along upon the line of bodies, from whom audible prayers could be heard proceeding. The horse trod upon each man twice, yet, as the sheikh passed on, those behind rose up apparently unhurt. This has however been disputed, and evidence has been produced of considerable injury inflicted by the iron-shod hoofs. It was in consequence of this that the Khedive Tewfik suppressed this singular religious rite. See Lane, *Modern Egyptians*, xxiv.; Butler, *Court Life in Egypt*.

Dositheus was a Jewish heresiarch of the 1st century A.D., who insisted on a painfully rigorous observance of the Sabbath, and died of excessive fasting.—There was also a grammarian of this name in the 4th century, who wrote a Latin grammar for Greek boys.

Dost Mohammed. See AFGHANISTAN.

Dostoieffsky, FEODOR MIKHAILOVITCH, a Russian novelist, was born at Moscow in 1818, passed through the imperial school of engineers, and after a short trial of the army adopted literature as a profession. His first story, *Poor People* (1846), which painted with unsparing truth the condition of the peasantry and the more hopeless state of the poor in the cities, at once drew attention to him, and to several less noteworthy works that followed. At this period he became involved in the Communist plots of Petrocheffsky, and in 1849 was condemned to twelve years' labour in the mines, and deported to Siberia. In 1856 he was permitted to return to St Petersburg, where in 1860 he published an account of his prison life (Eng. trans. 1887). His masterpiece, *Crime and Punishment*, which appeared in 1868, is one of the most powerful and affecting works in the whole range of modern fiction, realistic, but not with Zola's realism; strong in its grasp of character and its unshrinking analysis of motive; unique in a magnetic sympathy that impels the reader to identify himself with characters often sordid or repulsive, dwelling in an atmosphere of misery; and finally, is in its teaching good and ennobling. There is an English version (1886), and a French translation by Victor Derély. Other works that have appeared in English are *Injury and Insult*, *The Idiot*, *Friend of the Family*, and *The Gambler*. Dostoieffsky died at St Petersburg, 9th February 1881. In his later writings he developed an intense but scarcely enlightened patriotism, combined with an intolerance of European ideas, and a stubborn resistance to any liberal views attributed to the government.

Dotterel (*Eudromias morinellus*), a kind of plover, known in Britain as a bird of passage, though sometimes breeding at high elevations on the hills. It is widely distributed in Europe, in the north in summer, in the south in winter. A nearly related species (*E. asiatica*) has a similar distribution in Asia. The dotterel is about nine inches and a half in its whole length. In summer plumage, the upper parts are of a brownish-gray colour, the feathers edged with deep red; the cheeks, throat, and a band above the eyes, white; the breast bright rust-colour, with a white patch on the upper part of it, bounded above by a blackish

Dotterel (*Eudromias morinellus*).

line; a conspicuous black patch on the middle of the belly; some of the tail-feathers tipped with white. The winter plumage is much less definite. The bird is proverbial for its tame stupidity; but this is due to its unacquaintance with man's evil intent. It becomes shy and watchful after a little experience. It is much esteemed for the table, and well known in the London market. The name Ring Dotterel is applied to a sandplover frequenting the shore (*Ægialites hiaticula*), which seems to serve as sentinel to dunlins and sandpipers. Both Eudromias and Ægialites were formerly included along with the plovers proper (Charadrius). See PLOVER.

Douarnenez, a port in the French department of Finistère, on the Bay of Douarnenez, 8 miles NW. of Quimper by rail. It is important for the sardine-fishery, and has a pop. of 8637.

Douay (Roman *Duacum*), a town in the French department of Nord, on the river Scarpe, 20 miles S. of Lille by rail. It is one of the chief military towns in the north of France, is strongly fortified, contains an important arsenal, a cannon foundry, and a school of artillery. The principal buildings are the churches, the hôtel-de-ville, the public library, containing 100,000 printed volumes and 3000 MSS., the museum, hospital, and artillery barracks. The manufactures include lace, cotton, oil, soap, and iron machinery; and there is an active trade in corn, seed, and linen. Pop. (1881) 21,703; (1891) 25,560. During the middle ages Douay was a constant bone of contention between the Flemish counts and the French rulers. It passed with the rest of Flanders under the dominion of Spain, but was taken by Louis XIV. in 1667. It was captured by the Duke of Marlborough in June 1710, but on the withdrawal of the allies was re-occupied by the French, who were confirmed in their possession of it at the Peace of Utrecht.

For more than two centuries Douay was the rallying-point of Roman Catholic exiles from Great Britain. There were several educational and religious houses established in the town in connection with the English and Scottish mission. The English College, the parent and model of similar institutions at Rome, Lisbon, and elsewhere on the Continent, was founded in 1568, the tenth year of Elizabeth's reign, by William, afterwards Cardinal Allen (q.v.), as a house of studies for the English clergy abroad, and as a seminary or nursery for ecclesiastics destined for the English mission. The college was affiliated to the Douay University, which had been founded in 1562 by King Philip II., in whose dominion the town then was. Allen's foundation was supported by pensions from the Spanish king and from the pope. The first batch of four missionaries was sent into England in 1574. Political disturbances led to the migration of the college, in 1578, from Douay to Rheims, where it was under the protection of the king of France and the Guises. A colony of students from Rheims in 1578 formed the nucleus of a second college at Rome, under the government of the Jesuits; and the two establishments together sent into England, before 1586, about 250 priests, of whom no less than 60 suffered death at the hands of the executioner. The most flourishing period of Allen's college was that of its sojourn at Rheims (1578–93), though before the return to Douay it had begun notably to decline. On Allen's appointment as cardinal in 1587, and his consequent removal to Rome, the college was torn with internal dissensions, studies were neglected, and scandals ensued. It was at Rheims that the English Roman Catholic version of the Bible was begun by Dr Gregory Martin, with the assistance of Allen, Dr Bristow, and others. The New Testament was printed at Rheims in 1582. The Old Testament, also translated by Martin, with notes by Dr Worthington, was not completed and published until 1610 at Douay, and hence the version as a whole is commonly known as the Douay Bible (see BIBLE). Notwithstanding its many troubles the college was able to boast that before its dissolution at the French Revolution it had produced more than 30 bishops and 169 writers, while 160 of its alumni had given their lives on the gallows for the papal cause. An interesting list of the English Catholic books printed at Douay will be found in Duthillœul's *Bibliographie Douaisienne*. It is said that valuable documents from the college archives were made into cartridges by the French revolutionary soldiers. Some few of the manuscripts, however, have found their way into the public library of the town, and others are preserved in the archives of the Roman Catholic archbishopric of Westminster. Among the latter is the greater portion of the college Registers or Diaries, the first two parts of which were edited by the Fathers of the London Oratory in 1878.

The members were expelled from the college, and the property confiscated by the French government, 12th October 1793. A small portion of the property which remained unsold was restored to Mr Daniel, the last president, by an ordinance of the French king, dated January 25, 1816. But further claims for compensation under the terms of the treaty of peace were resisted by the British commissioners on the ground that the college was established for objects directly opposed to British law, and was to be regarded as a French rather than an English corporation. This decision on appeal was confirmed by a judgment of Lord Gifford in the Privy-council, 25th November 1825. There is no ground for the common story that the sum claimed was expended by the government in paying off the debts incurred by the Prince of Wales in adorning the Brighton Pavilion. The college buildings are now converted into the artillery barracks known as Les Grands Anglais.

On their return to England, the masters and students of the college, among whom was Lingard, the historian, laid the foundations of a similar college at Crook Hall, afterwards transferred to Ushaw, near Durham. Another college at Old Hall, Essex, was established by refugees partly from Douay, and partly from St Omers.

There was also established at Douay a Scotch College. This seminary, originally founded at Pont-à-Mousson, in Lorraine, by Dr James Cheyney of Aboyne, in 1576, was assisted by a pension from Queen Mary. After her death it was reduced to great straits, and could count only seven members. In 1594 it moved to Douay, thence to Louvain, and finally was once more transferred to Douay in 1608. Clement VIII. placed it under the administration of the Jesuits. Hippolyte Curle, the son of Mary's secretary, made over to the college by deed of gift a large sum of money, providing, however, that in case of his country's return to the Roman religion, the foundation should be transferred to St Andrews University. Curle became the second rector of the college, and died in 1638. The college was closed in 1793 by the French government, and turned into a prison. It eventually became the mother house of a congregation of nuns devoted to education, called Les Dames de la Sainte Union. The register of the Scotch College, then in the hands of Sir Maxwell Witham of Kirkconnell, was in 1889 being edited by the Rev. W. Forbes-Leith, S.J., for the New Spalding Club.

The English Franciscan friars established at Douay a house of their own, which produced some men of reputation for learning and piety. The English Benedictines did the same. There was also a college of Irish ecclesiastics in the town. The Benedictines alone retain a footing at Douay at the present time. They returned after the Revolution to their old buildings, or to a portion of them, where they still possess a college for the training of English members of the order.

A curious tract on the history of Allen's foundation was written by the Rev. Hugh Tootle, *alias* Charles Dodd, under the title of *The History of the English College at Douay, by R. C., Chaplain to an English Regiment that marched in upon its surrendering to the Allies* (Lond. 1713). The *First and Second Douay Diaries* of the English College, Douay, with an historical introduction by T. F. Knox (1878), has been already referred to. Full accounts of the later history will be found in Gillow's *Haydock Papers* (1888). Compare the Abbé Dancoisne's *Histoire des Établissements religieux britanniques fondés à Douai avant la Révolution Française*, and *Le Collège Anglais pendant la Révolution*, by the same author.

Double (Ger. *doppelgänger*), a kind of apparition, a person's own likeness appearing and usually admonishing the beholder of approaching death, a wraith; or simply implying *bilocation*, when the same person is supposed to be seen by others in two places at once. See APPARITION and the works there cited; also Lambertini's *De Beatificatione;* and for a kind of double consciousness, see PERSONALITY. Double is playfully applied to either of two persons so closely resembling as to be mistaken for each other.

Double Bass (Ital. *contrabasso* or *violone*), the largest stringed instrument of the violin species. Originally it had only three strings, tuned to A, D, G of the bass stave; but as much of the music written for it goes down to E and F below this range, a fourth string is now generally added tuned to E below the bass stave. Playing the funda-

mental base on which the harmony rests, it is an indispensable part of an orchestra, though it is only in the 19th century that special parts have been written for it. Formerly its part was simply to double, an octave below, the ordinary base of the harmony, played by some other instrument, or sung by the bass voice. From this probably arose its name of double bass. Though a powerful and essential orchestral instrument, it, on account of its rough tone and difficulty of management, has not, except in very exceptional circumstances, been used as a solo instrument. Domenico Dragonetti (1755–1846) was an unrivalled performer on the double bass.

Double Flowers. See FLOWER.

Doubling the Cube was one of three famous problems which were discussed by the early Greek geometers, the other two being the trisection of an angle and the squaring of the circle. There are several theories as to how the duplication problem originated; the statements of the ancients on this point being quite unsatisfactory. The legendary origin, told by Eratosthenes in a letter to Ptolemy Euergetes, was that King Minos, when he learned that the dimensions of a tomb for his son Glaucus were to be 100 feet each way, complained of them as too small, and commanded the tomb to be doubled and the cubical form to be retained. Another legend, also mentioned by Eratosthenes, was that certain Delians, in obedience to an oracle, attempted to double one of the altars, and finding a difficulty in doing so, consulted the geometers who were with Plato at the academy. The duplication of the cube hence came to be called the Delian problem.

In whatever manner the problem originated, it was much older than Plato's time, and the first contribution to the solution of it was made by Hippocrates of Chios. He showed that the solution could be obtained if between two straight lines, the greater of which was double the less, there could be inserted two mean proportionals; and in this modified form the problem was ever afterwards attacked. Solutions were discovered by various geometers, Archytas, Menæchmus, Eratosthenes, Nicomedes, and others, and an account of them will be found in the commentary of Eutocius on Archimedes's treatise *Of the Sphere and Cylinder*. This account is translated into English in the *Proceedings of the Edinburgh Mathematical Society*, vol. iv. pp. 2–17. It is often and inaccurately stated, even in mathematical books, that the duplication of the cube cannot be effected by geometry. The truth is that it cannot be effected by elementary plane geometry, where straight lines and circles are the only lines that are employed. By the use of the conic sections or several other geometrical curves, as well as by mechanical contrivances, the solution can be obtained without much difficulty. Nowadays the problem possesses only an historical interest, except for those persons whom De Morgan calls paradoxers.

Doublings, the heraldic term for the linings of robes or mantles, or of the mantlings of achievements. See MANTLING.

Doubloon (Span. *doblon*, 'double'), a gold piece, originally double the value of a pistole, formerly coined in Spain and Spanish America. Prior to 1848 it was worth 64s. 8d. The Doblon de Isabel, coined in 1848, was till 1868 equivalent to 20s. 8d.

Doubs, a department of France, on the eastern frontier, adjoining Switzerland and Alsace, has an area of 2010 sq. m. Pop. (1876) 306,094; (1891) 303,081. It is traversed by the river Doubs (total length, 270 miles), a tributary of the Saône, and is separated, on the NW., from the department of Haute Saône by the Ognon (120 miles), also a tributary of the Saône. The surface is hilly, especially in the SE., where the Jura Mountains reach a height of 4600 feet. The climate is moist and more rigorous than in most similar latitudes. The uplands are sparsely inhabited, but the population of the fertile river valleys is very thick. Agriculture has been notably advanced since 1870; swamps have been drained and waste lands reclaimed, and three-fourths of the entire area is now cultivated or under wood. Wheat and oats are the chief cereals, but the vine and fig-tree also thrive well; and the pasturage is excellent, and rears good breeds of horses and goats. In the valleys great quantities of butter and cheese are produced. Mines of iron are worked, and the manufactures include ironwares, clocks, glass, paper, and pottery. Doubs is divided into the four arrondissements of Besançon, Baume-les-Dames, Montbéliard, and Pontarlier. The capital is Besançon.

Douce, FRANCIS, an eccentric and learned antiquary, born in London in 1757, whose easy circumstances allowed him from an early age to give himself entirely to his favourite studies. He was some time keeper of the MSS. in the British Museum, and died 30th March 1834, bequeathing his splendid collection of books, MSS., prints, and coins to the Bodleian; his curiosities to Sir Samuel R. Meyrick; and his letters and commonplace-books to the British Museum, in a chest not to be opened till 1900. Some of his works are of enduring value from their honesty and learning. Of these the chief are *Illustrations of Shakespeare* (2 vols. 1807) and *The Dance of Death* (1833). He contributed to the *Archæologia* and *Gentleman's Magazine*, edited two books for the Roxburghe Club (1822 and 1824), and assisted in Scott's *Sir Tristram*, J. T. Smith's *Vagabondiniana* (1817), and the edition of Warton's *History of English Poetry* issued in 1824.

Dough-nuts, small brown cakes, rounded by the hand, made of flour, eggs, sugar, and milk, and fried or boiled in lard.

Douglas, the modern capital and principal seaport of the Isle of Man, is so called from its being situated near the junction of two streams—the *Dhoo* (black) and *Glass* (gray). Douglas lies on the margin of a highly picturesque bay, on the east side of the island, 75 miles NW. of Liverpool, 46 W. of Barrow, and 94 NE. of Dublin. From the excellence of the sea-bathing, and its central position, it has become highly popular as a watering-place. The old town, standing on the south-western edge of the bay, consists of narrow tortuous streets, and presents a vivid contrast to the handsome modern terraces and villas which occupy the rising ground beyond, and the ground facing the north of the bay. It possesses an excellent landing pier; another pier and breakwater, constructed of concrete cement blocks, was opened in 1879; the new street and charming promenade following the line of the bay is one of its most agreeable features. Conspicuous in the centre of the crescent of the bay stands Castle Mona, built by the fourth Duke of Athole, but now converted into a first-class hotel and winter gardens. The Tower of Refuge, a picturesque object, occupies a dangerous rock in the southern area of the bay, called Conister, and was erected in 1833 for the safety of shipwrecked mariners, by the late Sir William Hillary, Bart., who, during his residence at Douglas, founded the Royal National Lifeboat Institution. Douglas is the principal packet station of the island, with a daily service of steamers during the summer months, and possesses telegraphic communication with England. Pop. (1851) 9880; (1881) 15,719; (1889) 20,000.

Douglas, a small town of Lanarkshire, on Douglas Water, 11 miles SSW. of Lanark. It has decayed from its former importance, though coal, lime, and sandstone are worked in the valley. Of the old kirk of St Bride, the burial-place of the Douglases till 1761, only the choir and a spire remain. Modern Douglas Castle, a seat of the Earl of Home, is nearly a mile from the town. It is a poor successor to Scott's 'Castle Dangerous,' now represented by little more than a tower. Pop. 1262.—The scene of the 'Douglas tragedy' is Blackhouse Tower, on the Douglas Burn in Yarrow parish, Selkirkshire.

Douglas, THE FAMILY OF. A legend of the 16th century told how, in the year 770, a Scottish king, whose ranks had been broken by the fierce onset of a Lord of the Isles, saw the tide of battle suddenly turned by an unknown chief; how, when the victory was won, the monarch asked where was his deliverer; how the answer ran in Erse, *Sholto Du-glas* ('Behold that dark-gray man'); and how the warrior was rewarded with that Clydesdale valley which, taking from him its name of Douglas, gave surname to his descendants. This fable has long ceased to be believed. Equal discredit has fallen on the theory which the laborious Chalmers advanced in the *Caledonia*, that the Douglases sprang from a Fleming of the name of Theobald, who, between the years 1147 and 1164, had a grant of lands on the Douglas Water from the Abbot of Kelso. What was boasted of the Douglases by their historian in 1644 still holds true: 'We do not know them in the fountain, but in the stream; not in the root, but in the stem; for we know not who was the first mean man that did by his virtue raise himself above the vulgar.' It was thought likely, in the beginning of the 15th century, that the Douglases and the Murrays had come of the same stock, and in this old and not improbable conjecture all that is known on the subject must still be summed up.

William of Douglas, the first of the family who appears in record, was so called, doubtless, from the wild pastoral dale which he possessed. He is found witnessing charters by the king and the Bishop of Glasgow between 1175 and 1213. He was either the brother or the brother-in-law of Sir Freskin of Murray, and had six sons, of whom Archibald, or Erkenbald, was his heir, and Brice rose to be Bishop of Moray. Sir Archibald is a witness to charters between 1190 and 1232, and attained the rank of knighthood. Sir William of Douglas, apparently the son of Sir Archibald, figures in record from 1240 to 1273. His second son, distinguished in the family traditions as William the Hardy, spoiled the monks of Melrose, and deforced the king's officers in the execution of a judgment in favour of his mother. He was the first man of mark who joined Wallace in the rising against the English in 1297. It appears that he possessed lands in one English, and in seven Scottish counties—Northumberland, Berwick, Edinburgh, Fife, Lanark, Ayr, Dumfries, and Wigtown.

The history of his son, the Good Sir James of Douglas, is familiar to every one, as Bruce's greatest captain in the long War of Independence (see BRUCE). The hero of seventy fights, he is said to have won them all but thirteen, leaving the name of 'the Black Douglas'—so he was called from his swarthy complexion—as a word of fear by which English mothers stilled their children. He was slain in Andalusia, in 1330, on his way to the Holy Land with the heart of his royal master. The 'bloody heart' in the Douglas arms commemorates Bruce's dying bequest to him. His son William fell at Halidon Hill; and the next Lord of Douglas, Hugh, brother of Lord James, and a canon of Glasgow, made over the now great domains of the family in 1342 to his nephew Sir William.

EARLS OF DOUGLAS.—The Douglases had since the time of William the Hardy held the title of Lords of Douglas; but in 1357, Sir William of Douglas, who had fought at Poitiers, was made Earl of Douglas, and by marriage became Earl of Mar. In 1371 he disputed the succession to the Scottish crown with Robert II., claiming as a descendant of the Baliols and Comyns. He died in 1384. His son James, second Earl of Douglas and Mar, the conqueror of Hotspur, fell at Otterburn in 1388; and as he left no legitimate issue, the direct male line of William the Hardy and the Good Sir James now came to an end. His aunt had married for her second husband one of her brother's esquires, James of Sandilands, and through her Lord Torphichen, whose barony was a creation of Queen Mary in 1564, is now the heir general and representative at common law of the House of Douglas.

The earldom of Douglas, meanwhile, was bestowed on an illegitimate son of the Good Sir James—Archibald, Lord of Galloway, surnamed the Grim. By his marriage with the heiress of Bothwell, he added that fair barony to the Douglas domains; and having married his only daughter to the heir-apparent of the Scottish crown, and his eldest son to the eldest daughter of the Scottish king, he died in 1401. His son and successor, Archibald, fourth Earl of Douglas, was, from his many misfortunes in battle, surnamed 'The Tineman,'—i.e. the loser. At Homildon, in 1402, he was wounded in five places, lost an eye, and was taken prisoner by Hotspur. Next year, at Shrewsbury, he felled the English king to the earth, but was again wounded and taken prisoner. Repairing to France, he was there made Duke of Touraine, and fell at Verneuil in 1424. He was succeeded by his son Archibald, who distinguished himself in the French wars, and dying in 1439, was buried in the church of Douglas, where his tomb yet remains, inscribed with his high titles of 'Duke of Touraine, Earl of Douglas and of Longueville, Lord of Galloway, Wigtown, and Annandale, Lieutenant of the King of Scots.' His son and successor, William, a boy of sixteen, is said to have kept a thousand horsemen in his train, to have created knights, and to have affected the pomp of parliaments in his baronial courts. His power and possessions made him an object of fear to the Scottish crown; and, having been decoyed into the castle of Edinburgh by the crafty and unscrupulous Crichton, he was, after a hasty trial, beheaded, along with his brother, within the walls of that castle, in 1440. It was before him that the black bull's head was presented at table, in 'token of death.' His Scottish earldom was bestowed on his grand-uncle (the second son of Archibald the Grim), James, surnamed the Gross, who in 1437 had been made Earl of Avondale. His son William was, for a time, all-powerful with King James II., who made him lieutenant-general of the realm; but afterwards losing the royal favour, he seems to have entered into a confederacy against the king, by whom he was killed in Stirling Castle in 1452. Leaving no child, he was succeeded by his brother James, who in 1454 made open war against King James II., as the murderer of his brother and kinsman (the sixth and eighth Earls of Douglas). The issue seemed doubtful for a time, but the Hamiltons and others being gained over to the king's side, Douglas fled to England. The struggle was still maintained by his brothers. They were defeated at Arkinholm (where Langholm now stands), in May 1455; and the earldom of Douglas came to an end by forfeiture, after an existence of ninety-eight years, during which it had been held by no fewer than nine lords. The last earl lived many years in England, leagued himself in 1484 with the exiled Duke of Albany, was defeated and taken prisoner at Lochmaben, and died in the abbey of Lindores

in April or June 1488. So ended the elder illegitimate line of the Douglases.

EARLS OF ANGUS.—Meanwhile a younger and illegitimate branch had been rising to great power. William, first Earl of Douglas, while securing the earldom of Mar, also secured the affections of the young widow of his wife's brother, Margaret Stewart, Countess of Angus and Mar. The issue of this amour was a son, George, who in 1389 had a grant of his mother's earldom of Angus. George, fourth Earl of Angus, took part with the king against the Douglases in 1454; his loyalty was rewarded by a grant of their old inheritance of Douglas-dale and other lands; and so, in the phrase of the time, 'the Red Douglas put down the Black.' The 'Great Earl of Douglas' died in 1462, being succeeded by his son Archibald, surnamed Bell-the-Cat (see JAMES III.), who filled the highest offices in the state, and added largely to the family possessions. He was succeeded by his grandson, Archibald, who in 1514 married the queen-dowager of Scotland, Margaret, sister of Henry VIII. of England, and widow of James IV. of Scotland. The fruit of this marriage was a daughter, Margaret, who, marrying the Earl of Lennox, became the mother of Henry, Lord Darnley, the husband of Queen Mary, and father of James VI. The Earl of Angus had for a time supreme power in Scotland, but in 1528, the young king, James V., escaped from his hands, and sentence of forfeiture was passed against Angus and his kinsmen. On James's death in 1542, Angus was restored to his estates and honours. He was succeeded by his nephew, David, whose son, Archibald, the 'Good Earl,' died without male issue, and the earldom passed to a collateral branch. William Douglas of Glenbervie became ninth Earl of Angus.

MARQUISES AND DUKE OF DOUGLAS, AND LORDS DOUGLAS.—William, eleventh Earl of Angus, his grandson, was created Marquis of Douglas in 1633. The third Marquis was created Duke of Douglas in 1703, and died childless in 1761, when his dukedom became extinct, and his marquisate devolved on the Duke of Hamilton, as descended in the male line from William, Earl of Selkirk, third son of the first Marquis of Douglas. His grace's sister, Lady Jane Douglas, born in 1698, and married in 1746 to Sir John Stewart of Grandtully, was said to have given birth at Paris to twin sons in 1748. One of them died in 1753; the other in 1761 was served heir of entail and provision general to the Duke of Douglas. An attempt was made to reduce his service, on the ground that he was not the child of Lady Jane Douglas; but the House of Lords, in 1771, settled the famous *Douglas Cause* by giving final judgment in his favour. He was made a British peer in 1790, by the title of Baron Douglas of Douglas Castle, which became extinct on the death of his son James, fourth Lord Douglas, in 1857, when the Douglas estates devolved on his niece, the Countess of Home. The title of Earl of Angus was claimed in 1762, as well by the Duke of Hamilton as by Archibald Stewart, afterwards Lord Douglas; but neither urged his claim to a decision, and the title is still in abeyance. The right attached to it of bearing the crown of Scotland was debated before the Privy-council in 1823, when it was ruled that Lord Douglas's claim to that honour, being a claim of heritable right, fell to be decided in a court of law.

EARLS OF MORTON.—Sir Andrew of Douglas, who appears in record in 1248, was apparently a younger son of Sir Archibald, or Erkenbald, of Douglas, the second chief of the house. His great-grandson (?), Sir William of Douglas of Liddesdale, the Knight of Liddesdale—as he was called by his contemporaries, who regarded him as 'the flower of chivalry'—was assassinated in 1353 by his kinsman, William, first Earl of Douglas. The grandson of his nephew, the scholarly and princely Sir James of Douglas of Dalkeith, married a daughter of King James I., and in 1458 was created Earl of Morton. His grandson, the third earl, dying without male issue in 1553, the earldom devolved on his youngest daughter's husband, the Regent Morton—James Douglas, great-grandson of Archibald Bell-the-Cat (see MORTON). Aberdour and some other old domains of the family still remain with his successor, the Earl of Morton, who, there is every reason to believe, descends legitimately in the male line from William of Douglas, the great progenitor of the race in the 12th century.

James, second Earl of Douglas and Mar—the hero of Otterburn—had an illegitimate son, Sir William Douglas of Drumlanrig, whose descendants were created Viscounts of Drumlanrig in 1628, Earls of Queensberry in 1633, Marquises of Queensberry in 1681, Dukes of Queensberry in 1683, Earls of March in 1697, and Earls of Solway in 1706. On the death of the fourth Duke of Queensberry in 1810, that title went to the Duke of Buccleuch; the title of Marquis of Queensberry went to the heir male of the family, Sir Charles Douglas of Kelhead; and the title of Earl of March went to the Earl of Wemyss.

In 1646 the third son of the first Marquis of Douglas was created Earl of Selkirk. In 1651 the eldest son of the same marquis was created Earl of Ormond, and in 1661 Earl of Forfar. In 1675 the fourth son of the same marquis was created Earl of Dumbarton. In 1641 the second son of the tenth Earl of Angus was created Lord Mordington. In 1633 Sir Robert Douglas of Spott, a descendant of the Morton family, was created Viscount of Belhaven. Of all these titles, that of the Earl of Selkirk belonging since 1885 to the Duke of Hamilton, and that of Earl of Belhaven, survive; the others are dormant or extinct.

See the *History of the Houses of Douglas and Angus*, by David Hume of Godscroft (1644, 1 vol. fol.; reprinted in 1748 in 2 vols. 8vo); and the *Douglas Book*, by Sir William Fraser, prepared from the family muniments (4 vols. 4to, 1885). The Douglas cause produced a large literature of its own.

Douglas, GAWIN or GAVIN, the poet-bishop, was the third son of Archibald 'Bell-the-Cat,' fifth Earl of Angus, and was born about 1474. He was educated at St Andrews for the priesthood, and in 1496 was first presented to Monymusk, Aberdeenshire, but ere long was appointed to Prestonkirk, near Dunbar, then called Hauch or Prestonhaugh. In 1501 he was made dean or provost of St Giles, Edinburgh, and while holding these preferments he wrote all his poems. From the marriage of his nephew, the sixth Earl of Angus, to the widowed queen of James IV., Douglas expected rapid preferment; but the jealousy of the nobility and the Regent Albany was such that he was disappointed of the abbacy of Aberbrothock and the archbishopric of St Andrews, and when, through the influence of the queen, he had obtained the bishopric of Dunkeld directly from the pope (January 1515), he was imprisoned on an old statute for receiving bulls from the pope, and not allowed to be consecrated until more than a year after. On the fall of the party of Angus, after the queen, stung by his ill-treatment, had flung herself into the arms of Albany and determined on a divorce, the bishop fled to England to obtain the aid of Henry VIII., but was suddenly cut off at London by the plague in 1522, and buried in the hospital church of the Savoy. The three extant poems of Gavin Douglas are *The Palice of Honour*, most likely written in 1501, an allegory of the life of the virtuous man; a translation of the *Æneid*, with prologues; and

King Hart, an allegory of the human heart in its struggle with the temptations of the flesh, not printed in its author's lifetime, nor apparently till it appeared in Pinkerton's *Ancient Scottish Poems* (1786). There is also a minor poem entitled *Conscience*, whose beauties are sadly marred by its excessive conceits. Throughout his verse Douglas shows his deep indebtedness to Chaucer, but his youthful exuberance of ornament, his sense for colour and splendour, and the vigour of his 'braid and plane' Scotch dialect, are his own. His *Æneid*, which he finished most likely about 1513, was the first version of a Latin classic published in Britain; it remains to Gavin Douglas no small achievement in the history of English literature, that 'in a barbarous age he gave rude Scotland Virgil's page.' His collected works were edited by the late Dr John Small (4 vols. Edin. 1874). See also chap. vii. of the late Dr J. M. Ross's *Scottish History and Literature to the Reformation* (1884).

Douglas, Sir Howard, Bart., G.C.B., son of Admiral Sir C. Douglas, was born at Gosport in 1776, and served in Canada (1795) and in two Peninsular campaigns, being present at Corunna. He was successively governor of New Brunswick (1823–29), where he founded the university of Fredericton, of which he was the first chancellor, Lord High Commissioner of the Ionian Islands (1835–40), and M.P. for Liverpool (1842–46). He wrote several treatises accepted as authoritative at the time, among which are *An Essay on Military Bridges* (1816), which is said to have given Telford the idea of the suspension principle; a treatise on *Naval Gunnery* (1819; 5th ed. 1860, reproduced in America, France, and Spain); *Observations on Carnot's Fortification;* a work on the value of the British North American provinces (1831); and *Naval Evolutions* (1832). He died 9th November 1861. See Life by S. W. Fullom (1862).

Douglas, John, Bishop of Salisbury, the son of a shopkeeper of Pittenweem, Fifeshire, was born 14th July 1721. He was educated at Dunbar and Oxford, ordained deacon in 1744, and as an army chaplain was at the battle of Fontenoy (1745). His after-life is little more than a chronicle of his very numerous preferments, which ended in his translation to the see of Salisbury in 1791. He died 18th May 1807. Douglas only occasionally resided on his livings. He generally spent the winter months in London, and the summer months at the fashionable watering-places, in the society of the Earl of Bath, who was his great patron. He wrote much, mainly controversial: defending Milton from Lauder's charge of plagiarism (1750), writing the famous *Letter on the Criterion of Miracles* (1754) against Hume, ironical attacks on the Hutchinsonians, and political pamphlets. He edited Captain Cook's journals. See his *Miscellaneous Works*, with Life by Macdonald (1820).

Douglas, Sir Robert (1694–1770), a Scottish baronet, author of a well-known *Peerage* (1764).

Douglas, Stephen Arnold, American politician, was born at Brandon, Vermont, in 1813, and in 1834 began the practice of law at Jacksonville, Illinois. He was elected attorney-general of this state in the same year, member of the legislature in 1835, secretary of state in 1840, and judge of the supreme court in 1841. He was returned to congress in 1843–44–46, and to the United States senate in 1847–52–58. In the lower house he advocated the annexation of Texas, and of Oregon up to 54° 40′ N. lat., and favoured the war with Mexico, and in the senate he opposed the ratification of the Clayton-Bulwer Treaty, and declared himself in favour of the acquisition of Cuba, his desire being to 'make the United States an ocean-bound republic.' On the question of slavery he maintained that the people of each territory should decide whether it should be a free state or a slave state; this was known as the doctrine of 'popular' or 'squatter sovereignty.' In 1860 he received the regular Democratic nomination for the presidency, the seceding delegates nominating John C. Breckinridge. Douglas obtained 12 electoral and 1,375,157 popular votes, as against 180 electoral and 1,866,352 popular votes cast for Lincoln, to whom, in the early days of the rebellion, he gave an unfaltering support. He died 3d June 1861, at Chicago, where an imposing monument, surmounted by a statue, has been erected. See his Life by Sheehan (New York, 1860) and Flint (Phila. 1860).

Douglas, Sir William Fettes, P.R.S.A., was born at Edinburgh, 29th March 1822. He studied in the university there, and was for several years engaged in business. As a painter he was mainly self-taught, though he attended the Trustees' Academy for a short time. On first devoting himself to art he practised chiefly as a landscape-painter, but he soon turned to figure-subjects, producing 'Hudibras and Ralph visiting the Astrologer' (1856), 'Lovel and the Antiquary' (1857), 'The Summons to the Secret Tribunal' (1860), and 'The Magic Mirror' (1872), works distinguished by excellent colouring, and by especially firm, careful, and refined handling. His later years were entirely devoted to landscape water-colours. He was elected A.R.S.A. in 1851, R.S.A. in 1854, and P.R.S.A. in 1882; and he is represented in the National Gallery of Scotland by 'The Messenger of Evil Tidings,' 'The Spell,' and 'The Bibliophilist—David Laing, LL.D.' See *Photogravures from the Works of Sir W. F. Douglas, with Critical Sketch*, by J. M. Gray (1885). He died 20th July 1891.

Douglass, Frederick, an American orator, was born at Tuckahoe, near Easton, Maryland, in 1817, his father being a white man, his mother a negro slave. Permitted to work in a shipyard in Baltimore, he in 1838 escaped to New York, and thence to New Bedford, Massachusetts, where his negro employer, who had just read Scott's *Lady of the Lake*, induced him to substitute Douglass for the name of Bailey, conferred on him by his mother. In 1841 he attended an Anti-slavery Convention at Nantucket, and spoke so eloquently on the subject of slavery that he was employed as agent of the Massachusetts Anti-slavery Society, and lectured for four years with great success. In 1845 he commenced a lecturing tour in Great Britain, where a contribution of £150 was made to buy his freedom. Returning to America, he established in 1847 *Frederick Douglass's Paper*, a weekly abolition newspaper, at Rochester, New York. He was appointed assistant-secretary to the Santo Domingo Commission (1871), a presidential elector (1872), United States marshal for the District of Columbia (1876–81), and recorder of deeds there (1881–86). He was United States minister to Hayti 1889–91. He published, besides other works, his *Life and Times* (1881). Died February 20, 1895.

Doulton, Sir Henry, the head of the famous firm of Lambeth potters, was born at Lambeth, 24th July 1820, and on attaining his fifteenth year entered his father's establishment there, where he devoted himself to the most technical branch of the industry, and worked for many years at the potter's wheel. In 1846 he commenced the manufacture of stoneware pipes for sewage and drainage, for which a special factory

was erected near Lambeth Palace, and thus initiated the substitution of impervious pipes for the old flat-bottomed brick drains, with their gaping joints; in 1848 drain-pipe works, now the largest in the world, were started at Rowley Regis, near Dudley, and at present from 25 to 30 miles of pipes are turned out weekly from the various Doulton works. Sir Henry Doulton, however, is chiefly noteworthy as having been mainly instrumental in bringing about the revival in art pottery which has since spread into every civilised country; and his firm's works in art stoneware, silicon, impasto, terra-cotta, faience, and Doulton wares, have since 1870 excited the admiration of critics and gained the highest awards of judges at every exhibition of note throughout the world. He was created a Chevalier of the Legion of Honour (1878), and was awarded the Albert Medal (q.v.) in 1885; and in 1887 he received the honour of knighthood, on the occasion of the Queen's jubilee. Besides a staff of over two hundred artists (many of them ladies) in the commodious studios (1882), nearly four thousand persons are employed by the firm in London, and at the works in Staffordshire and Lancashire. See POTTERY.

Doune, a village of Perthshire, on the Teith, 9 miles NW. of Stirling by rail. Pop. 996. Doune Castle, built by Murdoch, Duke of Albany, in the early part of the 15th century, is now a magnificent and well-preserved ruin. It is described in Scott's *Waverley*, and was reduced to ruins by Hawley's dragoons in 1746. A mile to the west is Deanston, with its cotton-mills, long managed by James Smith (1789–1850), notable as an inventor, as the promoter of 'deep draining and thorough ploughing,' and as a philanthropist.

Douro (Span. *Duēro*), one of the largest rivers of Spain and Portugal, rises in the Pico de Urbion (7369 feet), in Old Castile, about 30 miles NW. of Soria (3445 feet above sea-level). From its source it flows south-east to Soria, then winds towards the west, and pursues a general westward direction till it reaches the Portuguese border, when it flows south-west for about 60 miles, forming the boundary between Spain and Portugal, and then flows west through Portugal, entering the Atlantic below Oporto. Its Portuguese tributaries are comparatively small. The total length of the river is about 490 miles; it is navigable to Torre de Moncorvo, 90 miles.

Dove, a river rising 4 miles SW. of Buxton, and flowing south and south-east along the borders of Derbyshire and Staffordshire to the Trent, which it enters at Newton Solney, after a course of 45 miles. It was the favourite fishing stream of Izaak Walton, who lived here with his friend, Charles Cotton; and it is still beloved of anglers. —DOVEDALE is a romantic glen, forming the course of the 'princess of rivers' for 3 miles, between Thorpe Mill and Mill Dale, below Alstonfield. It is hemmed in by fantastic walls of limestone rock, and presents a series of fairy-like combinations of rock and wood and water.

Dove. See PIGEON, TURTLE-DOVE.

Dove. In Christian art, as early as the 6th century, the dove was employed as an emblem of the Holy Ghost, of course from the words of Luke, iii. 22, which do not, however, state that the Spirit descended on our Lord at his baptism in the bodily form of a dove, but simply 'in a bodily form, as a dove'—i.e. with the fluttering motion of a dove. From the dove being also used to symbolise purity, it is generally represented white, with its beak and claws red, as they occur in nature. In the older pictures, a golden nimbus surrounds its head; the nimbus being frequently divided by a cross, either red or black. In stained glass windows we see the dove with seven rays proceeding from it, terminating in seven stars, significative of the seven gifts of the Holy Spirit. Holding an olive branch, the dove is an emblem of peace. When seen issuing from the lips of dying saints and martyrs, it represents the human soul purified by suffering. A dove with six wings is a type of the Church of Christ; and when so employed it has the breast and belly of silver, and the back of gold, two wings being attached to the head, two to the shoulders, and two to the feet. The pyx containing the host was sometimes made in the form of a dove, and suspended over the altar; and the dove is often placed on the covers of fonts. In this position it may still be seen in some parish churches in England.

Do've, HEINRICH WILHELM, physicist and meteorologist, was born in 1803, at Liegnitz, in Silesia, studied at Breslau and Berlin, and in 1845 became professor of Natural Philosophy at Berlin, where he died, 4th April 1879. He laboured successfully in many fields of science, especially optics and electricity; but his greatest services were rendered to meteorology, which he did much to establish on a scientific basis. He was from 1848 director of the Royal Meteorological Institute, with over eighty stations. To him is due, amongst a great variety of optical discoveries, the application of the stereoscope to the detection of forged bank-notes. Dove was a voluminous writer; his treatise on the *Distribution of Heat on the Surface of the Globe* was published in 1853 by the British Association, and his notable *Das Gesetz der Stürme* (4th ed. 1874) has also been translated.

Dovecot. The right of erecting and keeping dovecots was in England formerly a privilege of manors, and was rigorously protected by law; but such exceptional privileges have long been abolished. It is enacted by the Scottish statute 1617, chap. 19, still in observance, that no person shall build a dovecot or pigeon-house, either in town or country, unless he be possessed of lands or teinds of the yearly value of ten chalders of victual, lying within at least two miles of it. No person having such qualification shall build more than one dovecot within the 'bounds foresaid.' Dovecot breakers are guilty of theft; and under a rigorous Act of 1579, a third offence of dovecot breaking was capitally punishable. See Rankine *On Landownership*, p. 129 (1884).

Dovekie. See ROTCHE.

Dover, a Cinque Port and parliamentary and municipal borough in the east of Kent, 66 miles ESE. of London, and the headquarters of the south-eastern district of the British army, is not only a charmingly situated watering-place, but, being the nearest point of the English coast to France, is a seaport of rapidly growing importance. The admiralty pier, begun in 1847, and completed at an expense of over £750,000, extends seawards a distance of over 1500 feet, forming a harbour of refuge with three landing-places, available for vessels at all states of the tide. The inner dock was enlarged in 1874. Dover is the seat of the packet service for Calais and Ostend. The fortifications comprise Dover Castle, which occupies a commanding position on the chalk cliffs, 375 feet above the level of the sea, and still includes some of the old Saxon and Norman work; Fort Burgoyne on the north side of the town, Archcliffe Fort to the west, and the batteries on the Western Heights, where large barracks are situated. There are also the remains of a Roman pharos or lighthouse, and an Early English church, which has been restored. Dover has a new town-hall (1883), a museum, a hospital, and a large number of churches. It is chiefly dependent on its shipping trade and its attraction as a watering-

place, but shipbuilding and sail and rope making are carried on, and there are also flour and paper mills. Formerly it returned two members to parliament, but since 1885 returns but one. Pop. of borough (1871) 28,506; (1881) 28,486; (1891) 33,418. Dover is well sheltered by the cliffs, and ends landward in a charming valley leading to what is known as 'The Garden of Kent.' By the Romans it was known as *Portus Duris;* the Normans called it Dovere; the French, Douvres; whilst in legal documents of this day the town is Dovar, all four terms being variations of the Celtic word 'Dour,' the name of the small river which runs through the town. Fortified and walled by William the Conqueror, during whose reign it was nearly burned down, noted as the place of King John's submission to the pope, besieged by the French, held during the Civil War by the parliamentarians, threatened by the first Napoleon, and celebrated as the headquarters of the Lord Wardens of the Cinque Ports (see CINQUE PORTS), Dover holds a distinguished place in English history. Three submarine cables connect it with the Continent, and here is the entrance to the proposed Channel Tunnel (q.v.).

Dover, (1) the capital of Delaware, U.S., on Jones's Creek, 48 miles S. of Wilmington by rail. It has a state-house, and several factories for canning fruit. Pop. (1890) 3061.—(2) The oldest town of New Hampshire, founded in 1623, is situated on the Cocheco River, 68 miles N. by E. of Boston by rail, and has large cotton-mills and print-works, besides manufactures of boots and shoes, woollens, and iron. Pop. (1890) 12,790.

Dover, ROBERT (1575–1641), the father of Athletic Sports (q.v.) in England, about the year 1604.

Dover, STRAIT OF (Fr. *Pas de Calais*), the channel between England and France, connecting the English Channel and the North Sea, whose tides meet here. It is 18 to 25 miles broad, and 6 to 29 fathoms deep. On 24th August 1875, Captain Webb accomplished the wonderful feat of swimming from Dover to Calais in 21¾ hours. See CHANNEL (ENGLISH).

Dovercourt. See HARWICH.

Doveron. See DEVERON.

Dover's Powder was first prescribed by Thomas Dover, M.D. (1660–1742), who in 1709, whilst captain of a privateer, took Alexander Selkirk off from Juan Fernandez. The powder is prepared by mixing powdered ipecacuanha root, 1 part; powdered opium, 1 part; and sulphate of potash, 8 parts. The whole is thoroughly mixed, and the ordinary dose is from 5 to 10 grains. Occasionally, saltpetre is added. It is a most valuable medicine, and acts as a sudorific, increasing the proportion of sweat or sensible perspiration. In feverish conditions, where there is the dry furred tongue, and the dry skin, and the brain out of order, Dover's powder is reckoned to prove injurious; but where the tongue is moist and soft, the skin moist and soft, and the brain comparatively unaffected, Dover's powder is of great service. In heartburn 3 to 4 grains will often give relief.

Dovrefjeld, part of the mountainous plateau of Norway, connecting the Kiölen Mountains with the Jotun Fjelde, lies between 63° and 62° 40′ N. lat. The average elevation ranges from 2650 to 3600 feet; the highest point is Sneha-tten, 7566 feet. The main road from Christiania to Throndhjem crosses the Dovrefjeld by a pass 3445 feet above sea-level.

Dow, or DOU, GERARD, Dutch *genre*-painter, was born at Leyden on 7th April 1613. He studied under Bartolomeus Dolendo, an engraver, and Pieter Kouwenhoven, a glass-painter, and at the age of fifteen entered the school of Rembrandt. The influence of the last-named master is very visible in his Arundell picture of a scene from the life of Tobit. At first he mainly occupied himself with portraiture, but he soon turned to *genre*, treating, with extreme care, familiar subjects, small in scale, with few figures, and with little dramatic action. The most insignificant incidents of daily life were precious to Dow, and were delineated with the utmost delicacy, neatness, and care. The richness, transparency, vigour, and harmony of his colouring are beyond all praise, but his touch is minute, his way of work a little trivial, and wanting in the largeness and breadth which distinguish the productions of the greater *genre*-painters of Holland. His works, of which about 200 have been catalogued, are in all the great European collections. His own portrait, that of his wife, and 'The Poulterer's Shop,' are in the National Gallery, London; his celebrated 'Dropsical Woman' (1663) is in the Louvre, along with ten other examples of his art; the Amsterdam Museum contains five of his works, and the Dresden Gallery no fewer than sixteen. Dow died at Leyden in 1675.

Dowager (Fr. *douairière*, from *douaire*, 'dowry'), a widow with a dower; but commonly the title is applied only to the widows of persons of high rank. For queen-dowager, see QUEEN.

Dowden, EDWARD, was born in Cork in 1843, and was educated at Queen's College there, and at Trinity College, Dublin, where his course was remarkably distinguished. In 1867 he took by competition the professorship of Oratory at Dublin University, which he exchanged soon after for that of English Literature. Dowden has contributed many able articles to the leading magazines, and has proved himself a profound Shakespearian, and a critic of uncommon insight and capacity, by his *Shakspere: A Study of his Mind and Art* (1875), the invaluable Shakespeare primer (1877), *Studies in Literature: 1789–1877* (1878), *Southey* (1879) in the 'English Men of Letters' series, and *Transcripts and Studies* (1888). In 1876 he published a volume of fair poems, and in 1888 his authoritative Life of Shelley.

Dower. See JOINTURE.

Dowlais. See MERTHYR-TYDVIL.

Dowlas, a kind of coarse, strong, unbleached linen, used in England more than in Scotland for sheets and pillow-cases. In both countries it is made into aprons for joiners, housekeepers, and others, and it is still to some extent used by working-people for shirts. It is a plain fabric, and is manufactured largely at Knaresborough, in Yorkshire, at Dundee, Kirkcaldy, and other places in Scotland. Since the introduction of calico, the home demand for dowlas has very much diminished.

Dowlatabad. See DAULATABAD.

Down, a maritime county of Ireland, in the south-east of the province of Ulster, 50 miles long (NE. to SW.) and 35 broad (NW. and SE.). Area, 612,399 acres; pop. (1881) 272,107; (1891) 266,893. It has a coast-line of 67 miles, or 139 by the inlets and isles off its shores. It has four spacious inlets: Belfast Lough, Strangford Lough, Dundrum and Carlingford Bays. The Mourne Mountains cover 90 sq. m. in the south, and rise in Slieve Donard to 2796 feet. The other parts of County Down are mostly undulating and hilly, with plains and fine meadows along the rivers. The chief rivers are the Upper Bann and the Lagan. The Newry Canal admits vessels of 50 tons, and with the Ulster Canal opens communication through almost all Ulster. Nearly one-half

of the entire area is under crop, mostly oats, potatoes, turnips, wheat, flax, and barley. Many pigs, horses, and cattle are reared for export. The chief manufacture is linen, especially the finer fabrics, as muslin, woven in the houses of the small farmers, but hosiery, leather, salt, thread, and woollens are also made; and these, with corn, butter, pork, and hides, are the chief exports. Down is among the best cultivated of the Irish counties, and has more resident gentry (almost all Protestants, of English and Scotch descent) than any other Ulster county. Of its population, over 40 per cent. are Presbyterians, and nearly 30 per cent. Roman Catholics, while about 23 per cent. are Episcopalians. It contains 70 parishes, and since 1885 sends four members to parliament, besides one for the borough of Newry. The chief towns are Downpatrick, Newry, Newtownards, Banbridge, Lisburn, Holywood, and Donaghadee (with part of Belfast). County Down contains many ancient remains, as raths, round towers, castles, and abbeys. On the top of Slieve Croob (1755 feet) are twenty-three stone cairns, one being 54 feet high. See Alex. Knox, *History of County Down* (Dublin, 1875).

Downham Market, a town of Norfolk, on the right bank of the Ouse, in a flat fen country, 11 miles S. by W. of Lynn by rail. Pop. 2631.

Downing Street, a short street in Whitehall (named after Sir George Downing, secretary to the Treasury in 1667), where are the Colonial and Foreign Offices, with the official residence since 1735 of the First Lord of the Treasury. Here cabinet councils are held, hence the term is sometimes employed for the government in office.

Downpatrick, or simply DOWN, the capital of County Down, situated near the influx of the Quoyle into the south-west end of Lough Strangford, 27 miles SE. of Belfast, and 140 NNE. of Dublin by rail. Downpatrick takes its name from St Patrick, and is the seat of the diocese of Down, which was united with that of Dromore in 1842. It returned a member to parliament till 1885. Vessels of 100 tons reach the quay a mile from Downpatrick. Its chief manufacture is sewed muslin. Pop. (1871) 3621; (1891) 3132.

Downs (Fr. *dunes*, from the root *dun*, 'a hill,' common to the Teutonic and Celtic languages), a term applied, like *denes* in Norfolk, to hillocks of sand thrown up by the sea or the wind along the sea-coast (see DUNES, DRIFT). It is also a general name for any undulating tract of upland too light for cultivation, and covered with short grass. It is specially applied to two broad ridges of undulating hills south of the Thames, beginning in the middle of Hampshire, and running eastward, the one (the North Downs) through the middle of Surrey and Kent to Dover (about 120 miles), and the other (the South Downs) through the south-east of Hampshire and near the Sussex coast to Beachy Head (about 80 miles). Between the two ranges lies the valley of the Weald, from which the chalk strata have been removed by denudation. Towards the Weald, the descent from both Downs is rapid, and presents cliffs as of a sea-margin; while the opposite slopes are gradual. The highest point of the North Downs is Botley Hill (880 feet); and of the South Downs, Ditchling Beacon (858). These uplands are covered with fine short pasture, which, from its aromatic quality, forms excellent feeding-ground for the famous Southdown sheep.

Downs, THE, a roadstead for shipping off the east coast of Kent, opposite Ramsgate and Deal, between North and South Foreland, and protected externally by the Goodwin Sands—a natural breakwater with 1 to 4 fathoms water, and often partly dry at low tide. This large natural harbour of refuge is 8 miles by 6, with an anchorage of 4 to 12 fathoms. It is unsafe only in south winds. The Small Downs, an appendage of the Downs proper, lies inside the Brake Sand, has from 2½ to 5 fathoms water, and is about 2 miles wide. The obstinate but indecisive battle of the Downs was fought in June 1666, between the English under Monk, and the Dutch under De Ruyter, De Witt, and Van Tromp. See also BLAKE (ROBERT).

Downton, a town of Wiltshire, on the right bank of the Avon, here split into three branches, 6 miles SSE. of Salisbury. It has an Early English market-cross, a cruciform church, and a singular earthwork (the Moot); whilst 2 miles north is Trafalgar House, presented in 1814 by the nation to Lord Nelson's brother and successor. For the agricultural college (1880), see AGRICULTURE. Pop. of parish, 3378.

Doxology (Gr., 'a praising'), an exclamation or prayer in honour of the majesty of God, such as Paul uses at the close of his epistles, and sometimes even in the middle of an argument (Rom. ix. 5). The hymn of the angels (Luke, ii. 14) is also called a doxology by the Christian church; so likewise are the close of the 'Lord's Prayer' and the 'Trisagion' ('Holy, holy, holy'). The so-called 'Greater Doxology,' which is simply an expansion of the angelic hymn, in the Roman liturgy is placed immediately after the beginning of the Mass, and in the English Prayer-book at the close of the communion office. It commences with the words, *Gloria in excelsis Deo* ('Glory to God in the highest'). The Lesser Doxology, 'Glory be to the Father, and to the Son, and to the Holy Ghost, as it was,' &c., is repeated at the end of each psalm in the service of the Roman and Anglican churches. The Greater Doxology is of Eastern origin, and is first met with, though not in its final form, in the seventh book of the Apostolic Constitutions (q.v.), where it is described as the 'morning prayer;' but it is probable that this, as well as the Lesser Doxology and the 'Trisagion,' came into use at a much earlier date, as the Scriptures began to circulate among the churches, the 'Trisagion' (cf. Isa. vi. 3) being presumably the earliest. The origin of the Lesser Doxology (perhaps traceable to Matt. xxviii. 19) is the most obscure, and it is only certain that its present form is the result of the Arian controversy, the second clause having been unknown in Christendom for several centuries.

Doyle, SIR FRANCIS HASTINGS, poet, was born at Nunappleton, near Tadcaster, August 22, 1810. He was educated at Eton, and Christ Church, Oxford, and took a first-class in classics in 1831. He was called to the bar, but his devotion to poetry and his innate love of horses and horse-racing were hardly consistent with success as a barrister. He succeeded his father as second baronet in 1839, held lucrative offices in the Customs, and filled for ten years (1867–77) the chair of Poetry at Oxford, together with an All Souls' fellowship. In 1886 he published his *Reminiscences and Opinions, 1813–1885*, which revealed its author's genial humour, broad sympathies, and liberal culture. Doyle died June 8, 1888. His two series of Oxford lectures he published in 1869 and in 1877; his volumes of verse were *Miscellaneous Verses* (1841), *Two Destinies* (1844), and the *Return of the Guards, and other Poems* (1866). By his 'Birkenhead,' 'The Private of the Buffs,' 'The Red Thread of Honour,' 'The Saving of the Colours,' and 'Gordon,' he made himself in an especial sense the laureate of English heroism.

Doyle, RICHARD, caricaturist, was born in London in 1824, second son of John Doyle (1797–1868), who was himself a celebrated caricaturist, under the signature H. B. He received instruction

in art from his father, and became a contributor to *Punch*, the current design on the cover being from his pencil, and furnished its pages with the well-known sketches of 'Ye Manners and Customs of ye Englyshe.' In 1850 his connection with *Punch* ceased, owing to its criticisms of the Roman Catholic Church, of which he was a member, and he afterwards employed himself in the illustration of books. Among his works of this nature may be mentioned the *Adventures of Brown, Jones, and Robinson*, and the illustrations to the *Newcomes*, the *Scouring of the White Horse*, to Leigh Hunt's *Jar of Honey*, and Ruskin's *King of the Golden River*. He contributed 'Sketches of Modern Society' to the *Cornhill Magazine*, and published a Christmas book for 1869, called *In Fairy Land*. Doyle drew with care, accuracy, and skill thousands of animated little figures, and his caricatures are all distinguished by the most genial humour, and the most graceful drawing. He was also a clever painter in water-colours, and his work in this medium was frequently exhibited at the Grosvenor Gallery. He died December 11, 1883.

Dozy, REINHART, a learned Orientalist, was born February 21, 1820, at Leyden. He studied at the university of his native city, and devoted himself especially to oriental studies. In 1844 he entered the MSS. Library, and in 1850 he was appointed extraordinary, and in 1857 ordinary professor of History at Leyden. He died 29th April 1883. His fame rests chiefly on his valuable works on the history of Spain under the Moorish domination. His *Histoire des Musulmans d'Espagne* (4 vols. Leyden, 1861) is a brilliant model of what a history should be, in style, arrangement, and matter. Equally important is his earlier work, *Recherches sur l'Histoire politique et littéraire de l'Espagne pendant le Moyen Age* (1849), of which a second edition, enlarged and completely recast, was published in 1860, and a third in 1881. In this Dozy exposed the gross and wilful corruptions of the monkish chroniclers, and destroyed many popular illusions based upon the Poem and Chronicle of the Cid; with much learning there is here, however, a tendency to pedantic hypercriticism, and an exaggerated contempt for his predecessors. His most important philological work is the *Supplément aux Dictionnaires Arabes* (2 vols. 1877–81), which contains a vast number of rare and technical Arabic words, collected in the course of extensive reading, and explained with his usual learning. His other publications are the *Historia Abbadidarum* (1852), and editions of Al-Marrakushi's *History of the Almohades* (1847; 2d ed. 1881), of Ibn-Badrun's *Historical Commentary on the Poem of Ibn-Abdun* (1848), and of Ibn-Adhari's *History of Africa and Spain* (1848–52); *Al-Makkari, Analectes sur l'Histoire et la Littérature des Arabes d'Espagne* (1855–61); *Het Islamisme* (Harl. 1863; French trans. 1879); and a speculative treatise entitled *Die Israeliten zu Mekka* (1864). He also assisted in the editing of some of the valuable texts of the Brill press, and in collaboration with Professor de Goeje, brought out an edition and translation of Al-Idrísí's *Description de l'Afrique et de l'Espagne* (1866).

Dracæna. See DRAGON-TREE.

Drachenfels ('Dragon's Rock'), a peak of the range called the Siebengebirge, on the right bank of the Rhine, 8 miles SE. of Bonn, and has an elevation of 1056 feet. Its top, which commands a glorious prospect, may be gained by a mountain railway (1883).

Drachma, DRACHM, DRAM. The drachma was a silver coin, the unit of the money-system in ancient Greece. It varied in value in different parts of Greece and at different times, but always remained the 6000th part of the talent, and the 100th part of the mina, and was divided into six obols. The Attic drachma is estimated as equivalent to 9¾d. of our money—very nearly a French franc. The drachma (originally 'a handful') was also the name of a weight, and 100 drachmas made a mina (nearly 1 lb.) in weight, as in money. The unit in the monetary system of modern Greece, since 1833, is also called a drachma, which is divided into 100 lepta, and in 1867 was made equal to the franc of the Monetary League, although since the renewal of the forced paper currency in 1885 it has been worth only about 8½d. The modern Greek weight called drachma is equal to ½ oz. avoirdupois. In the British system of weights there were, till recently, two drachms or drams: the avoirdupois, equal to $\frac{1}{16}$ oz., and the apothecaries' (not now used), equal to ⅛ oz. See DIRHEM.

Draco (Gr. *Drakōn*), an Athenian lawgiver and archon, who, in the year 621 B.C., was appointed to draw up new laws for the disordered state. These, however, effected little change in the form of the state; but by being committed to writing, put an end to the arbitrary administration of justice on the part of the archons, and resulted in the establishment of a court of appeal—that of the Ephetæ. Draco's legislation had a beneficial and permanent effect upon the political development of Athens. The extraordinary severity of these laws, however, which punished the slightest theft, or even laziness, with death, no less than sacrilege, murder, and treason, caused them to be often neglected, and made them so hated, that Solon was appointed to draw out a new code of laws (594). These were termed *nomoi*, as opposed to the *thesmoi* of Draco. Solon, though he softened their severity in most instances, retained that law which punished a murderer with death. Draco at a later period went to Ægina, where, after having introduced his laws, he is said to have been stifled in the theatre by the garments thrown upon him as a mark of respect by the people. The severity of his laws gave rise to a pun by Herodicus, who declared that Draco's laws were those of a dragon (Gr. *drakōn*) and not of a man. Hence also originated the metaphorical remark of Demades, 'that they were written not in ink but in blood.' Extremely severe and sanguinary laws are still called *Draconic*.

Draco, a constellation in the northern hemisphere. The star γ Draconis, a bright star nearly in the solstitial colure, was used in determining the coefficient of aberration of the fixed stars.

Dracontium, a genus of Araceæ, of which one West Indian species, *D. polyphyllum*, has a medicinal history and repute similar to that of Green Dragon (see DRAGON, GREEN). The poisonous tubers yield starch on washing.

Draft, a written order for the payment of money. It is properly distinguished from a bill by being addressed by the drawer, not to his debtor, but to his agent, servant, or correspondent. This distinction is, however, little attended to.

Drag, a mechanism for slackening the speed of carriages, by operating on one or more of the wheels. The form of drag best known to old travellers by coach was that of the 'shoe,' a hollow piece of iron attached by a chain to the carriage, which being put below one of the hind wheels partially reduced the vehicle to the nature of a sledge; by which dragging process the carriage was suitably retarded on going down-hill. As the shoe-drag required to be applied and removed with some inconvenient detention of the vehicle, a step was made in advance when a method of retarding a wheel without detention was discovered. This new process, which is known as the patent drag,

consists of a connected piece of mechanism, altogether operated upon by the driver without moving from his seat. A handle affects a series of rods and levers by which a block is pressed against each of the two hind wheels, so as to slacken their motion. Such is the kind of drag now very generally attached to cabs and gentlemen's private carriages. It is of French origin. In the case of vehicles used for heavy loads, the levers are worked by a handwheel and screw instead of a handle. Tram-cars have four shoes applied to as many wheels by a system of levers moved by a handwheel and chain, and locked by means of a ratchet and catch. In addition, tram-cars have now an emergency brake, worked by a compressed spiral spring, which can be released by touching a catch with the foot. See BRAKES.

Drag'oman (from Arab. *tarjumân*, 'interpreter;' cf. TARGUM), the general name given in Eastern countries to an interpreter, or to a guide to foreigners. The dragoman is, however, much more than the Italian *cicerone*, or the French *commissionaire* or *valet de place*. In Syria, for example, he is a contractor for the management of expeditions, and undertakes to solve all the difficulties that arise between the traveller and the natives. The dragomans attached to embassies have special privileges. 'Student-dragomans' is a term sometimes given to 'student-interpreters' preparing for the consular service in the East. See CONSUL.

Dragon, (1) a name surviving from mythology and imaginative beast-lore, as the scientific title of a genus of arboreal lizards, of which the most familiar is *Draco volans*. The genus is especially remarkable for the extension of the skin of the sides on the prolonged posterior ribs. A parachute is thus formed which enables these 'dragons' to take rapid swoops from branch to branch. The tail is very long; the skin of the throat forms a loose wattle; the colours are particularly brilliant.

Fringed Dragon (*Draco fimbriatus*).

There are several species inhabitants of the East Indies, not including Ceylon.—(2) The term dragon has also been applied in modern times to a large lizard (*Thorictis dracœna*) found in Brazil and Guiana. It attains a length of 3 feet, most of which goes to the tail. Tejus and Ameiva are allied genera.—(3) The ancient myths might to some extent be rehabilitated in the application of the term 'dragon' to some of the extinct saurians. See LIZARDS, REPTILES.

DRAGON, in Mythology. In the mythical history and legendary poetry of most nations, the dragon holds a prominent place as the embodiment of the antagonistic and hostile principle as it has opposed itself to man from the earliest period in the world's history. In other words, the dragon is the emblem of all that is obstructive, loathsome, and horrible in nature, the ideal of the spirit of evil which is in opposition to the order, harmony, and progress of the human race. On the other hand, in both China and Japan, the 'Bob-tailed dragon' is an exception, where he is regarded with veneration. 'His fidelity as a friend,' says Mr Conway in his *Demonology and Devil Lore* (i. 105), 'led to the ill return of an attack by which his tail was amputated, and ever since his soured temper has shown itself in raising storms. When a violent tempest arises, the Cantonese say "the bob-tailed dragon is passing," in the same proverbial way as the Aryan peasantries attribute the same phenomenon to their storm gods.' But this favourable aspect of the dragon is the exception. Again, whilst the serpent seeks the attainment of its object by cunning and deceitful artifices—crawling on its belly, and always assuming ostensibly characteristics the very opposite of its own—the dragon proceeds openly to work, running on its feet, with expanded wings, and head and tail erect, violently and ruthlessly making onslaught on its victim, spouting fire and fury from both mouth and tail, and wasting and devastating the whole land. Hence, as the universally recognised enemy of mankind, the overthrow of the dragon was made to figure as one of the greatest exploits of gods and heroes. As the highest ideal of human strength and courage, the task properly fell to Hercules; but it was not confined to him, for we find both Apollo and Perseus represented as dragon-slayers. In the Vedic mythology the dragon Vritra, the god of evil and darkness, is in antagonism to Indra, the god of light and good. From legendary poetry, the dragon passed into art, some of the earliest efforts of which probably consisted in depicting it on the shield or carving it for the crest of a conqueror's helmet. The dragon does not seem to have been a native emblem with the Romans, and when they ultimately adopted it as a sort of subordinate symbol, the eagle still holding the first place, it seems to have been in consequence of their intercourse with nations either of Pelasgic or Teutonic race. Amongst all the new races which overran Europe at the termination of the classical period, the dragon seems to have occupied nearly the same place that it held in the earlier stages of Greek life; in modern Greek folk-tales, the dragon is specially prominent. For the story of Cadmus and the dragon's teeth, see CADMUS. In the *Nibelungen Lied*, we find Siegfried killing a dragon at Worms; and the contest of Beowulf (q.v.), first with the monster Grendel, and then with the dragon, forms the principal incident in the curious epic which bears the name of the former. Even Thor himself was a slayer of dragons (Grimm, *Deutsche Mythologie*, ii. 653). Among the Teutonic tribes which settled in England, it was from the first depicted on their shields and banners, and most of the dragon myths of Great Britain were no doubt importations brought over by early colonists—the celebrated Lambton worm being a survival of an Aryan superstition. The Anglo-Saxon *wyrm* meant equally dragon, serpent, and worm; and in such names as Ormsby, Ormskirk, we have reminiscences of the 'laidly [loathly] worm' of the old ballads. As a device, the dragon appears to have been the standard of the West Saxons, and of the English previous to the Norman Conquest. It formed one of the supporters of the royal arms borne by all our Tudor monarchs, with the exception of Queen Mary, who substituted an eagle. Several of the Plantagenet kings and princes inscribed the figure of a

dragon on their banner and shields. Peter Langtoffe says, at the battle of Lewes, fought in 1264, 'the king schewed forth his schild, his dragon full anstere.' Amongst the Celts, it was the emblem of sovereignty, and as such borne as the sovereign's crest. Lord Tennyson's *Idylls* have made every one familiar with 'the dragon of the Great Pendragonship,' blazing on Arthur's helmet, as he rode forth to his last battle, and 'making all the night a stream of fire.'

The fiery dragon, or fire-drake, and the flying dragon in the air, were meteoric phenomena, of which we have frequent accounts in old books, and, indeed, as Brand remarks, 'the dragon is one of those shapes which fear has created to itself,' and which appears in circumstances, and clothes itself in forms, as various as our fears.

Of the two Hebrew words translated dragon in the authorised version of the Old Testament, one obviously means a serpent; while the dragon in Bel and the Dragon is a monster. The dragon of the Apocalypse is identified with the old serpent, the devil. In Christian art, the dragon is the emblem of sin, the usual form that is given to it being that of a winged crocodile. It is often represented as crushed under the feet of saints and martyrs, and other holy personages. Sometimes its prostrate attitude signifies the triumph of Christianity over paganism, as in pictures of St George (see GEORGE, ST), St Michael, and St Sylvester; or over heresy and schism, as when it was adopted as the emblem of the Knights of the order of the Dragon in Hungary, which was instituted for the purpose of contending against the adherents of John Huss and Jerome of Prague.

The dragon is often employed in heraldry, and figures of the heraldic dragon vary considerably according to the fancy of the draughtsman. The chief characteristics are the head of a wolf, the body of a serpent, four eagles' feet, bat-like wings, and barbed tongue and tail. An animal so represented is said to be *dragonné*. See GRIFFIN. A dragon without wings is called a lindworm, or lintworm, which Grimm (*Deutsche Mythol.* ii. 652) explains to mean a beautiful or shining worm. It should be noted that in some of the older treatises on natural history full descriptions of the dragon occur, the belief in its actual existence having been a widespread belief. Two of the ablest scientific writers of the 16th century, Conrad Gesner, professor of Natural History at Zurich, and Aldrovandi, the Pisan professor, have given elaborate descriptions of the dragon. In ancient mythology the task of drawing the chariot of the night was assigned to dragons, on account of their supposed watchfulness; and in devising loathsome ingredients for the witches' mess, Shakespeare (*Macbeth*, IV. i.) speaks of 'the scale of dragon,' alluding to the horror in which this mythical being was held.

Dragon, GREEN (*Arum* (*Dracunculus*) *vulgaris*), an Araceous plant, with spotted petioles and handsome lobed leaves, and dark-coloured fetid flowers, is common in Greece and other countries of southern Europe, and is occasionally to be seen in gardens. The root-stock is acrid, emetic, and was formerly of medicinal repute in the treatment of piles; also (apparently for no better reason than the doctrine of signatures could draw from the spotted stems) in the treatment of snake-bites.

Dragonet (*Callionymus*), a genus of spiny-rayed bony fishes near the Gobies (q.v.), remarkable for having the gill-openings reduced to a small hole on each side of the nape, and the ventral fins placed under the throat, separate, and larger than the pectorals. The species are numerous, widely distributed in the temperate seas of the Old World, and generally finely coloured. The Gemmeous Dragonet (*C. lyra*) of the British coasts—called *Gowdie* (*gowd*, 'gold') in Scotland—is a fish about 10 or 12 inches long, of a prevailing yellow colour

Gemmeous Dragonet (*Callionymus lyra*).

varied with spots of brown. At the reproductive season the male becomes very gorgeously adorned with blue and violet spots and stripes. This fish is also called Skulpin or Sculpin—a name given in America to a marine bull-head or *cottus*.

Dragon-fly, a name applied to the members of a large family (Libellulidæ) of orthopterous insects, in the subdivision technically known as Pseudo-neuroptera. They are very frequently referred to under the title Odonata. They are well-known insects, conspicuous in their large size, brilliant iridescent colouring, and rapid, restless flight. The slender grace of some forms, especially when half-concealed by the drapery of the wings, has suggested their French title of *demoiselles*, while the Germans hint at a similar comparison in calling them *wasserjungfern*. None the less do they deserve our English name, for they are indeed the dragons and tyrants of the insect world.

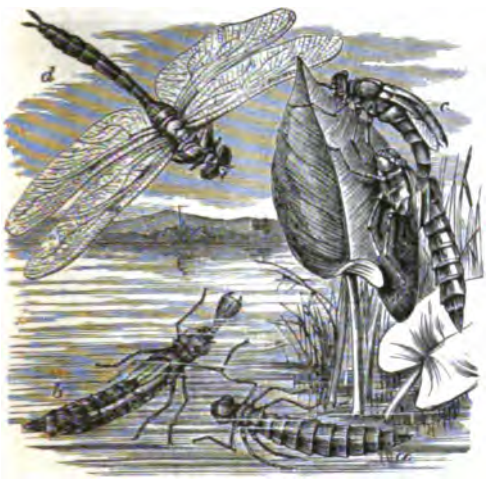
Structure.—The body is long and lank; the two pairs of wings are large and almost equal; the head is freely movable upon the thorax; the eyes are usually very large, and are associated with eye-spots; the mouth organs, overlapped by a large upper lip, are very strong, and remarkably adapted for the capture and mastication of other insects.

Habit.—The dragon-flies live near water, in which they spend their early life. During the day

Dragon-fly and Nymph (*Libellula depressa*).

they are ceaselessly active, poising in the air with very rapid vibrations of their wings, or darting over the pools indeed like 'living flashes of light.' They rest upon bushes and the like during the night. Both as larvæ and as adults they are exceedingly voracious, feeding chiefly upon other insects. The two sexes are often seen flying

together in amatory dance, the male clasping his partner's neck with his tail. The colours of the sexes are often different, and the characteristic radiance of the male is in some cases assumed only at reproductive maturity. The males are sometimes larger, never smaller, than the females. The eggs are laid under water, sometimes within aquatic plants. The larvæ live in the water until they are ready for their metamorphosis. Their voracity is very great, and is satisfied by the deft exercise of the peculiarly modified second pair of maxillæ (labium), which can be extended in front of the head like a pair of nippers mounted on a flexible



Metamorphoses of Dragon-fly (*Aeschna grandis*): a, larva; b, pupa; c, perfect insect issuing from pupa case; d, perfect insect, with wings fully developed.

stalk. This peculiar development is often called the 'mask.' In some young dragon-flies (smaller species of Agrion) there are leaf-like respiratory plates (tracheal gills) at the end of the body; in most the respiration is effected by a rhythmic water-current in and out of the rectum, on the walls of which there are numerous plates abundantly riddled by tracheæ. The expulsion of the water is strong enough to drive the larva slowly onwards. Before the final moult, the larva creeps up the stem of some water-plant, and rests for a while. Then 'an inner impulse rends the veil of his old husk, from head to tail come out bright plates of sapphire mail.' The wings are first small, soon 'grow like gauze,' and are perfected in the using. Tennyson's well-known description of the metamorphosis is vividly accurate.

Forms.—The family includes some 1500 species, which are widely distributed, but most abundant in tropical countries. Yet even the exotic forms do not surpass the splendour of some of our British species. There are three sub-families: (1) Agrioninæ (e.g. Agrion, Calopteryx); (2) Aeschninæ (e.g. Aeschna, Gomphus); (3) Libellulinæ (e.g. Libellula). There are numerous British species—e.g. *Aeschna grandis*, the great dragon-fly, about 4 inches long, and the smaller *Libellula depressa*. The restless activity, the splendid colouring, the voracious carnivorous diet, are probably associated facts.

See T. de Charpentier, *Libellulinæ Europææ descriptæ et depictæ* (Leip. 1840); De Sélys-Longchamps et Hagen, *Revue des Odonates ou Libellules d'Europe* (Brussels, 1850); and the works of Kirby and M'Lachlan.

Dragonnades, the name applied to the persecution of French Protestants, begun by Louis XIV. in 1681, by quartering dragoons in Protestant villages and houses, and giving up the inhabitants to the outrage and plunder of the soldiery, until they should abjure their faith. Armed expeditions marched through the provinces, and by their prompt measures many heretics were restored to the bosom of the church; and in consequence, on the 22d October 1685, Louis revoked the Edict of Nantes (q.v.), that the good work might be fully accomplished. See CAMISARDS, and HUGUENOTS.

Dragon-root (*Arisæma atrorubens*), an Araceous plant, of which the acrid tuber is applied to various uses in domestic medicine, especially in North America.

Dragon's Blood is a name which has come down to us from ancient pharmacy in somewhat vague application to a number of resinous substances broadly agreeing in their deep-red or reddish-brown colour and astringent properties, but of very various origin. *Dracæna draco*, the Dragon-tree (q.v.) of the Canary Islands, yields on incision or even exudation from the stem or leaves, a variety which was formerly of commercial importance, and which is found in the prehistoric Guanche graves, apparently as an accessory of the embalming process. A more important variety is that obtained from the fruits of *Calamus draco*, an East Indian palm. The Red Sandalwood (*Pterocarpus santalinus*, a papilionaceous tree) is another East Indian source, while its West Indian congener, *P. draco*, is of considerable importance. The allied *Dalbergia monetaria* of Guiana, and the Mexican *Croton draco*, must also be mentioned. In Australia the resin of *Eucalyptus resinifera* has also acquired the same name. On account of its colour and astringent properties, dragon's blood has long been used in the preparation of dentifrices; also in alcoholic solution for staining marble, leather, wood, &c., and in oils and turpentines in the preparation of varnishes.

Dragon's Head (*Dracocephalum*), a genus of Labiatæ, common in gardens, so called from the form of its corolla.

Dragon's Mouth, a popular name for Antirrhinum, generally replaced in common usage by that of Snap-dragon (q.v.).

Dragon-tree (*Dracæna draco*). This genus of Liliaceæ (sub-order Smilaceæ) is not only remarkable for its resin (see DRAGON'S BLOOD), but also

Dragon-tree (*Dracæna draco*) at Teneriffe.

through the indefinite thickening of its stem by means of a cambium-like layer of embryonic cells, and the consequent resemblance in permanence and general habit to a dicotyledonous tree. The examination of a microscopic section of a young stem, however, shows that the thickening arises not as in

dicotyledons or conifers through the activity of true cambium—i.e. a surviving tract of embryonic tissue between the wood and bast of the fibro-vascular bundles—but in an essentially distinct and simpler manner. The stem is at first normally monocotyledonous in structure—i.e. with closed scattered bundles of the ordinary type. The embryonic layer (false cambium) lies wholly outside these, and grows steadily outwards, depositing new imperfect bundles on the inner side alone (see MONOCOTYLEDONS, STEM). The growth is slow, but seems practically unlimited. Thus the great dragon-tree of Orotava, Teneriffe, so famous through the description of Humboldt and other travellers, was about 75 feet high, 50 feet in girth, with an internal cavity about 10 feet in diameter. Not simply was it of almost as vast size when the islands were discovered in 1492, but calculations, based on the observed rate of growth of younger trees, carried it back to a probable age of from five to six thousand years. Unfortunately it was blown down by a storm in 1868. Species and varieties of Dracæna are in great and increasing esteem as foliage plants. *D. marginata*, *stricta*, *terminalis*, &c. may be mentioned as old favourites, but a due conception of their

Branch of *Cordyline* (Dracæna) *australis*.

importance may be best obtained by reference to florists' catalogues. Species of the allied genus Cordyline, especially those from New Zealand, are sufficiently hardy to be planted out of doors in summer. *D. terminalis* is used for hedges in the East, and boundary marks in the West Indies, on account of its conspicuous red foliage.

Dragoon, a cavalry soldier who is armed with an infantry firearm, and trained to fight on foot as well as on horseback. The name was derived from the dragon's head worked upon the muzzles of the short muskets first carried by Marshal Brissac's horsemen in the year 1600. Dragoons were originally intended to act as mounted infantry, and in order to make them more efficient in that capacity, the Russians have recently armed theirs with the long rifle. In the British army, all Cavalry (q.v.) carry Carbines (q.v.), but the name dragoon is given to those regiments which wear helmets only. After the Crimean war, the so-called *light* dragoons were changed into hussars, leaving three regiments of dragoons, seven of dragoon guards, and the three cuirassed regiments of household troops. Six of these are classified as *medium*, and the remainder as *heavy* cavalry, but the men and horses are all big, as compared with those of hussar and lancer regiments. The weights carried by the horses on the march are 19 stone 4 lb. for dragoons, 18 stone 10 lb. for lancers, and 18 stone for hussars. The oldest dragoon regiment is the Scots Greys, established 1683.

Draguignan, the capital of the French department of Var, on a tributary of the Argens, and at the base of the wooded Malmont (2151 feet), 51 miles by rail NE. of Toulon. It has a college, and manufactures of leather, silk, soap, &c. Pop. 8562.

Drainage is the art of carrying off water from the soil and subsoil of land by means of open or closed drains or trenches; the term, however, is generally understood to apply to closed drains. By its means the fertility of wet land has been greatly increased, and the climate of districts which were before wet and swampy very much improved. When the drains are put in every six or ten yards, it is called *furrow* or *frequent* draining.

The vast amount of capital which has been expended in drainage since the development of the improved methods of draining attests its utility and necessity. Before the introduction of furrow-draining, stiff and tenacious clays were of comparatively little value. They were cultivated at much expenditure of labour, and the crops which grew upon them were influenced to an exceptional extent by the variations of the seasons.

Drainage by open ditches was no doubt the first mode of freeing land from superfluous water. The Roman agricultural writers mention the good results arising from covered drains, formed of wood and other substances, which served so far to render the land dry. In the 18th century, a large extent of clay-land was drained at narrow intervals in Norfolk and Essex, by putting in brushwood and even straw in the bottom of the drains. The progress of draining, which is now regarded in many soils as essential to economic culture, was slow and partial, until James Smith of Deanston, in 1823, reduced the practice to a system, and showed the principles upon which its efficiency depended. Through the exertions of this advocate, furrow-draining soon became a *sine quâ non* in the culture of clay-soils, or indeed most soils, in moist climates.

Practical men consider the line of greatest fall, or quickest descent, as the best for cutting drains in a field. The smaller drains are usually conducted into larger or *main* drains, instead of each discharging its quota of water into the open ditch. This is rendered necessary, as the mouths of the smaller drains would be more liable to be choked up by the growth of weeds; while the collecting of water into main drains secures a fuller flow to sweep out any matters which might accumulate where the discharge was small. Moreover, the less of the action of the air in the drains the more efficient they are.

The most efficient, and at the same time most cheaply cut drain, is one represented at fig. 1. It is made so that a pipe of a cylindrical form may be laid along the bottom, which need be of no greater width than what is necessary to allow of the pipes being properly laid. Drains of this form are cut with a set of spades which are of different widths—the broadest being used for taking out the top, and the narrowest for the bottom. The work of forming pipe-drains is now accomplished in some cases by a mechanical apparatus which is propelled by steam-power, and which at the same operation makes the cutting in the soil and lays the pipe.

Fig. 1.

Before the general use of pipes, stones were the common materials with which drains were formed.

Smith of Deanston, recommended that they should be broken so small, that they might pass through a ring two inches and a half in diameter. From nine inches to a foot in depth was the quantity which was commonly put in. Where stones can be easily got they are still preferred to tiles, as cheaper, and if well put in, more efficient and durable. A good plan is to set a pretty large block at each side of the bottom of the drain, and then use a third as a sort of wedge. A coating of smaller stones is surmounted by turf.

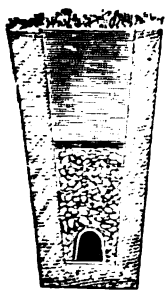


Fig. 2.

When tiles and pipes were first used, it was even thought necessary to have some gravel, or small stones, placed above them in the drains, for the purpose of enabling the water to find its way into them, as seen at fig. 2. It was soon found, however, that tile drains were quite as efficient without any stones or gravel; and that they were less liable to be choked up, as the clay or earth acted as a filter in preventing the intrusion of any kind of solid matter.

Many kinds of tiles and pipes have been tried, but the cylindrical form is most used. At one time, a bore in the pipe of an inch in diameter was thought sufficient, but two-inch pipes are now preferred, the size of pipe selected in each case, depending upon the probable amount of water to be carried away. Drain-pipes are usually made about 15 inches in length. In some cases a *collar* is used to insure the complete continuity of the drain. The *collar* is a short length of circular tube which loosely embraces the two pipes and thus covers the joint. This *collar* was at one time thought quite essential for the durability of the drain, but it has been found in practice that well-laid pipes will work efficiently and endure satisfactorily without them. And, therefore, as they increase the cost considerably they are not now so largely used. In soft mossy or clayey subsoils, semi-cylindrical tiles called muggs have been laid on lath, with the bend up.

Mr Smith at first advocated the making of drains from 2½ to 3 feet deep, at intervals of from 10 to 40 feet. Experience, however, has been gradually favouring deeper drains, at wider intervals. Even on the most tenacious soils with subsoils of *till*, few now think of having drains less than 33 to 36 inches in depth, though the distance apart should not in many cases be more than from 15 to 18 feet. The depth, however, depends greatly on the soil; 3 to 4 feet, with the leader drains 6 inches more, are common dimensions. In mossy land the depth has sometimes to be 7 feet. The width between drains depends on the wetness of the land and the character of the subsoil. It is now well understood that the success of draining by pipes depends upon the fissures which are produced in the subsoil by the droughts of summer never entirely closing up; and thus minute channels are formed, which lead the water into the drains.

The principal advantages of drainage are, the deepening of the staple soil, and rendering it more friable, so that a superfluity of water, which would cause the formation of those chemical compounds that are found in stagnant water, is prevented. The greater depth of mould, and more perfect culture, render the soil more absorbent of moisture in dry weather. As crops can usually be sown sooner on drained lands, they also ripen earlier, and produce more abundantly. In short, while drained land obtains a greater capacity for moisture and manure, it imparts to plants greater capabilities for economically working up the materials which they find in the soil and atmosphere, seeing they are maintained in the most healthy conditions of growth.

Drainage in its various forms has, as is well known, not only improved the fertility and value of land in Britain, but materially changed the aspect and climate of large districts which before suffered from the wet, swampy character of the surface soil. Mosses and wet rushy lands have been transformed into dry and productive fields, while by the removal of all superfluous pools, the air is freed from those hovering vapours which are injurious to general amenity and salubrity. To the farmer, the more immediate advantage of drainage consists in that rapid running off of the water which falls as rain, so as to admit of working lands without any undue delay, while natural springs and dampness, from whatever source arising, are also run away with wonderful success. Drainage on methods similar to those of Mr Smith is also practised in the United States.

The drainage of houses and cities is considered at SEWAGE; and the reclamation by draining of fens, swamps, lakes, and inundated regions is noticed under WASTE LANDS, BEDFORD LEVEL, BŒOTIA, BOG, HAARLEM LAKE, HOLLAND, POLDER, ZUIDER ZEE.

Drainage-tubes, in Surgery, are a recent but important addition to the surgical appliances for which this profession is indebted to a distinguished French surgeon, M. Chassaignac. Their general adoption in Britain has been largely due to the advocacy of Sir Joseph Lister. They are composed of india-rubber, from ⅛ to ⅜ inch in diameter, perforated with numerous holes, and of various lengths. They are especially useful in chronic abscesses, but also in large wounds, such as those made by amputation, and in all cases where there is apt to be a deep accumulation of discharge. They are introduced in such a manner that one end is on a level with, or projects above the skin; the other is in communication with the seat of discharge; and by allowing that discharge constantly to escape from the external wound, they diminish both chemical irritation from putrid accumulation and mechanical irritation from pressure. For operation wounds, some surgeons prefer to use tubes of decalcified bone, which are gradually absorbed by the action of the tissues, and do not necessitate a change of dressing for their removal. In some situations, where india-rubber tubes would be apt to collapse under the pressure of the surrounding parts, tubes of glass (in certain abdominal operations) or of metal (in empyema) may be used instead.

Drake, SIR FRANCIS, the greatest of the Elizabethan seamen, was born near Tavistock, most likely in 1540. His father was apparently in humble life, is said to have had twelve sons, and to have been obliged for conscience' sake to take shelter in Kent. The boy was apprenticed at an early age to the master of a small vessel, who bequeathed it to him, after which he followed the coasting trade some years. 'But the narrow seas were a prison for so large a spirit, born for greater undertakings,' and by 1565 he was voyaging to Guinea and the Spanish Main. In 1567 he commanded the *Judith* of 50 tons in his kinsman John Hawkins's ill-fated expedition; next made in 1570 and in 1571 voyages to the West Indies with a view to find intelligence how to make good the losses he had suffered from the Spaniards at that time. Next in May 1572 he equipped two small ships, the *Pasha* and *Swan*, with but seventy-three men, landed at Nombre de Dios, 29th July, and beat off the Spaniards after a short struggle, in which he was severely wounded. His own fainting from loss of blood alone prevented the 'Treasure of the World'

from being carried off. In this audacious expedition Drake further burned Porto Bello, captured and destroyed many Spanish ships, crossed the isthmus to the highest point of the dividing ridge, where, climbing a tree from whose tops the guides told him both seas could be seen, he gazed upon the vast waters of the South Seas, and with that touch of romantic enthusiasm that redeemed all his piracies, 'besought Almighty God of His goodness to give him life and leave to sail once in an English ship in that sea.' Drake arrived in Plymouth on Sunday, 9th August 1573, during sermon-time, when the news of his return 'did so speedily pass over all the church, and surpass their minds with desire and delight to see him, that very few or none remained with the preacher, all hastening to see the evidence of God's love and blessing towards our gracious queen and country.'

In 1577 he fitted out another small squadron of five vessels, the destination of which was kept secret, consisting of his own ship the *Pelican* of 100 tons, the *Elizabeth* of 80 tons, and three smaller vessels, and with these sailed from Plymouth on the 13th December. One Thomas Doughty was tried and executed at Port St Julian for an attempt to stir up a mutiny, and on the 20th August, the squadron, now reduced to three ships by the burning of two, entered the Strait of Magellan, and here Drake changed his own ship's name from the *Pelican* to the *Golden Hind*. In sixteen days they made the passage, then followed violent tempests for fifty-two days, during which the *Marigold* foundered with all hands and the *Elizabeth* parted with the admiral and resolved to return home. She reached England, 2d June 1579. Drake was driven far to the southward, but at length was able to alter his course and steer northwards again. At Valparaiso he provisioned his ship from the Spanish storehouses, reached Callao on 15th February 1579, found a rich prize off Cape Francisco (March 1) and another on 4th April. Drake now determined to return home by crossing the Pacific. He touched land at a creek on the northern side of the Golden Gate, then for sixty-eight days together had no sight of land until he made the Pelew Islands. After refreshing three weeks at Ternate, and a thorough refit on the south-west coast of Java, he held for the Cape of Good Hope, and arrived in England, 26th September 1580. The queen, in the face of Spanish protests, was at first uncertain how to receive Drake, but at length (April 4, 1581) paid a visit to his ship at Deptford, and knighted him on its deck.

In the autumn of 1585 Drake sailed with a fleet of twenty-five ships against the Spanish Indies, harrying Hispaniola, Cartagena, and the coast of Florida, and after great sufferings from sickness, brought home the 190 dispirited Virginian colonists, with tobacco and potatoes (28th July 1586). Early in 1587 he set sail with a strong squadron to cripple the king of Spain in his own seas, and retard his preparations for invasion—a sport which he called 'singeing the king of Spain's beard.' Sailing right into the harbour of Cadiz, he sank or burned as many as thirty-three ships, and made his way out unscathed. The seeming recklessness of his tactics was no devil-may-care bravado, but due to consummate seamanship no less than promptitude and courage. Drake next sailed to the Azores, capturing a rich homeward-bound Portuguese carack worth £100,000. In the face of the impending struggle for which Philip II. had long been preparing, his persistent plan was to follow up the policy of harassing the enemy on his own coasts—'to seek God's enemies and her majesty's where they may be found.' In a letter to the reluctant and parsimonious queen not three months before the actual sailing of the Armada, he reiterates his advice 'to encounter them somewhat far off, and more near their own coast, which will be the better cheap for your majesty and people, and much the dearer for the enemy.' There is no doubt that Drake's plan was the best, and had not the elements themselves fought for England, the issue might have been vastly different.

Drake's division in the three-fold arrangement of the English fleet was at first stationed off Ushant, until all the ships were blown together to Plymouth by the same storm that carried the Spaniards across the Bay of Biscay. Here, on the Hoe, the admirals and captains were playing the famous game of bowls, when the news was brought that the enemy was off the Lizard. Howard was eager to put to sea at once, but Drake would first finish the game, saying 'there 's plenty of time to win this game, and to thrash the Spaniards too.' The story, whether true or no, is in perfect keeping with the character of the man. Early next morning the battle began, and raged along the Channel throughout the week. Drake's consummate seamanship and audacious courage covered him with fresh glory, and inspired new terror in the Spaniards. He captured the *Rosario* off Portland, whose captain, Don Pedro de Valdes, ransomed himself with £3000 three years later. On the 29th July occurred the final action so disastrous to the Spaniards, after which they came to their fatal determination to return to Spain round the Orkneys. Two days later Drake wrote to Walsingham: 'There was never anything pleased me better than the seeing the enemy flying with a southerly wind to the northward. God grant you have a good eye to the Duke of Parma, for with the grace of God, if we live, I doubt it not, but ere it be long so to handle the matter with the Duke of Sidonia, as he shall wish himself at Saint Mary Port among his orange trees.' It was not long before want of ammunition compelled Drake and Howard to fall back from the chase, but the storms of the northern seas took up their work and swept the Spaniards to destruction. Drake's fears that the Armada might refit in Denmark were happily frustrated, and the liberties of England were saved. Next spring a great expedition under him and Sir John Norreys sailed for the coasts of Spain and Portugal, but had little success beyond the damage inflicted upon the Spanish shipping, while sickness and actual hunger carried off thousands on board the crowded and ill-victualled ships. Drake spent his next few years in peaceful labours on shore, bringing a new water-supply to Plymouth, and representing the town in parliament. In August 1595 he sailed from Plymouth on his last expedition to the West Indies. Ill-fortune followed the fleet from the beginning; Hawkins, the second in command, died off Porto Rico in November, and Drake himself fell ill from dysentery and died off Porto Bello, 28th January 1596. His body was put into a leaden coffin and next day committed to the deep; in the fine words of an anonymous poet quoted in Prince's *Worthies of Devon*:

> The waves became his winding-sheet; the waters were his tomb;
> But for his fame, the ocean sea was not sufficient room.

The best Life is still that by Barrow (1843); a monograph by Julian Corbett appeared in 1890.

Drake, FRIEDRICH, a celebrated German sculptor, born at Pyrmont, 23d June 1805, and trained under Rauch of Berlin. Among his principal works are 'The Eight Provinces of Prussia' (colossal allegorical figures, adorning a hall in the royal palace at Berlin), and a 'Warrior crowned by Victory,' which is reckoned one of the masterpieces of German sculpture. But Drake owes his celebrity chiefly to statues, busts, and medallions,

and there are few of his great countrymen of whom he has not preserved a marble memorial. His statues of Schinkel, the two Humboldts, Rauch, Oken, his colossal statues of Frederick-William III., and William I. at Cologne, deserve especial mention; as also the busts of Bismarck and Moltke. Drake, long professor of Sculpture in the Academy at Berlin, died 6th April 1882.

Drake, NATHAN, Shakespearian scholar, was born at York in 1766, graduated M.D. at Edinburgh in 1789, practised his profession for forty years at Hadleigh, in Suffolk, and died in 1836. He published several collections of more than average essays, but his name now lives only in his learned and valuable *Shakespeare and his Times* (2 vols. 1817). A supplementary work was entitled *Memorials of Shakespeare, or Sketches of his Character and Genius by Various Writers* (1828).

Drake, SAMUEL GARDNER, American antiquary, was born in Pittsfield, New Hampshire, in 1798, and in 1828 established in Boston what is said to have been the first antiquarian book-shop in the United States. He published a number of reprints and of valuable works relating chiefly to the early history of New England. He died 14th June 1875.

Drakenberge ('Dragon Mountains'), the general name given by the Dutch colonists to the range of mountains in the east of South Africa, between Cape Colony and the Vaal River. From about 29° S. lat. the three chains which form the southern portion unite and extend north-eastward in one mass, whose highest points are the Mont aux Sources and Catkin Peak (10,360 feet). The range is crossed by Van Reenen (5415) and De Beers (5635) passes.

Dram. See DRACHMA.

Drama, a Greek term literally signifying action, and applied to that form of literature which serves as text for what in the same sense is called acting, that is to say, the performance before spectators of an 'acted' and spoken imitation of scenes of life. The following article discusses merely the drama as limited to a class of literary productions, the art of acting and the history of theatrical performances being reserved for the article THEATRE. Nor will any attempt be made here to give a detailed account of the work of distinguished dramatists, which will be found from Æschylus downwards under the proper heads. We shall here confine ourselves to the survey of the general characteristics of the successive schools of literary drama in Greece, Rome, the middle ages, and modern Europe. In some oriental languages the drama holds a not unimportant place, but the written examples are not supposed to be of very great antiquity, and in any case they are, as drama, much inferior in interest to the European examples.

No specimens of the earliest age of Greek drama, that is to say, of the compositions, either purely dithyrambic or consisting of choric songs interspersed only with monologue, which are supposed to have prevailed in the infancy of the art, now survive, nor can much (if anything) be said to be known about them. Our earliest examples, the dramas of Æschylus, whose chief predecessors were Phrynichus, Chœrilus, and Pratinas, exhibit the drama in a very advanced condition, so far as the particular style goes. The dialogue, though in the earliest examples not more than two actors were permitted to be present as speakers on the stage at the same time, is managed so as to unfold a varied and completely dramatic story; while the chorus, either as a whole or subdivided into sections, performs its lyrical odes, and, when necessary, takes part by its leader, and rarely by other members, in the actual dialogue. The almost immediate addition of the tritagonist or third speaking actor, which, whether due to Æschylus himself or not, appears in his later plays, is practically the only change of importance subsequently made; and this was not as a rule further extended in Greek tragedy, that is to say, in the works of the three great writers, Æschylus, Sophocles, and Euripides, of whose works we possess, though unfortunately but a very small proportion, yet a part considerable when considered by itself. Very rarely the *quarta persona* or something like him appears, but this is a mere exception, and unimportant. We have thus the very remarkable phenomenon of an extremely artificial and complicated art, which seems almost within a single generation to have attained its furthest possible development. The actors—who sometimes make a tolerably numerous list, though not more than three may, as a rule, figure on the stage at once, except as mute persons—conduct the dramatic performance strictly so called by dialogue, gesture, and a certain amount (though less than on the modern stage) of action. The chorus, in its odes, explains incidents which assist if they are not necessary to the comprehension of the action, moralises on this same action, and occasionally takes part in it, giving in its specially choric utterances a certain heed to the keeping up of the sacred character which (see THEATRE) seems to have been associated with the origin of dramatic performances, if not of dramatic writing, in almost all countries.

The plays written for this disposition of company were for the most part, if not always, arranged in trilogies or sets of three, followed or not by a fourth play of a quite distinct and comic or satiric character. Whether there was any original reason for this arrangement, except that of convenience, is not known; but the reasons of convenience, when the limitations of the drama are considered, are obvious. For with each new play the restrictions of the Unities were relaxed, or rather disappeared altogether, and a fresh time, a fresh place, and an only distantly connected scheme of action could be entered upon. These famous Unities, which at various times in the history of literature have been the subject of the fiercest discussion, appear to be less *a priori* rules which the authors had before them and obeyed, than generalisations from these authors' practice, which later critics and students deduced and formulated. Some slight and some serious deviations from them, as in the case of the change of scene and the lapse of time in the *Eumenides*, have been detected. But generally speaking, the Unity of Time rules that not more than twenty-four hours are to be supposed to pass; the Unity of Place, that the scene shall not be changed; and the Unity of Action, that nothing like an independent underplot shall be permitted, every incident, and practically every speech, being subordinated to the main argument. On the whole, these strict conditions are very strictly observed. When they were taken with the exact and (in the case of the choruses) intricate metrical structure of the verse, they set Greek tragedy at the head of all literary performances as an example of exquisite symmetry of form, of severe but not overdone proportion. It is, however, almost as remarkable that, at least in Æschylus and Sophocles (for the 'Third Poet' is in this respect far inferior), no deficiency of dramatic interest attends this severity of form. Even in the earliest examples the metrical arrangements—iambic trimeter and trochaic tetrameter for the dialogue, anapæstic dimeter for part of the chorus work, and a vast variety of apparently lawless but in reality most correctly regulated rhythms for the rest—are consummate. The magnificent poetical quality of Æschylus, the sense of overmastering fate with which he

manages to charge all his drama, and the perfect humanity of Sophocles, relieve their work entirely from the charge of sterility which has been brought against more modern imitations of their form. No other general remark is required as to Greek tragedy, except that its subjects, as we have them, were limited to poetical and heroic tradition, with a certain admixture of what in modern literature we should call the chronicle-play, or drama of contemporary event. The only extant example (for we know that there were others) is the *Persæ* of Æschylus; an exceedingly interesting play, because it shows the ease with which the Greeks could achieve what has baffled almost all moderns.

We are even more scantily furnished with examples of Greek comedy. Indeed, we have no complete specimens, except (very fortunately) the work of the acknowledged chief of the style, Aristophanes. Yet we know that not only the two poets whose names are indissolubly coupled with his—Eupolis and Cratinus—but many others, illustrated what is called the Old Comedy, in which persons and political events of the day were satirised with a fearlessness never exceeded, rarely equalled, and likely to provoke (as we know it did provoke) violent reprisals. In addition to this we have in the *Cyclops* of Euripides an example, though probably not a very typical example, of the satiric play which finished the tragic trilogy, making with it a tetralogy. Of the so-called Middle and New Comedies which succeeded the Old, and which successively attenuated its bold personal attack into a weak comedy of manners, we have no specimens at all, though we can judge to some extent of their nature by the Latin imitations which have survived. But the great name of Menander, although illustrated at the present day only by the merest fragments, survives with a reputation in the New Comedy only inferior to that of Aristophanes in the Old. Of the two later kinds, the best that can be said is that the Greek genius, with its almost unfailing peculiarity of pushing such kinds as it attempted at all to their utmost capabilities, elaborated pretty completely the stock comedy, or comedy of certain general types of character; and that great as have been the changes of manners, no one, with the single exception of Molière, has made much original addition thereto since. Of the Old Comedy much more might be said, though we must for the present chiefly refer the reader to the article ARISTOPHANES. It must suffice here to say that to an abundance of wit in dialogue, not excelled even by Molière and Congreve, Aristophanes joined poetical faculties to which neither of these great writers can make the faintest pretence, a bold and thorough grasp of politics, which he exhibits especially in the parabases or direct addresses to the audience, and a quality of humour in the English sense, which no other ancient has approached. If it were not for the limitations of the female characters which Greek manners necessitated, Aristophanes would probably have been the equal of Shakespeare in the comedy of which *As You Like It*, *A Midsummer Night's Dream*, and *Much Ado About Nothing* are examples that never can be excelled, and that have never been equalled in their own way. As it is, the *Knights*, the *Clouds*, and the *Frogs* deserve exactly the same description.

It was thus the fortune of this extraordinary people, in the literary practice of a very brief period of years, to leave examples ranking to this day in the first class of the literature of the world, and serving as the basis of a set of critical rules which, followed not always with knowledge, governed literature until but the other day. Their immediate disciples and successors, the Latin poets, added but little if anything to the general system of drama, and their work has been transmitted to us in a most fragmentary condition. Latin tragedy of the regular kind may be said to have perished *en masse*, with a singular and very important exception. By very great good luck the comic work of Plautus and Terence, which we possess in good measure, not only represents for us the two great divisions of the Greek comic drama which, as we have said, are in Greek utterly lost, save in the most insignificant fragments, but exhibits in its own characteristics a very important difference of feature. The work of Terence is distinctly literary work, probably coming as near as the author could manage to its Greek originals. The work of Plautus, though hardly less indebted in many cases to those originals for plot and incident, displays a very strong infusion of vernacular character—the character, as we may judge, of the lost Atellan farces, and the character generally of Roman humour. The fault of Terence is, that he is thin; the fault of Plautus is, that he is coarse; and as far as we can judge from evidence but little more abundant than the fragmentary bones of extinct animals, these two defects may or must have been characteristic of the Roman drama generally. Of the tragedy, as we have said, at least of the early tragedy of Pacuvius, Accius, and others, it is very hard to judge at all; but there seems good ground for regarding it as a feeble copy of Greek, probably with attempts to make up for feebleness by rant of diction. The very remarkable group of works which are attributed to Seneca, whether to L. Annæus Seneca, the philosopher, or another of the same name, but which at least date with certainty from the imperial period of Rome, stand by themselves. They represent various styles, the heroic and so to speak romantic kind, the kind of already somewhat distant history, and the kind of contemporary interest. They are pretty obviously what we call 'closet drama,' that is to say, whether they were ever acted or not they were clearly written as writing, and not merely as playwright's work. They have, with much literary ability, a certain absence of *vis vivida*, though this absence has often been exaggerated. But where they are so very important is in this—that they, far more than the great early plays of Greece, determined the tragic revival of the Renaissance. It is Seneca, not Æschylus, not Sophocles, not even Euripides, that the experimenting dramatists of Italy, of England, of France most of all, follow when they attempt the regular tragedy in the 16th and 17th centuries. Seneca (not any of 'The Three') is directly responsible for Corneille; and if England had not set her face against it, it was Seneca who would have been reproduced in England by Sackville and Norton, by Edwards, by Daniel, by the Countess of Pembroke, and others; as he was in France by Garnier and Montchrestien; as he had been in Italy by Trissino.

It is, however, evident that the drama, as distinguished from pantomimic shows, beast-fights, and the like, was not a favourite kind of literature either with the Romans or with the inhabitants of the Roman empire; and this partly accounts for the ferocity of the early fathers of the church against the theatre, a theatre which was for the most part occupied by things very different from the *Antigone* or the *Eumenides*, by things compared to which even the *Lysistrata* would appear innocent. It also accounts for the small attraction which dramatic writing seems to have had for the authors of the empire. Lucian, for instance, ought to have written admirable plays; but he has left us not one. And by degrees, from the combination of all the causes hinted at and others, drama seems to have become practically extinct. The early dark

ages produce nothing worth speaking of, while the Terentian comedies of the nun Hrotswitha stand by themselves, and are little more than literary *pastiches*. When the drama reappears, the reappearance marks a genuine new birth. As before, this birth was connected with the offices of religion, though the precise extent to which this connection reached is a matter of great, and (if one who has given some attention to it may say so) of never-to-be-settled debate among the learned. It is sufficient to say that about the 11th century in France appear the beginnings of the famous miracle or mystery play, which has sacred subjects only, is in its earliest forms very short, and consists for the most part in the representation 'by personages,' as the vernacular phrase went, either of scenes from the Bible or of legends of the saints. There is no chorus in the proper classical sense, though rarely there are approaches to it. The metre is usually rhymed octosyllabic couplets, with a few more complicated schemes thrown in, and the dramatic action, though genuine and complete as far as it goes, is very simple. This kind, which is still represented in sophisticated forms by the famous Ammergau passion-play, was extremely popular; and though later in other countries than in France, has tolerably early representatives in most of them, especially in Germany and England. France, however, was its special home, and the liking of the people for these at first sacred dramatic performances seems to have branched out there into a variety of secular kinds, which, so early at any rate, are not paralleled anywhere else. As early as the 13th century a single French author, Adam de la Halle, originated, so far as is known, two important styles, the comic opera (in *Robin et Marion*) and the modern comedy, in the half autobiographic composition called the *Jus* [*Jeu*, 'game'] *Adam* or *Jus de la Feuillie* ['of the booth']. Of these compositions the former has hardly a trace of roughness, while the latter contains no hint of classical inspiration. By the 14th century probably, by the 15th certainly, France had added to the miracle or mystery, which branched out into the 'profane mystery' or chronicle-play dealing with current events or ancient history, not merely the *farce* — the dramatisation of the earlier verse *fabliau* or comic story, and the 'Morality'—an allegorical play of virtues, vices, and the life of man generally, to which the general medieval passion for allegory gave great vogue; but also the *sotie* or political farce, something like though not in the least imitated from the Athenian comedy of the old type, as well as not a few minor varieties. The passion for dramatic entertainments was very great; societies or guilds existed for their performance, and it was not unusual for days, or even weeks, to be occupied in a single display. We still have mysteries extending to fifty thousand lines, and altogether it may be said that this passion for scenic representation, as it has been always more widespread, developed itself earlier in France than in any other European country. It is not a little striking also, that in the south-west corner of France the morality still substantially survives in the Basque *pastorales*.

In no other country than France, however, did the tastes of the middle age receive a more complete check and change at the Renaissance; and as this change was partly connected with the importation of Spanish and Italian fashions, it may be desirable very briefly to sketch the great and interesting dramas of the two peninsulas before recounting the later history of dramatic literature in France.

Great as are the performances of Italy in European literature, her achievements in drama, even to these late days, are of little moment, when compared with the towering fame of Dante and Petrarch, of Ariosto and Tasso. Her chief influence was to direct France into following the Senecan tragedy, and, through a writer who took the French name Larivey, but who was really a Giunto, the Terentian comedy somewhat relaxed. No Italian medieval work for the stage is in the least remarkable; but as soon as the Renaissance dawned, divers writers, Trissino especially, adopted the stiff form of tragedy already referred to, and persons no less notable than Macchiavelli, Cardinal Bibbiena, and the great Ariosto, attempted comedy. Before very long, however, the lyrical drama, which under the name of opera, was from Italy to conquer Europe, pushed drama proper much out of favour. It was a little restored by a group of learned writers in the late 17th century, the chief of whom was the Marquis Maffei, a soldier, an antiquary, and a playwright, whose *Merope* Voltaire deigned to follow very closely. Goldoni and Gozzi started a school of comedy which was to a great extent a reflection of national manners, and has real distinction. Whether as much can be said of the formal lyric dramas of Metastasio in the middle, or of the much vaunted tragedies of Alfieri at the end of the 18th century, is perhaps a matter of taste. There are some who hold that in no poet is the worse side of the so-called classical drama more apparent than in the second of these writers. But neither Alfieri nor any other writer of Italy has succeeded in drama, since the school of Venetian comedy above mentioned, in striking what may be called an original note, though during the 19th century Manzoni and others have attempted the style. In general literary history the dramatic achievement of modern Italy is the determination of France into the classical model.

Very different is the record of Spain. It is an infinitely more germinal history than that of Italy, though unluckily it is even shorter. The strong, though apparently not sustained originality of Spain, showed itself nowhere more than in her drama. No medieval performances of much merit are cited by historians; but instead of being diverted by the Renaissance into a mere following of classical models like France and Italy, the Spaniards showed independence almost equal to, and an immediate command of form far greater than, that of the English theatre itself. In part they continued the religious tradition by their *autos;* in part they diverged into romantic drama of the freest kind; and they almost invented for themselves the comedy of fashionable life and intrigue which was imitated freely by all the great playwrights of the 17th century in other countries, and which is famous for its prodigal waste of ingenuity, if also for its rather penurious thrift of probability. They furnished in the Don Juan (q.v.) story one of the two or three most fertile dramatic motives of Europe, and in Lope de Vega and Calderon they produced dramatists not equalled in fertility anywhere, and surpassed in genius only by the greatest names of the world. Half at least of the most famous plays of the French classical period are more or less directly borrowed from Spain, and England also pillaged in her turn. But the period of Spanish dramatic productiveness was unfortunately as short as it was brilliant; and it has had no revival. What the Spaniards did for Europe in dramatic matters was to develop a fertile and powerful drama in complete defiance of classical traditions, to show the dramatic possibilities of the supernatural, and to push almost to the farthest extent the comedy of ingenious surprises, and 'wheels within wheels.' The merits of this drama are the more remarkable that its most usual metrical vehicle, the trochaic

dimeter, does not seem beforehand very well suited for the purpose.

The first influence which impelled men to the creation of the new drama in France came, as has been said, from, or rather through Italy; but it was necessary before dramatic work of the first class could be produced, that the Spanish influence should also be felt. It is at first sight surprising that so vigorous and racy a kind as the indigenous comic drama of France had already shown itself to be, should be pushed out by a merely learned and literary importation. Nor in fact was it so, except in Paris and one or two other centres of culture, while even there it was not completely banished until the genius of Molière, which long exercised itself in something very like the ancient farce, effected a combination between the vernacular, the Terentian, and the Spanish comedy. In tragedy, however, the school commonly called the Pléiade—i.e. the poet Ronsard and his set—effected a complete revolution or innovation, following the Senecan model. The two plays of Jodelle, a member of the Pléiade itself, *Cléopatre* and *Didon*, set the example of a tragedy exactly resembling those attributed to Seneca, with choruses and all apparatus complete. This style of tragedy was continued for many years, and was cultivated by at least two poets of the greatest talent, Robert Garnier and Antoine de Montchrestien; but the choruses were by degrees dropped as unsuitable to modern audiences. Still the substance of the tragedy remained much the same, even when, in the hands of a later school, of whom Alexandre Hardy was the chief, a great infusion of Spanish romanticism took place. Nor was the scheme much altered, whatever might be the case with the treatment, when Rotrou and Corneille at last formed the French classical tragedy proper. For the details of this reformation, and of the similar, though less strict reformation which comedy, in the hands of Scarron, Corneille, and Molière chiefly, also underwent, reference must be made to the separate articles on Corneille, Molière, and Racine. As produced by these three great men, and by imitators in the second half of the 17th century, both tragedy and comedy assumed shapes which France long retained unaltered, and which for a time gave law and pattern to all Europe except England, and even to some extent there. The tragedy was of the Greek or rather the Senecan kind, without choruses, and with a slight relaxation of some of the minor stringencies, but with the unities for the most part maintained, and with, as a rule, the fortunes of a love affair substituted for the classic themes of fate and inherited doom. The metrical structure was unvarying, alexandrines or iambic trimeters arranged in couplets tipped with *rimes difficiles*, or rhymes as elaborate as possible. Much less restriction trammelled comedy, which accordingly ranks higher. It might be written either in prose or in verse; the unities of place, and even to some extent of action, were neglected or construed loosely. A very great variety of interest and subject matter was admitted, and the elaboration of really witty dialogue supplied endless opportunities of ornament. At the same time, in the hands of Molière nearly always, though less often in those of his followers, the moral or satirical purpose was carefully observed. The reign of these two kinds continued with little interruption, though with great variety, and on the whole constant diminution of merit, till the end of the first quarter of the 19th century. In tragedy, Crébillon the elder succeeded in raising the style to something not far below Corneille's level, while Voltaire, applying his own singularly various and versatile talent to it, and enlarging the range of subject and situation, produced work which ranks as drama, though not as poetry, almost with the work of Corneille and Racine itself. In comedy, the level continued higher, very excellent work of the Molièresque kind, slightly altered in various ways, being done by Destouches, Marivaux, Piron, and others; while towards the middle of the 18th century, a sort of third or bastard kind, variously called as it approached one extremity or the other, *comédie larmoyante*, or *tragédie bourgeoise*, was introduced by La Chaussée, Sedaine, Diderot, and others. Unlike most bastard kinds this proved fertile, and under the generic name of *drame* may be said to have important representatives at the present day. It tended naturally to emancipate itself from the restrictions of tragedy, and so no doubt helped the great revolt of what is called the Romantic Movement, which about 1830 practically destroyed the old French tragedy, and seriously interfered with the Molièresque tradition of comedy. Here, too, reference must be made to special names —e.g. Dumas, Hugo, and De Musset. It must be sufficient here to say that the alteration has revived the always keen interest of Frenchmen in the drama, and introduced a vast quantity of literary work of much higher value than had been produced in drama since the latter half of the 17th century. France has once more become the central seat of drama in Europe, and foreign nations have been much busier in adapting her productions than in producing original work of their own. At the same time it must be confessed that tragedy proper has continually dwindled, and that even comedy of the higher kind has been somewhat injuriously affected. The chief new growth of value at once literary and dramatic has been in the production of dramatic sketches of various sorts, slight in substance and brief in duration, but admirable of their kind. During the Second Empire an immense popularity was also achieved by comic opera or rather *opera bouffe* of a not very exalted class, the sprightly music of Offenbach contributing much to this result.

Of the great literary European nations, Germany has on the whole contributed least to the European drama, though one dramatic motive, the Faust story, worthy to rank with that of Don Juan, is due to her, and though at two distinct periods, the middle of the sixteenth and the junction of the eighteenth and nineteenth centuries, the supernatural drama, of which this Faust legend has given the chief example, exercised, mainly on German impulse, great influence abroad. Otherwise the Germans have been, save for one brief period, more remarkable for assiduous cultivation of the art of acting, and the theory of the stage, than for the production of great dramatic work. There is no German drama of European reputation that dates either from the middle ages or from the Renaissance, or from the 17th century; and it was not till the middle of the 18th that Lessing, not so much by his actual dramas as by his critical discussions of the drama and dramaturgy generally, earned for himself a really great place in dramatic history. At the end of that century what has been called the *Sturm und Drang* school flooded Europe for a time with extravagant or sentimental productions of the class of which Schiller's *Robbers* and Kotzebue's *Menschenhass und Reue* ('The Stranger') are the most famous examples in two different kinds; while the first mentioned is perhaps the best, and the second one of the worst in literary merit. Kotzebue, indeed, was a very popular dramatist everywhere for a time. The two great writers, Schiller and Goethe, stand on a different level altogether. The former, calming down from the state of mind out of which grew his *Robbers*, produced a series of plays which to the English taste suffer from a too close approxima-

tion to the French style, while, according to classical standards, they err by dramatic license, but which nevertheless contain much noble poetry and some striking drama. But in this same style Goethe's *Egmont* far surpasses anything of Schiller's, except the splendid chronicle-play of *Wallenstein*, while his *Iphigenia in Tauris* is (except Milton's *Samson*) the only modern classical drama which is really classical, and his *Faust* is not only one of the capital works of European literature, but includes rather than constitutes some of the finest dramatic work to be found out of Shakespeare. The chief vehicle of German dramatic poetry is the same as that of English, the unrhymed iambic decasyllable.

There are more reasons than one for taking the drama of England last, the two most pertinent being that it was, except the German, the last to crystallise itself into a determined form, and that while that form has on the whole maintained itself, each of the influences which have been already discussed in their several countries of origin has successively exercised more or less force there. In England, as elsewhere, the miracle-play existed, and divers collections of it, known as the York, Digby, Townley, Chester, and other collections, have been preserved and published. But these are both later and ruder than the French examples. Nor does the drama seem to have taken in medieval England, until quite the beginning of the 16th century, anything like the various extensions which it received in France. From this latter period we have a sufficient variety of kinds—interludes, moralities, mysteries, and so forth—the most important single composer of these being John Heywood. The great and original school, commonly known as that of the Elizabethan dramatists, did not, however, arise till the last quarter of the century. Among the somewhat amorphous dramatic products which preceded it, without as far as can be seen giving this great group of playwrights much help of pattern or precept, it is usual and proper to distinguish three pieces—*Ralph Roister Doister*, by Nicholas Udall; *Gammer Gurton's Needle*, assigned to Bishop Still; and the tragedy of *Gorboduc*, or *Ferrex and Porrex*, by Sackville the poet and Thomas Norton. The first and second are comedies, or rather farces, the second of ruder type than the first, but both exhibiting a considerable advance from the mere interlude towards comedy proper. The third, composed under the same influence as the drama of the Pléiade, is after the style of Seneca—a style which happily, though more than once attempted in the years immediately following, was obstinately resisted by the English genius, and took no root here whatever. It is not possible to assign any foreign origin to that school of English drama, which, suddenly appearing in the work of the so-called 'university' group, of Marlowe, Greene, Peele, and in a rather different vein Lyly, passed into the far more capable hands of Shakespeare, Ben Jonson, Chapman, Dekker, Beaumont and Fletcher, Webster, Middleton, Thomas Heywood, Massinger, Ford, and Shirley. To indicate even briefly the main characteristics of this drama would overpass the whole limits of this article. Suffice it to say, that allowing for its admitted defects in order, measure, and elaborate finish, as well as in dramatic arrangement and in academically perfect literary style, no drama in the world excels or equals it in the vigorous variety of dramatic character and situation, or in the application of the highest poetry to the purposes of drama. Its desinence is usually fixed at the death of Shirley (1666), but, as a matter of fact, the best plays of the class had ceased to be written even before the closing of the theatres twenty years earlier, as a result of the Puritan hatred for stage plays. By this time the two great ethical defects of the whole school, the unnecessary horror of its tragedy, and the unnecessary foulness of its comedy, had reached their highest point, while both the dramatic and the poetic quality of its practitioners had sadly fallen off. In particular, the secret of blank verse which had afforded so admirable a vehicle was all but lost before ever the Civil War broke out. Accordingly, when after the Restoration tragedy revived (the staple matter of comedy and its usual manner are so much the same in all circumstances that fewer changes appear therein in every case), it assumed a very different complexion. Partly influenced by the admiration of things French, but more by the fact that Davenant had been enabled by Oliver Cromwell's love of music to introduce even during the Commonwealth a sort of musical drama, there came in what are called 'heroic' plays, the chief formal characteristic of which is that they are written, not in blank verse, but in rhymed couplets. These held the stage for some twenty years or so, their chief practitioner being Dryden, with Crowne, Otway, Lee, and others to back him in tragedy, and Shadwell, Crowne, Otway, Etheredge, Wycherley, and others in comedy. At last Dryden himself, either following or guiding the public taste, returned to blank verse, and produced in it the last really fine examples of English tragedy, properly so called, for the work of Rowe and Congreve in this kind is not noteworthy. The 18th century produced nothing of value, and all the attempts that have been made since at pure tragedy on the English stage have been either merely literary work, or a kind of *drame*, or else performances of scarcely any literary merit but some stage adaptability.

No such fate for a long time befell comedy. It has frequently been held that the Restoration dramatists in the proper sense (for the term is often very loosely used) introduced an entirely new style. It might perhaps be maintained without much difficulty that Etheredge and Wycherley, the two chief writers of the new school, rather adjusted the old humour comedy of Jonson, and the bustling lively comic work of Fletcher, to the change of manners, the greater demand for literary style, and the example of Molière. Following them, in the reign of William of Orange and that of Anne, Congreve, Vanbrugh, and Farquhar carried this altered style to almost its highest possible perfection. All their work, as well in the earlier as in the later examples of it, was, however, marred by a singular brutality of thought, even where (which was rarely the case) this brutality of thought was not coupled with an equal coarseness of language. For a long time the public demanded, enjoyed, or tolerated this; but at length taste changed, and the famous paper war, which had begun with Jeremy Collier's attack on the stage, undoubtedly did much to purify English comedy. But it did not strengthen it, and nothing in the way of comic dialogue has since been produced which equals the best scenes of Vanbrugh and Congreve. It is, however, justly complained that this liveliness of dialogue is frequently studied at the expense of the verisimilitude and progress of the action. No similar complaint had to be made, though much comic work of merit was produced, until the time of Goldsmith. His two masterpieces were followed at no very great interval by the famous work of Sheridan, in which the methods of what may still be called Restoration comedy are adapted to altered tastes in literature and morals with surpassing skill. Sheridan is the last great name in the English drama, and though, especially of late years, the taste for theatrical performances has spread enormously, and the opportunities of gratifying it have increased in proportion, drama of the first or even a high second-rate quality has perpetually

refused to be written. With rare intervals the works of Shakespeare have kept the stage; but all the other old tragic dramatists have become obsolete, and, except Goldsmith and Sheridan, the old comic writers have shared the same fate. Successive schools of dramatic writing have had their day of favour, sometimes owing to the predilections of certain popular actors. Thus a school imitated from the Germans of the *Sturm und Drang* class was followed by a period of jejune, though decent dramas such as Talfourd's *Ion*, Milman's *Fazio*, and the works of Joanna Baillie and Sheridan Knowles. Then succeeded (though exact succession is rarely to be predicated of such things) a period of light low comedy and farce, such as that identified in one way or other with the names of Mathews, Planché, and Maddison Morton. And this again has been followed by a rage for burlesque, for a new kind of comic opera of not inconsiderable merit, &c. But Shakespeare has always continued to be acted, and has trained actors without producing dramatists. The most considerable, probably, of strictly 19th-century English playwrights was the late Lord Lytton. Yet the *Lady of Lyons*, *Money*, *Richelieu*, &c., though usually effective on the stage, can scarcely be said to be so to the reader, while some later dramas by poets of excellence, though respectable or admirable to the reader, have either not succeeded in being acted at all, or have not been acted successfully.

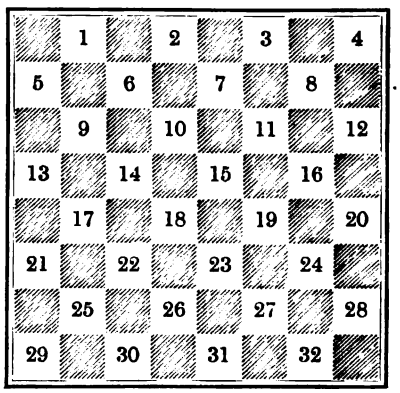
It has seemed preferable for the plan of such an article as the present to adopt the historical method rather than to divide the drama into its kinds and examine the characteristics of each, such as tragedy, comedy, farce, melodrama, pantomime, and others, with their subdivisions, philosophical and historical. A survey of the great body of dramatic literature in our possession will, however, lead to the not uninteresting conclusion that not merely the forms which literary work for dramatic representation can take, but even the situations and incidents which are suitable to such representation, are by no means very numerous, and tend to reproduce themselves in the practice of different times and different nations with considerable regularity. So also in necessary consequence do the faults incident to the looser and severer systems of drama respectively recur. We also see, as might again be foreseen, that considerably less variety is obtainable in tragedy than in comedy, and that the former is infinitely the more difficult, and, in any excellence, the less abundant variety. Such questions as the baleful effect alleged, and probably with justice, to have been exercised on the drama by the popularity during the 19th century of the prose novel, and the extension of periodical literature generally, can also only be hinted at. But it may be briefly said that the ages and circumstances in which drama has flourished most, have been those in which, by this or that accident, it occupied for a time and sometimes almost monopolised the position of public instructor and informer on questions of thought and news, as well as that of public amuser. And another point worth noting is that the periods of best acting have by no means always coincided with the periods of best drama-writing.

Drammen, a seaport of Norway, on the Dramselv, which here discharges its waters through the Dramsfiord into the Gulf of Christiania, 33 miles SW. of Christiania by rail. The Dramselv is the second largest river in Norway, draining, with its tributaries, an area of 6500 sq. m.; it is crossed here by three bridges, one of them 345 yards long. The town is divided into three quarters—Bragernäs on the north, and Strömsö and Tangen on the south bank of the river—and has large sawmills and chicory factories. Its chief industry, however, is in timber, which forms the bulk of the exports, annually valued at over £400,000. Pop. (1875) 18,851; (1887) 19,391; (1891) 20,687.

Draper, JOHN WILLIAM, a distinguished American author and man of science, was born at St Helens, near Liverpool, May 5, 1811. He received a course of chemical training in London, and in 1833 emigrated to Virginia. In 1836 he graduated with honours as a doctor of medicine at the university of Pennsylvania; and after holding for some time a professorship in Hampden-Sidney College, Virginia, he was called in 1839 to the chair of Chemistry in the university of New York. He did much to strengthen the medical department of that institution, of which he was for a long time the president. He wrote a large number of papers on scientific subjects, such as the chemical action of light, radiant energy, phosphorescence, spectrum analysis, photography, and the chemistry and physics of living organisms. Among his works are *On the Forces that Produce the Organisation of Plants* (1844), *Scientific Memoirs* (1878), a work on Physiology (1856), *History of the Intellectual Development of Europe* (1862), *History of the American Civil War* (3 vols. 1867–70), and a *History of the Conflict between Science and Religion* (1874). The last-named work had a wide success, and was translated into several languages. He died January 4, 1882.—His son, HENRY (1837–82), attained distinction as an original observer in astronomy and chemistry, working with great enthusiasm and success in both sciences. —Another son, JOHN CHRISTOPHER (1835–85), was a successful teacher of chemistry and physiology, and the author of various text-books and scientific memoirs.

Draught, in maritime affairs, is a technical name for the depth to which a ship sinks in the water when afloat. The draught is marked on the stem or stern-post, or both, from the keel upwards. See SHIPBUILDING.

Draughts, a game played with 'men' on a checkered board, like a chess-board, of sixty-four black and white squares, is of unknown origin. Though Strutt (*Sports and Pastimes*) calls it a modern invention, other authorities consider it very old. It was certainly played in Europe in the 16th century, and in 1668 a treatise on the game was published in Paris by Mallet. The Greeks and Romans had a similar game, and the Egyptians are represented on monuments as engaged in some such amusement. In France it is called *Jeu des Dames*, a name which probably appears in *Dambrod*, the common Scotch name for the draught-board.



The figure represents the board, numbered in the usual method for registering games. Two players, each having a set of twelve men—one set white,

the other black (or round and square, or distinguished in any other way), sit opposite each other, having their men arranged on squares 1 to 12 and 21 to 32 respectively. The men can be placed either on the black or white squares, but the whole must be placed on one colour only. Whichever colour is used, however, the single corners 4 and 29 must be at the players' *left* hand.

The object of the game is to clear off the opponent's men altogether from the board, or to so shut them up that they cannot be moved. Generally the black men play first, and as the men are changed each game, the first move becomes alternate. The movements of the men are very simple. Each player alternately moves one man at a time diagonally forward, always keeping on the same coloured squares. When an enemy's man stands in the way, no move can be made unless there be a vacant square immediately beyond, into which the man can be lifted, in which case the man leaped over is 'taken,' and removed from the board; and so on, till the game is lost and won, or drawn. When a man on either side has succeeded in making his way to the opposite side of the board, he becomes *crowned*, which is done by putting another man on the top of him; and he can then move in any diagonal direction, but always only one square at a time.

When the men are reduced to a few on each side, a somewhat mysterious element called *the move* comes into play. This may be explained by the following case: Suppose only one man left on each side, one on square 2, the other on square 10; should it be the turn of the man on 2 to move, he must obviously be taken and lose the game. The one on 10 is said to have the advantage of *the move*. The only chance for a man with the move against him is to get into a double corner, when the game is drawn. When there are several men left on either side, then it becomes a matter of nice calculation and great importance to find which side has the move, on account of the advantage arising therefrom. Many treatises have been written on the theory of *the move* and the method of calculating it.

Though a long way behind chess as a game of skill, or perhaps rather in consequence of that fact, draughts has always been a popular game, especially in Scotland, where for many years James Wyllie (the 'herd-laddie') was the acknowledged champion of the world. It has also found much favour in the United States, where Mr C. F. Barker attained the championship. An international match between that gentleman and Mr J. Smith, champion of England, was played at Spennymoor, England, in December and January 1888–89. Thirty-two games were to be played; and the result was that Barker won 5 games, Smith won 1, drawn, 23.

Drave (Ger. *Drau*), a river of Austria, rising in Tyrol, at an altitude of 5477 feet, and flowing 447 miles with a general east-south-easterly course, through or along the borders of Styria, Croatia, Slavonia, and Hungary, till, 10 miles below Essek, it falls into the Danube. In the first part of its course it is a mountain-torrent, rushing furiously through the mountain passes of Tyrol; but joined by numerous streams, its volume increases, and from Villach downwards (379 miles) it is navigable.

Dravidians is a name given to a large group of the non-Aryan races of Southern India, including those speaking Tamil, Telugu, Canarese, Malayalim, Toda, Gond, and six other tongues of minor importance—in all some 20,000,000 of people. These languages are all distinguished by having a rational and an irrational gender in nouns, which in the verbs also are indicated by pronominal suffixes. Thus 'they did it' is different in Tamil, according as the nominative is rational or irrational. The grammatical relations are generally expressed by pronominal suffixes. Rask did much to establish the Dravidian group; the second edition of Bishop Caldwell's great work, *Comparative Grammar of the Dravidian Languages* (1875; the 1st ed. having appeared in 1856), is the standard authority. See INDIA.

Drawback, a term in commerce, employed in connection with the remitting or paying back by government of excise duties on certain classes of articles exported. Excise duties, as a matter of course, enhance by so much the natural price of the commodity on which they are imposed. Were these duties not remitted, the commodity so taxed would not be ordered by those foreign countries where articles of the same kind could be purchased free of such duties. To afford facility for the exportation of these articles, the state resorts to the expedient of returning to the exporter a sum equal in amount to what he or the manufacturer had paid to the excise. Such is drawback. Among other matters of fiscal policy, Adam Smith, in his *Wealth of Nations*, discusses the propriety of giving drawbacks, and sees in them nothing that is adverse to a sound political economy. 'To allow,' he says, 'the merchant to draw back upon exportation, either the whole or a part of whatever excise or inland duty is imposed upon domestic industry, can never occasion the exportation of a greater quantity of goods than what would have been exported had no duty been imposed. Such encouragements do not tend to turn towards any particular employment a greater share of the capital of the country than what would go to that employment of its own accord, but only to hinder the duty from driving away any part of that share to other employments. They tend not to overturn that balance which naturally establishes itself among all the various employments of the society, but to hinder it being overturned by the duty: they tend not to destroy, but to preserve, what it is in most cases advantageous to preserve, the natural division and distribution of labour in the society.' It will, however, be admitted that the system of drawbacks is liable to abuse. The bounties paid by several European states to sugar, for example, were based on the payment of drawbacks, the sum returned being actually larger than the sum paid as duty. See BOUNTY.

Drawbridge. See BRIDGE.

Drawing is the expression of form in graphic art. The term is more particularly applied to expression of form by line. In the preliminary study of drawing, a lead-pencil or other pointed instrument is employed, and the pupil is directed to copy geometrical or other well-defined forms bounded by distinct lines. But in nature no such boundary lines exist; her objects relieve themselves to the eye as spaces that are lighter or darker in tone, or of varying colour. All expression by line of natural things is consequently a conventional rendering, and the true skill of the artist lies in the imagination and insight with which he chooses such lines as are typical and vital, as most simply and forcibly reveal the character of the thing drawn. Such selection is, in particular, the chief excellence of an etched plate, etching being, of all artistic processes, that in which the line is most sensitive and susceptible to the slightest impulse of the artist, and a process in which the line tells by itself, and does not instinctively tend to become merged in a series of accurately gradated tints, as is the case in engraving with the burin. The slighter etchings of Rembrandt are unsurpassable examples of expressive selection of line; while the woodcuts of

Holbein's 'Dance of Death' show how accurately the character of even a minute face may be rendered by a very few blunt lines and touches, set each in its absolutely right place. The more academic method of drawing, of which the classical outlines after Flaxman are examples, has in it less of spirit and insight. It trusts greatly to an unbroken and formally correct outline, and founds its charm less on seizure of individualities of character than on dignity of abstract design, and the grace inherent in flowing curves. In painting, art has rid herself of the conventionalism of line, and, like nature, expresses form by spaces. In speaking of the drawing of a picture, we indicate not only, or chiefly, the contours of its figures, but also their interior modelling, the subtle delicacies of colouring, of tone, and of light and shade, so far as these express the form of objects and reveal their individuality. Architectural drawing has its own rules; and mechanical or engineering drawing differs widely from other kinds in being done wholly by aid of instruments. See ART INSTRUCTION, vol. i. pg. 456; PERSPECTIVE.

Drawing and Quartering. The punishment for Treason (q.v.), in force till 1870, was that the offender be *drawn* to the place of execution on a hurdle; that he be hanged by the neck and disembowelled; that his head be severed from his body, and that body be divided into four parts, or *quartered*. Despard (q.v.) and his six confederates were in 1803 drawn, hanged, and beheaded. See *Notes and Queries* for 1880–82.

Drawing-room. See COURT (Presentation at).

Drayton, MICHAEL, poet, was born at Hartshill, near Atherstone, Warwickshire, in 1563. It is not known whether he was a member of either university; nor is there any foundation for the statement that he served in early manhood as a soldier. In his epistle to Henry Reynolds he refers to the time when he was 'a proper goodly page,' but does not say to what family he was attached. His earliest production was *The Harmony of the Church*, a metrical rendering of scriptural passages. For some reason it gave offence to the authorities, and was condemned to be destroyed. In 1593 he published a volume of eclogues, under the title of *Idea, the Shepherd's Garland*, which afterwards underwent considerable revision. The first of his more important poems was *Mortimeriados* (1596), which he republished (with many alterations) in 1603, under the title of *The Barons' Wars*. As a whole this historical poem is somewhat deficient in interest, but it abounds in fine passages. *England's Heroical Epistles*, first published in 1597, and frequently republished, written on the model of Ovid's *Heroides*, has more polish and less inequality than we find in many of Drayton's works; the versification is fluent and the diction choice. In *Poems, Lyric and Heroic* (1606), appeared the *Ballad of Agincourt*, the most spirited of English martial lyrics. The first eighteen 'songs' or books of Drayton's greatest work, *Polyolbion*, were published in 1613, with annotations by John Selden; twelve more songs were written later, and the complete poem appeared in 1622. This gigantic undertaking was the labour of many years. Drayton aimed at giving 'a chorographical description of all the tracts, rivers, mountains, forests, and other parts of Great Britain;' and expended on his monumental work a vast amount of learning, industry, and skill. From the nature of the subject the poem could not fail to be to some extent monotonous; but the monotony is amply relieved by the beauty of the pastoral descriptions. In 1619 Drayton collected in a single volume all the poems (with the exception of *Polyolbion*) which he wished to preserve. Eight years afterwards he published a new volume of miscellaneous poems, among which was the whimsical and delightful *Nymphidia, the Court of Fairy*, a triumph of ingenious fancy. His last work, *The Muses' Elysium*, appeared in 1630; it contains some pastoral poems of finished elegance. He died in 1631. There is a monument to him in Westminster Abbey, and the inscription was probably by Ben Jonson. Drayton wrote many sonnets; one of them ('Since there's no help, come let us kiss and part') was pronounced by Rossetti to be 'almost the best in the language, if not quite.' An edition of *Polyolbion*, in three volumes, was published in 1876 by the Rev. Richard Hooper; Mr A. H. Bullen has edited a volume of *Selections* (1883); and in 1889 fac-simile reprints of the early editions were being issued by the Spenser Society.

Drayton-in-Hales. See MARKET-DRAYTON.

Dreaming may be defined as the manifestation of conscious mental activity during sleep. It is probable that during the profoundest sleep there is a complete suspension of all forms of conscious activity. Our senses cease to respond to ordinary stimuli, we cannot will any act or originate any thought, and we are unconscious of our own existence. At the same time, all reflex acts are lowered, breathing and the action of the heart become slower, and the other organic functions are also diminished. These phenomena are due to the exhaustion of the energy of the brain, and to the changes necessary for its restoration, and for the removal of tissue waste. They are accompanied by a diminution of the amount of blood flowing through the organ. As we go to sleep, our senses drop off one by one, we cease to see or smell, while we still continue to hear. Even during sleep our faculties may not fall equally into abeyance. A light sleeper may, without waking, answer questions put to him. Men may sleep on horseback or on the march, the central nervous mechanism co-ordinating the necessary movements alone remaining awake and active. Again, as is well known, an expected sound, however light, may arouse one oblivious to all other noises. It is obvious then that during sleep there may be all degrees of abolition of activity in the various faculties. Some may be in full power, while the others are completely or partially suspended. We dream then because our brain is in a condition of partial activity. It is maintained by some that no sleep is ever so profound as to be perfectly dreamless. Sir William Hamilton thought that we dream always, but simply forget our dreams. This proposition, which obviously cannot be proved, is supported by the fact that we forget with the utmost readiness what we know we have dreamed, and that others may see in our actions evidence of dreaming of which we ourselves afterwards retain no recollection. Many facts in connection with injuries to the head point, however, in an opposite direction. Dr Maudsley quotes the case of a boy who was rendered insensible by the kick of a horse. After trephining the depressed bone he became sensible. The surgeon took advantage of the hole in the skull to make firm pressure on the exposed brain after asking him a question. While the pressure lasted he remained silent, but the instant it was removed he made a reply, never suspecting that he had not answered at once. With regard to the time at which we dream there has been much discussion. Many consider that we dream only in the semi-conscious state of falling asleep or of awakening. This unquestionably is true in many cases, but the evidence of somnambulism and of the night terrors of children would indicate that we may dream at any time; and, moreover,

we may find ourselves dreaming when suddenly awakened out of a deep slumber.

The ideas constituting our dreams may, in rare cases, be coherent complicated trains of thought. Mathematical problems ineffectually attacked during the day have been solved in this way, legal opinions given on difficult questions, and sermons composed and written. Many such cases are recorded by trustworthy persons. Coleridge composed the poem of *Kubla Khan* during a three hours' sleep, and wrote out on awakening the existing fragment, extending to fifty-four lines, which, but for an accidental interruption, might have reached two or three hundred. In most cases, however, there is no apparent cohesion in the sequence of our ideas. The control of the will or power of forming common-sense or moral judgments, is more or less completely lost. The most improbable events do not surprise us. Miss Cobbe (*Macmillan's Magazine*, 1870) narrates how Mr Richard Napier, one of the most benevolent of men, dreamt he ran his best friend through the body, and ever afterwards recalled the gratification with which he saw the point of the sword come out through his shoulder. The philanthropist commits cruel acts without remorse. All distinction of time and place is lost, we converse with the dead, we are transported thousands of miles in a moment, and so on; and we take it all as a matter of course, or have at the most a feeling of slight wonder. The rapidity of the sequence of our ideas is one of the most remarkable of the phenomena of dreaming. This may be compared with the similar condition which sometimes occurs during the act of drowning, when the whole of one's past life may be mirrored on the mind in a moment. Dreams which seem to cover months, or even years, take place within a few seconds or minutes. It is well known that a sound which may awake a sleeper, may at the same time give origin to a dream which apparently covers a long period of time. As already mentioned, many of our most complicated dreams take place during the act of wakening. On the other hand, it must not be imagined that all dreams are mere momentary occurrences. Every one who has watched a dog dreaming knows over how long a time the act may be prolonged, as is indicated by the succession of yelping and barking movements. It is not perfectly accurate to say that the will and the judgment are altogether in abeyance. We may find ourselves voluntarily prolonging a pleasant dream, which we recognise as such; and we may by a similar process awaken ourselves so as to interrupt a disagreeable or depressing one.

The subject-matter of dreams is always composed of previous mental experiences, the majority of which are obtained through the sense of sight. For the most part they are those of recent date, perhaps those of the day preceding. But not rarely old and forgotten experiences may be recalled by associations the clue to which is quite lost. A momentary and possibly hardly noticed sensation during the day, may, during sleep, recall the ideas associated with an occasion long ago when the same sensation was experienced. It is an interesting question how the deaf and the blind dream. Dr Darwin records the case of a gentleman who had been deaf for thirty years, and who never dreamt of persons conversing with him except by the fingers or in writing, and never had the impression of hearing them speak. Mr Johns, in the *National Review* for 1885, states that the blind, who can of course have no visual images, dream as actively as those who see, and dream by hearing, and touching, and smelling; they tell the size of a room by the sound of imaginary persons walking in it; recognise a friend by his voice, or by touching him; or the freshness of the morning by the smell of the air.

Dreams sometimes may be directly ascribed to impressions on the special senses. Thus it is told of Dr Gregory that he dreamt of ascending the crater of Mount Etna, after having gone to sleep with a bottle of hot water at his feet. A French observer, Maury, had a series of experiments conducted on himself to determine whether special sense-impressions would always produce corresponding dreams. He directed a person to make various experiments on his senses, and to awaken him soon after each. When his lips and nose were tickled with a feather, he dreamt that the skin of his face was being torn off with a pitch plaster. Pinching the back of his neck made him dream of a doctor who had blistered him there in his infancy. In many of his observations, however, no connection could be traced between the dream and its immediate cause. The special character of many dreams is determined by the condition of the organs of the thorax and abdomen, and of the muscular system. For example, the presence of indigestible or undigested food in the stomach, by embarrassing the breathing and the action of the heart, suggests the ideas of the various forms of nightmare, the monster, or the crushing weight from which there is no escape, which are closely akin to the sensations induced by similar effects on the heart during the day. An uncomfortable position in bed, a strained condition of the muscular system, will cause dreams of falling over precipices or of struggling. Certain well-known drugs give a specific character to dreams. The magnificent visions of the opium stupor have been made familiar by the classical account of De Quincey. (It is well to mention that the splendour of the dreams is not so certain to follow the indulgence of the opium habit as is the degradation of our mental and moral and physical nature.) The furious homicidal delirium caused by hashish (Indian Hemp) is indicated by its being the origin of the term Assassination. Excessive indulgence in alcohol gives rise to delirious dreams characterised by unfounded dread and suspicion. Workers in india-rubber factories, who are exposed to the inhalation of bisulphide of carbon, suffer from fearful dreams of being murdered and falling over precipices. Many other drugs induce almost as certain results.

The state of the circulation and that of the nervous tissue of the brain are important factors whose influence can hardly be separated. Sound sleep, like sound thought, is impossible either with an over-congested brain, or in one with a deficient supply of blood. In the former case, there is a tendency to a rapid succession of vivid dreamings, interrupted by intervals of wakefulness. The brain cells are too excited by the excess of blood to pass into a condition of repose, and their activity tends to keep up the congestion of the organ. When the blood is deficient in quantity or in quality, or poisoned by substances which ought to be removed from the body, and when the nervous system is exhausted by such causes as over-fatigue, shock, or depressing emotions from over-indulgence in any form, then unpleasant depressing dreams are apt to follow.

The onset of acute disease (especially when affecting the nervous system) is not unfrequently heralded by continued dreaming or continued sleeplessness. Depressing dreams should be always regarded as an indication of need for attention to health, or to relaxation from work, more especially, perhaps, by those engaged in professional pursuits.

With regard to the effect of dreams, many, no doubt, are forgotten utterly; some, forgotten during the waking state, are vividly recalled during

succeeding dreams. Many, perhaps most, are indistinctly remembered for a short time: others again, like the dream of Clarence, produce an ineradicable impression of reality:

> I trembling waked, and for a season after
> Could not believe but that I was in hell,
> Such terrible impression made my dream.

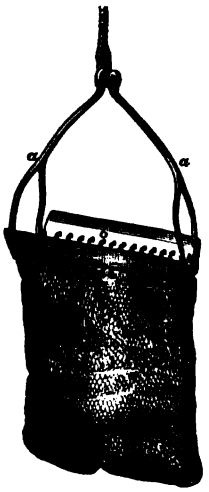
In some forms, which may be named somnambulic dreams, in which the dream is acted as well as thought out, it is remarkable that almost no recollection is retained. Such cases are familiar to us in their mildest forms, in the child talking, crying, or using his fists in his sleep. The night terrors of nervous children, so frequent during their second dentition, often cause unnecessary anxiety. In these, the child may start up suddenly out of a sound sleep, manifesting signs of pain or terror. After a time, generally without waking, the child lies down, and in the morning has no recollection of the occurrence. Under this category must also be included acts of unconscious violence occurring during sleep, which sometimes lead to most distressing consequences. Dr Clouston of Morningside, Edinburgh, refers to a case where a confirmed somnambulist during his sleep seized his child, to whom he was devotedly attached, and caused his death by dashing him against the wall, under the belief that he saw a wild animal in the room. The man in question was acquitted on the charge of murder, it being held that he was not responsible during sleep. The condition might be described as one of sanity during the waking hours, and of the opposite during sleep. Many similar cases are on record. They are generally indications of a strong hereditary tendency to instability of the nervous system. See SOMNAMBULISM.

Among the peoples of antiquity, dreams were regarded as direct messages from the spiritual world, of either divine or diabolical origin, and their interpretation was elevated to the rank of a science. Nowadays the tendency is to explain away the undoubted facts of foretelling the future on the ground of mere coincidence. It would be marvellous if among the multitude of dreams having reference to the future some did not come true. Such cases arrest the attention, while others are forgotten. To the writer it appears that this latter explanation of mere coincidence cannot be accepted. He would regard the apparent foretelling of the future as on a par with the working out of a problem by the mathematician. In the former case, it is the solution during sleep of the question that has been occupying the mind of the deep political, moral, or religious thinker. The anxieties connected with a 'low Nile' would give rise to the dream of Pharaoh as certainly as would the mental tension of Condorcet lead to his continuing his mathematical calculations during sleep. What the ancients considered a direct message from God we term the working of the natural law. In neither case is the matter one of chance or mere coincidence.

See Abercrombie's *Inquiries concerning the Intellectual Powers* (1830); Seafield's *Literature and Curiosities of Dreams* (1869); Carpenter's *Mental Physiology* (1881); Maudsley's *Pathology of Mind* (1879), and his *Natural Causes and Supernatural Seemings* (1886).

Dredge, a machine used for bringing up from the bottom of lakes, or of the sea, specimens of the organisms and plants which exist there. A rude species of hand dredge appears to have been in use from the earliest times, and is still employed among the peoples of the Pacific islands, an improved form being common in all civilised countries possessing a seaboard. As a means of scientific investigation, the dredge was first used by Müller, who, before 1779, had made systematic investigations into the deep-sea fauna and flora off the coasts of Norway and Denmark. Other naturalists were not slow to recognise the value of the results thus obtained, and the dredge was extensively employed by the principal scientific men of the period, among whom Forbes especially deserves mention, although it was some time before its full value as a means of investigation was thoroughly appreciated and understood.

For ordinary purposes, and for use where the water does not exceed 100 fathoms in depth, Dr Robert Ball's dredge (1838) is generally recognised as most useful. With such slight modifications as occur to most dredges, it continues to be employed in preference to other forms. The frame is 1½ feet long, with scrapers not more than 3 inches wide, and so placed that the distance across the scraping surfaces is between 7 and 8 inches; these scrapers are connected by the frame-ends, made of bar iron five-eighths of an inch in diameter. Two curved iron arms (*a*, *a* in fig.) are fixed to the extremities of the cross-bar by means of 'eyes,' which allow the arms to fall down over the mouth of the dredge. The bag is secured to the thick inner end of the scrapers by means of an iron rod and stout iron rings (*b*, *b* in fig.). This bag may be of any depth, but 2 feet will be found very convenient; it ought to be hand-netted from stout twine, and the lower end lined with coarse canvas, to prevent the escape of the more minute animals and plants. All the materials used in the construction of a dredge, the iron especially, ought to be of the very best quality. Captain Calver, of the *Porcupine* (1869–70), invented the use of hemp tangles (half a dozen tangles fastened to an iron rod attached to the bottom of the dredge), and found them very successful in sweeping the bottom of objects which did not find their way into the dredge.



Dr Ball's Dredge.

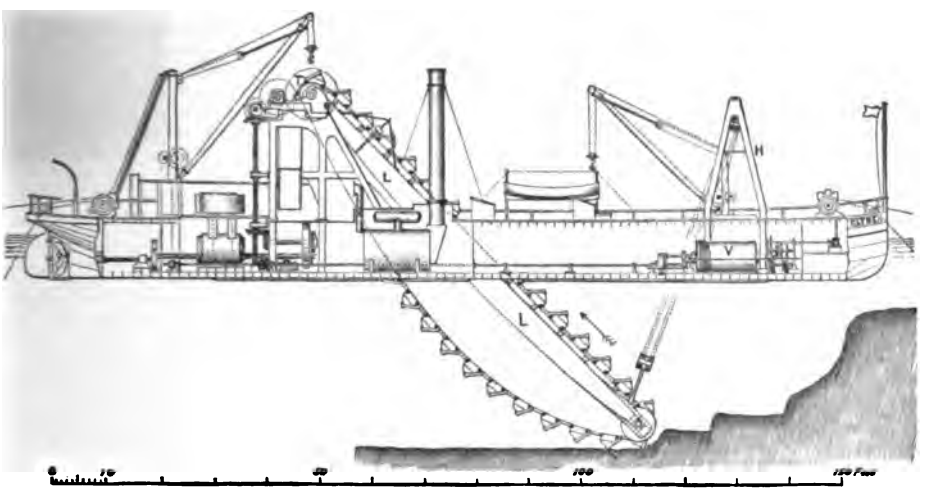
In the cruises of the *Blake* (1877–80), a case of stout canvas was used to cover the dredge, with the result that the most delicate organisms were brought up entirely uninjured, even after the machine had been dragged along rough ground for some time; the cover was also found to preserve the net from injury from contact with sharp rocks. When dredging, before the net is let down, the depth of the water should always be ascertained by casts of the lead, when not already approximately known, and, whenever practicable, a deep-sea thermometer ought to be used in conjunction with the lead, and the temperature of the water, which has a more important bearing on the distribution of life than is generally supposed, carefully observed and recorded. The rope attaching the dredge to the vessel ought to be tested before use, as any failure in it may lead to the loss of the dredge and its contents, and must be kept sufficiently slack to prevent its snapping from any sudden jerk. The length let out should be, as a rule, double the depth of water, to avoid danger of breakage from ordinary causes. If, however, the water be under 30 fathoms, the length of rope ought to be three times the depth. The rope thus used should be made from the finest quality of Russian hemp, one inch and a half in circumference, containing about twenty yarns in three strands. The boat from which dredging operations are carried on

should always be kept moving, but very slowly. Unless there be some strong wind or considerable current, the use of oars or sails must be called in, as the dredge acts as an anchor to the vessel, but the rate of progress ought not to much exceed one mile per hour.

For further particulars regarding dredges and dredging, see Sir Wyville Thomson's *The Depths of the Sea*, *The Challenger Expedition Report*, *Narrative*, vol. i., and *The Three Cruises of the Blake*, by Professor A. Agassiz. An account of a very ingenious dredge used by the Prince of Monaco, who has employed the electric light to attract the fish into the net, will be found in the *Scientific News*, vol. i. p. 98.

Dredging-machine, a machine for clearing out or deepening the channels of rivers, harbours, &c. Such machines are of four kinds—viz. the single central bucket-ladder machine, the double-ladder machine, the side-ladder machine, and the hopper-dredger. The first named is the most common, and is shown in the figure. The diagram represents a machine made in 1881, for the deepening of the lower portion of the Clyde. It was the largest machine of the kind which had been built at that time. Its length is 164 feet, breadth 30 feet, and depth 10 feet. The engines are of 350 indicated horse-power, and the machine is capable of lifting from a depth of 35 feet 500 tons an hour of ordinary dredgible material. It is fitted with two sets of buckets, one set for soft boulder-clay of 20 cubic feet capacity each, and one for hard clay of 7 cubic feet capacity. The bucket-ladder, L, is 85 feet in length. The upper tumbler, T, which is five-sided, is made to rotate by means of powerful gearing worked by the engine. This gives motion to the bucket-chain to which the buckets are attached, causing them to pass over the upper tumbler at the rate of 15 per minute for soft stuff, and 10 per minute for hard material. The ladder can be raised or lowered at leisure by means of the topping lift, H. The barrel, V, round which the hauling part of the chain tackle passes, is grooved, and of cast-iron, and weighs 13 tons. The vessel is fitted with screw-propeller, so as to shift without the aid of a tug. The cost of the dredger shown is about £19,250.

The double-ladder and side-ladder dredgers are



Dredging-machine.

similarly constructed, excepting that the latter has the bucket-ladder projecting over one side in order to permit of its working close up to a quay or dock-wall. These dredgers discharge the dredged material into barges lying alongside by means of shoots.

The hopper-dredger, designed by Messrs Simons of Renfrew, is constructed so as to dispense with the use of barges, the dredged material being discharged into the hold or hopper of the vessel. When this is filled, the vessel is detached from her moorings, and is propelled to the place of deposit, when the stuff is discharged through the bottom by lowering the hopper doors. The bucket-ladder in this machine is made to traverse so that the lower end can be run out before the bow, and so cut a passage for the vessel through a dry bank. This dredger saves the cost of the barges, and works more economically. The barge-loading dredger works more expeditiously, as it lies always at its moorings dredging and filling barges constantly; while in the case of the hopper-dredger, the dredging is entirely suspended while it is steaming away to the place of deposit, and time also is lost dropping and picking up moorings, particularly in stormy weather. But each kind has its proper place depending on the circumstances.

When a dredger is set to work it must be very securely moored by long bow and stern chains; moorings have also to be run out from each bow and each quarter. The system of cross dredging is generally adopted. By this mode the vessel is moored at one side of the bank to be dredged; the ladder is lowered so as to take a cut of about 9 inches, and then the one set of side chains are hove in and the opposite set paid out at a speed, varying according to the nature of the stuff being dredged, of from 10 to 25 feet a minute. When the bank has been crossed, the bow chain is hove in perhaps about 12 feet, and a new cut carried across; and so on until the required depth is reached. The speed of the winding can be increased or diminished according to the nature of the bottom. The tear and wear of dredging-machines is very great, and buckets, links, and pins have to be made of great strength. The barges for conveying the dredgings are usually made to carry from 300 to 500 tons. They are strongly built, and steam when loaded about 9 miles an hour. The engines are 250 horse-power indicated. The hoppers are 60 feet long, 20 feet wide at top, and 9 feet at bottom. The bottom of the hopper is closed by 12 doors, which are held up by strong chains passing round ratchet-wheels. These are suddenly let go when the cargo

is to be dropped. The cost of the barges is about £8000 to £9000; and when the place of deposit is 12 to 15 miles distant, three of them are required for such a dredger as has been described.

A dredger capable of removing rock, the *Dérocheuse*, was constructed for the Suez Canal Company, by Lobnitz & Co., shipbuilders, Renfrew. Forming part of this dredger is a set of Lobnitz's patent rock-breaking rams. These rams, which are in principle simply huge chisel-pointed hammers, weighing four tons each, are raised by hydraulic power, and allowed to fall from 10 to 20 feet. There are five on each side of the well, the ordinary bucket-dredge working between them, and raising the rock broken by the hammers. This dredger is also fitted with Lobnitz's patent guide-wheel, which allows the bucket-ladder to occupy less space in the dredger by bearing up the bag of the bucket-chain. It is also claimed for this guide-wheel that the loss of dredged material is less, the wear and tear is less, and that the revolutions are increased with the same engine-power by its use.

Dred Scott Case, brought before the supreme court of the United States in 1856, was the case of a negro called Dred Scott, who with his wife and two children had been held as slaves by a Dr Emerson in Missouri. After Dr Emerson's death, Scott and his family claimed to be free, as having resided with their owner in a free territory. The decision was hostile to their claim, and they were held to be still slaves. See SLAVERY.

Dreissena, a genus of bivalves, in the mussel family (Mytilidæ), peculiar in having the mantle halves almost completely united. One species (*D. polymorpha*) deserves notice, since, from its home in the Black Sea and Caspian, it has travelled westward on ships or logs, and has now established itself in many European (including British) estuaries and canals.

Drelincourt, CHARLES, a French Protestant divine, was born at Sedan in 1595, and was from 1620 a pastor near Paris, where he died in 1669. He wrote, among other works, a book that was translated and frequently reprinted in English, under the title *Consolations against the Fear of Death.* See DEFOE.

Dren'the, a frontier province of the Netherlands, bordering on Hanover; area, 1030 sq. m.; pop. (1892) 135,658. It is the least populous province in the kingdom. The soil is in general poor, only about one-half of the surface being capable of cultivation, the remaining portion covered chiefly with heath and morass. The inhabitants are chiefly employed in agriculture, pasturage, and in digging and exporting peat.

Dresden, the capital of the kingdom of Saxony, is situated in a charming valley on the Elbe, 116 miles SE. of Berlin, and 62 ESE. of Leipzig. The Altstadt and Friedrichstadt on the left bank of the Elbe, and the Neustadt and Antonstadt on the right or northern bank, are united by the Augustus Bridge, dating in its present form from 1727–29; the Albert Bridge, erected in 1875–77, both masterpieces of architecture; and by the Marienbrücke, which is at once a railway and a carriage bridge. Dresden is a pleasant and attractive, though not exactly a beautiful town. It contains several open squares, and is embellished with statues and public gardens; and the Brühl Terrace, on the south bank of the Elbe, originally laid out by Count Brühl in 1738, is a charming promenade, on which in 1889 extensive improvements were made. Its architecture and splendid art collections, the presence of the Saxon court, and the numerous foreigners who are attracted by its artistic and educational reputation, render Dresden one of the pleasantest and gayest of the smaller residential continental towns.

Dresden occupies an important position in the history of art, especially as the cradle of rococo art, which culminated here about the middle of the 18th century. Herder called it the German Florence. The Academy of Art, opened in 1764, and specially famous for drawing and architecture, the choir in connection with the Roman Catholic church, and the Conservatory of Music, are all of no small importance to the progress of art at the present day. Scientific, educational, æsthetic, and benevolent institutions also abound in the town. The museum, one of the finest specimens of modern architecture, built by Semper in 1847–54, contains collections of engravings (400,000 examples) and drawings, besides the famous picture-gallery. The last, which owes its origin chiefly to Augustus III. of Saxony, who purchased the Modena gallery in 1745, is one of the finest collections out of Italy, and contains about 2400 paintings, mainly by Italian and Flemish masters. The gem of the collection is the 'Sistine Madonna,' by Raphael; other masterpieces being Titian's 'Tribute Money,' and Correggio's 'Magdalene' and 'La Notte.' The so-called 'Holbein Madonna,' often ranked second among the treasures of the gallery, is now admitted to be a copy, the original of which is at Darmstadt. Adjoining the museum is the Zwinger, a remarkable rococo building of 1711–22, designed as the vestibule of an elaborate palace, of which, however, no more was ever built. It now contains valuable collections of casts, zoology, mineralogy, and mathematical and philosophical instruments. The Johanneum, erected as royal stables at the end of the 16th century, now accommodates the historical museum, founded in 1833, the gallery of arms, and the priceless collection of porcelain, which embraces 15,000 specimens. The Augusteum, or collection of antiquities, chiefly Roman objects of the Imperial times, and the Royal Public Library, are deposited in the Japanese Palace, built in 1715 in the Neustadt. The library contains nearly 350,000 volumes, 20,000 maps, and 4000 MSS., and is particularly complete in the departments of literary history and classical antiquity, as well as in histories of France and Germany. The 'Green Vault' in the royal palace contains a valuable collection of precious stones, pearls, and curios, and articles in gold, silver, ivory, &c. The cabinet of coins is also preserved in the palace. The list of art treasures in Dresden may be closed with the collection of antiques (chiefly ecclesiastical), and the gallery of casts of the works of the sculptor Rietschel, both in the 'Lustschloss,' erected in 1680, in the Grosse Garten, a handsome public park, 350 acres in extent. Among the important buildings not yet mentioned are the royal palace, a large and rambling edifice of no architectural importance, begun by Duke George in 1534, and completed by Augustus II.; the prince's palace, erected by Augustus II. in 1718; the Brühl Palace, dating from 1737; the town-house (1741–45), restored and enlarged in 1862–65; and the magnificent new theatre (1871–78), designed by Semper. Of the churches, the finest are the Frauenkirche (1726–34), with a lofty dome and lantern 320 feet in height; the Roman Catholic church (1737–56), in an elaborate baroque style, adorned on the exterior with sixty-four statues; the Sophienkirche (1351–57), restored and provided with towers in 1865–69; and the Kreuzkirche, the largest church in Dresden, dating in its present form from 1764–85. The Synagogue (1838–40), designed by Semper, is also worthy of mention.

The most important industries are the manufactures of gold and silver articles, artificial flowers, machinery, chemicals, paper-hangings, painters' canvas and colours, chocolate, &c.; and straw-plaiting, brewing, and market-gardening. The

so-called 'Dresden china' is manufactured not at Dresden but at Meissen (see POTTERY). A considerable trade is carried on by means of the Elbe, which is also enlivened by numerous small passenger-steamers. Pop. (1871) 177,087; (1885) 246,086; (1890) 276,085.

Dresden is of very early Slavonic origin, though first officially mentioned as a town in 1216. The oldest part of the town was on the right bank of the river, but having been rebuilt after a conflagration in 1685, it has since been known as the Neustadt. Henry the Illustrious made Dresden his capital in 1270, and after the division of the Saxon lands in 1485 it became the seat of the Albertine line, and its prosperity gradually increased. Several successive sovereigns contributed to its embellishment, particularly Augustus I. and Augustus II. It suffered severely, however, during the Seven Years' War, and again in August 1813, when the war between Napoleon and the allies having broken out afresh, the armies of the latter gathered from all sides towards Dresden, which they regarded as the key of the French position. The assault was made on the 26th, but was beaten back by Napoleon; and the allies retreated on the 27th, after hard fighting. Napoleon did not quit the city till the 7th October, leaving nearly 30,000 men still behind. As all access was cut off by the Russians, the city suffered severely from famine. A capitulation was at length brought about on 11th November. During the revolution of 1849, also, very great damage was inflicted upon the town, but it has rapidly recovered. Dresden was occupied by the Prussians in 1866 during the war between Austria and Prussia. Since that period numerous improvements have been effected, and the city has been extended, especially in the south-eastern suburbs, known as the English and American quarters.

Dreux, an ancient town of France, in the department of Eure-et-Loir, on the Blaise, 27 miles NNW. of Chartres by rail. It lies at the foot of a hill crowned with the dilapidated ruins of an ancient castle, formerly the possession of the Counts of Dreux. From among the ruins rises a beautiful chapel, erected by the mother of Louis-Philippe in 1816, and to which were removed in 1876 the remains of the king and other members of the House of Orleans who had died in exile. The town-hall and the parish church are both good specimens of Gothic. Dreux has several dye-houses, and manufactures of iron, leather, and hats. Pop. 7811. Dreux is the ancient *Durocassis*, a town of the Carnutes in *Gallia Lugdunensis*. In 1562 the Constable Montmorency defeated the Huguenots here, and took their leader the Prince of Condé prisoner.

Dreyse, JOHANN NIKOLAUS VON, inventor of the needle-gun, was born in 1787, at Sömmerda, near Erfurt, in Prussia, and worked as a locksmith in Germany, and in a musket-factory in Paris from 1809 to 1814. He then founded an ironware factory in Sömmerda, and commenced the manufacture of percussion-caps under a patent in 1824. In 1827 he invented a muzzle-loading, and in 1836 a breech-loading needle-gun, which was adopted in the Prussian army in 1840. A large factory was at once established, which produced 300,000 weapons between 1841 and 1863. In 1864 Dreyse was ennobled; he died 9th December 1867.

Driffield, GREAT, the chief town in the Wolds, East Riding of Yorkshire, 11 miles N. of Beverley by rail, is connected with Hull, 19 miles to the south, by a navigable canal. The surrounding district is fertile, and the town has a considerable corn and cattle trade, besides manufactures of flour, linseed-cake, and artificial manures. Pop. 5937.

Drift, a name formerly given to boulder-clay, a deposit of the Pleistocene epoch. More fully, it was called the Northern Drift, Glacial Drift, or Diluvial Drift, in allusion to its supposed origin. The old river-gravels of Pleistocene age were also often termed river-drift. The term drift has now fallen out of use. For an account of the deposits formerly termed drift, see BOULDER-CLAY, PLEISTOCENE SYSTEM. For the drift-men, see MAN.

DRIFT-WOOD is wood carried by tides and currents to a distance from its native locality. Thus the shores of the Faröe Islands, Iceland, &c. are often strewn with logs brought by the Gulf Stream. Fragments of drift-wood occur as fossils in many geological formations, as in the Carboniferous Sandstones, the Chalk, the London Clay, &c.

SAND-DRIFT is sand driven and accumulated by the wind. Deposits thus formed are occasionally found among the stratified rocks, but compared with other strata they are few, though, from their anomalous character, an acquaintance with their phenomena is of importance to the geologist. As a rule, the mineral ingredients of wind-blown sand are better rounded than the grains of an aqueous accumulation of sand—the latter being carried in suspension, and thus to a large extent escaping the mutual trituration to which the former are subjected. Moving sands are at the present day, in many places, altering the surface of the land. In the interior of great dry continents, as Africa, Asia, and Australia, extensive districts are covered with moving sands. The continuous blowing of a steady wind in one direction often covers a rich tract with this arid material. But the influence of the wind on loose sand is most evident along low sandy coasts, where hills, called 'dunes,' are formed entirely of it; they sometimes attain a considerable height, as much, for instance, as 200 or 300 feet. Dunes are advancing on the French coasts of the Bay of Biscay at the rate of about 60 feet per annum, covering houses and farms in their progress. Similar accumulations are forming on the coasts of Nairn, Cornwall, Wexford, and other parts

Section of Culbin Sandhills, Nairnshire.

of the British Isles. The Culbin Sands, in Nairn and Elgin shires, cover a large district which at a period not very distant was rich arable land. The prevailing wind is from the west, hence the hills are slowly moving in an easterly direction, at the rate of a mile in somewhat less than a hundred years. A singular stratification exists in these hills. The prevailing west wind lifts, or rather rolls the particles of sand up the gentle incline of the western aspect of the hill, until they reach the summit, where they fall, forming a steep declivity to the east, equal to the angle of repose for sand. A shower consolidates the surface of the new bed, or a land-breeze carrying fine dust separates it by a very thin layer of finer material from the one that follows, and thus, as the hill moves eastward, a regular series of strata is formed at a high angle, as is shown by the diagram. The progress of the hill is represented by the dotted outline. Little can be done to arrest the progress of these devastating sand-drifts. It has been recommended to plant *Carex arenaria* and similar sand-loving plants, which have long creeping roots: they certainly check to a considerable extent the influence of the wind. A great forest of sea-pine seven miles in width has since 1789 been maintained along the

sand-dunes of the French *Landes* (q.v.), with great benefit to the country inland.

Drill (*Cynocephalus leucophæus*), a species of Baboon (q.v.), a native of Guinea, similar to the mandrill, but rather smaller and less ferocious.

Drill is a general name for the exercises by which soldiers and sailors are made efficient. In the army, there are three classes of drill. First, 'setting-up' and 'gymnastic' drill, to improve the physical development of the recruit; secondly, sword, lance, and bayonet exercises, gun-drill, riding, driving, signalling, shelter-trench, and repository drill (the technical name for shifting heavy ordnance), &c., to teach him to handle his arms, horse, or tools to the best advantage; thirdly, marching, squad, company, squadron, battery, battalion and brigade drill, &c., to enable the men composing these various bodies to act together. A system of musical drill was introduced into the British army in 1887; various evolutions being performed to the sound of music, without any words of command. An ordinary recruit requires about four months' drill to become efficient in the infantry, two years in the cavalry, and three in the artillery. In the navy, the drills vary in the same way with the nature of the duties required. Manuals of every kind of drill have been prepared for both services.

Drills. See BORING.

Drimys. See WINTER'S BARK.

Drinking Usages. See TOAST.

Dripstone (Fr. *larmier*). The dripstone is a projecting moulding or tablet placed over the head of a Gothic doorway or window, for the purpose of throwing off the water, whence it is also known as a water-table or weather-moulding. Though such was, no doubt, its primitive use, the dripstone latterly became a mere ornamental appendage, which served to enrich and define the outline of the arch, and was applied internally, where it was evidently of no particular use, as well as externally. Ruskin points out that the dripstone which forms the upper member of Gothic cornices is one of the chief features which distinguish the style of the rainy north from that of the more sunny south.

Driving (see COACHING, and RIDING AND DRIVING). Driving vehicles or riding furiously and recklessly in a public place, to the danger of the lieges, is an offence at common law in England, and may be prosecuted as culpable neglect of duty according to the law of Scotland. It has, however, been made a statutory offence, and a long series of acts passed to regulate the misconduct of drivers of public carriages, under which prosecutions are now as a rule brought. In the United States, furious driving in cities generally is a misdemeanour punishable by fine and imprisonment. In the absence of state laws, municipalities regulate the rate of driving.

Drogheda, a seaport town, and county of itself, in the south-east of County Louth, built mostly on the north bank of the river Boyne, 4 miles from its mouth, 32 N. of Dublin by rail, and 81 S. of Belfast. The Boyne is crossed here by a railway viaduct 95 feet high. There are linen and cotton manufactures, ironworks, tanneries, breweries, and salt-works. It has a considerable export trade, chiefly with Liverpool (140 miles distant), in corn, meal, flour, cattle, linen, hides, butter, and eggs. Vessels of 500 tons reach the quay, and barges of 50 tons ply 19 miles up the Boyne to Navan. Pop. (1881) 12,297; (1891) 11,541, almost entirely Catholics. Up to 1885 Drogheda sent one member to parliament. From the 14th to the 17th centuries, Drogheda (often called *Tredah*) was the chief military station in Leinster. In 1649 Cromwell stormed the town after a desperate struggle, and for a stern lesson to the Irish, put its stubborn garrison to the sword. Poyning's laws were enacted here in 1494, and about the same time a mint was set up. Drogheda surrendered to William III. the day after the battle of the Boyne (q.v.). See John D'Alton's *History of Drogheda* (2 vols. 1844).

Drohobycz, a town of Austria, in Galicia, 50 miles SW. of Lemberg by rail. It has extensive salt-works, paraffin-manufactories, and dye-works. Pop. (1880) 15,714, half of whom are Jews.

Droits, ADMIRALTY. See ADMIRALTY DROITS.

Droitwich, a municipal borough in Worcestershire, on the Salwarpe, 6 miles NNE. of Worcester. It is a railway junction, and is connected by canal with the Severn. Originally a British town, and probably the Roman *Salinæ*, it was first known as Wych, from the salt-springs, to which Droit was afterwards prefixed, expressing a legal right to them. Its chief trade is salt, for which it has been famous from remote times, the brine-springs yielding over 100,000 tons of salt a year. Pop. (1881) 3761; (1891) 4021. Droitwich sent one member to parliament until 1885. The saline baths here are now visited annually by thousands. See W. Bainbrigg's *The Droitwich Salt Springs* (1873).

Drôme, a department of France, on the east bank of the Rhone, to the south of the department of Isère. Area, 2508 sq. m. Pop. (1866) 324,231; (1891) 306,419. The surface is generally hilly, and even mountainous in the east, where spurs of the Alps rise to a height of 5900 feet; and, except in the Rhone valley, the soil is not very productive. Drôme is traversed by a number of affluents of the Rhone, the most notable being the Isère and the Drôme (75 miles), from which the department takes its name. Along the Rhone, however, where a Mediterranean climate prevails, the almond and olive flourish, though an occasional crop is lost from frost, and oil-nuts and the mulberry are extensively grown. Also, the cultivation of the vine was an important industry before the ravages of the Phylloxera affected it; Hermitage and the white wine Clairette de Die were especially famous. Wheat, potatoes, and melons are produced in large quantities, and the cultivation of truffles has become noteworthy. Coal, cement, and potter's clay are found; and there are manufactures of silk, woollen, straw, and iron goods, pottery, paper, leather, and glass, besides an active trade in the raw products of the district. The department is divided into the four arrondissements of Valence, Montélimar, Die, and Nyons, with the town of Valence for capital.

Dromedary.

Dromedary, a swift variety of the one-humped camel (*Camelus dromedarius*), bearing the same relation to it as race-horse to cart-horse. Its usual

pace is a trot, which, with terrible joltings to the rider, can be maintained often at the rate of nine miles an hour for many hours on a stretch. A journey of 600 miles can be performed at a slower rate in five days. After running for twenty-four hours, when in good condition, the dromedary is refreshed with a frugal meal of barley and powdered dates, along with a little water or camel's milk, and is then ready for another day of it. A gallop is a pace for which the dromedary is not adapted. Many varieties—e.g. for racing—are reared, and white forms are much prized in some parts of the East. Though now distinctive of North Africa, the dromedary seems to have been unknown to the ancient Egyptians. For general information, see CAMEL.

Dromore, a town, with linen manufactures, in the north-west of County Down, on the Lagan, 17 miles SW. of Belfast by rail. Pop. 2491. It is still the seat of a Roman Catholic diocese, as it was also of an Episcopal till 1842, when it was united with Down. Jeremy Taylor was Bishop of Dromore, and lies buried here in his cathedral.

Drone. See BEE.

Drontheim. See TRONDHJEM.

Dropsy (Gr. *hydrops*, from *hydōr*, 'water'), a class of diseases always of serious import, though not often, perhaps, directly fatal. Dropsy is rather a symptom than a disease; it consists of the effusion of watery fluid from the blood into the skin and subjacent textures, or into the cavities of the body. When the effusion is chiefly in the superficial parts, the dropsy is called Anasarca (*ana*, 'upon,' *sarx*, 'the flesh'); when it is in the abdomen, it is termed Ascites; when in the space around the lungs, Hydrothorax. Dropsy most commonly depends on disease of the Heart (q.v.) or Kidneys (q.v.); in cases of ascites, the liver and spleen are often at fault. The treatment of dropsy is chiefly by Diuretics (q.v.) and other evacuant remedies, which remove the fluid from the textures by unloading the blood of its excess of serum. It is, however, a matter of some difficulty to find the proper remedy in each individual case. In all cases of dropsy, the internal organs should be, if possible, submitted to a strict medical examination, and the treatment regulated accordingly. Mechanical means are also frequently used to relieve the patient of the fluid—in the case of the cavities of the body, Tapping (q.v.); in the cellular tissue either free incisions, or small tubes inserted through the skin, by which the fluid is allowed gradually to drain away.

Dropwort. See SPIRÆA, and WATER DROPWORT.

Droseraceæ, a small order of thalamifloral dicotyledons allied to Saxifrages, and including about 110 species. They are small herbaceous plants, generally inhabiting marshy places, and with leaves frequently circinate in bud, and usually covered with glandular processes or hairs. These are very frequently adapted to the capture and digestion of insects. See INSECTIVOROUS PLANTS.

Droskey. See CARRIAGE.

Drouet, JEAN BAPTISTE, COMTE D'ERLON, French marshal, was born 29th July 1765, at Rheims, entered a regiment of volunteers in 1792, and took part during the years 1793–96 in the campaigns of the Moselle, Meuse, and Sambre. His conduct in the Peninsular war was highly distinguished. After the fall of Napoleon, the Bourbons gave him the command of the 16th division, but he was shortly after arrested on the charge of conspiring against the royal family. On the return of Napoleon from Elba, he contrived to seize the citadel of Lille, in which he had been imprisoned, and held it for the emperor, who made him a peer of France. At the battle of Waterloo he commanded the first *corps d'armée*. After the capitulation of Paris, he fled to Bavaria, where he resided until the July revolution, when he returned to France, and received in 1832 the command of the army of Vendée. During 1834–35, he held the important office of governor-general of Algeria, and in 1843 was elevated to the rank of marshal. Drouet died 25th January 1844.—JEAN BAPTISTE DROUET (1763–1824) was a zealous revolutionist of the extreme Jacobin section; and LOUIS DROUET (1792–1873) was a very famous flute-player.

Drouyn de Lhuys, EDOUARD, a French statesman, born in 1805, was attached to the embassies at Madrid and at the Hague. In 1840 he was placed at the head of the commercial department under the Minister of Foreign Affairs, and shortly after was elected deputy for Melun; but he afterwards was deprived of his office because of his opposition to the government. Under Louis Napoleon's presidency he became Minister of Foreign Affairs, and in 1849 went to London for a short time as ambassador; after the *coup d'état* he became one of the vice-presidents of the Imperial Senate, and again Minister of Foreign Affairs. Being disappointed at the issue of the Vienna Conferences in 1855, he resigned his office. In 1863 he was recalled to his old post, resigning again in 1866. He died March 1, 1881.

Drowning. See ASPHYXIA, ARTIFICIAL RESPIRATION (Vol. VIII. p. 666), HUMANE SOCIETY.

Drowning was long a customary mode of capital punishment. Tacitus, writing about the end of the 1st century, tells us that the Germans hanged their greater criminals, but that meaner and more infamous offenders were plunged under hurdles into bogs and fens. Drowning was also a Roman punishment. The Lex Cornelia decreed that parricides should be sewn up in a sack with a dog, cock, viper, and ape, and thrown into the sea. The Anglo-Saxon codes ordered women convicted of theft to be drowned. The punishment was in such common use throughout the middle ages that grants of capital jurisdiction ran *cum fossa et furca* (i.e. 'with pit and gallows'). The pit, ditch, or well was for drowning women; but the punishment was occasionally inflicted on men. In Scotland, in 1556, a man convicted of theft and sacrilege was sentenced to be drowned, 'by the queen's special grace.' So lately as 1611 a man was drowned at Edinburgh for stealing a lamb; in 1623 eleven Gypsy women were sentenced to be drowned in the Nor' Loch there. By that time the punishment of drowning had become obsolete in England. It survived in Scotland until 1685 (the year of the drowning of the Wigtown martyrs), and in France was employed so late as 1793 at Nantes in the infamous *noyades* of Carrier (q.v.). The offending wives of the Turkish sultans were wont to be sewn up in a sack and cast into the Bosporus.

Droylsden, Lancashire, a suburb of Manchester, 3½ miles E. of it, with railway station. Pop. (1871) 6768; (1881) 8687; (1891) 9482.

Droz, ANTOINE GUSTAVE, novelist, was born at Paris, 6th June 1832, grandson of Jean Pierre Droz (1746–1823), an engraver of medals, well known in his day. At first Droz studied art, but soon to his profit exchanged the pencil for the pen, making a brilliant reputation that is not quite easy to understand in the pages of *La Vie Parisienne*, with his *Monsieur, Madame, et Bebé*, which, published in book-form in 1866, reached in twenty years its 120th edition. Later books are *Entre Nous* (1867), *Le Cahier bleu de Mademoiselle Cibot* (1868), *Autour d'une Source* (1869), *Un Paquet de Lettres* (1870),

Les Étangs (1876), *Tristesses et Sourires* (1883), and *L'Enfant* (1885).

Drugget (Fr. *droguet*), a woven and felted coarse woollen fabric, usually with a printed pattern, chiefly used for covering carpets, and hence called in some parts of Great Britain crumb-cloth. It is generally too thin to take the place of a proper carpet, but it is sometimes so employed. The name is also given to a stout dress fabric made with a linen warp and a worsted weft. It is made into petticoats, workmen's aprons, &c.; sometimes only the weft, but often both warp and weft, being dyed. This stuff is still to a considerable extent made by handloom in Scotland.

Drugs. See PRESCRIPTION, CHEMISTS AND DRUGGISTS, and ADULTERATION.

Druidism is commonly spoken of as the religious system of the Gauls and Britons, or of the Celtic peoples. Professor Rhys, however, affirms that the real religion of the Celts was an Aryan Polytheism like that of Italians and Greeks; and that Druidism, in so far as found amongst the Celts of Gaul or Britain, was by them derived probably from pre-Celtic and non-Aryan aborigines (Ivernians, Iberians, Euskarians or Basques, Neolithic men?), and was thus non-Aryan in origin. There is no reason, he says, for holding that Druidism was found amongst the Brythonic races proper, though it was in force amongst the Goidelic (Gaelic) peoples of the British Isles. Cæsar thus describes the character and functions of the Druids: 'They attend to divine worship, perform public and private sacrifices, and expound matters of religion. A great number of youths are gathered round them for the sake of education, and they enjoy the highest honour in that nation; for nearly all public and private quarrels come under their jurisdiction; and when any crime has been committed, when a murder has been perpetrated, when a controversy arises about a legacy or about landmarks, they are the judges too. They fix rewards and punishments; and should any one, whether a private individual or a public man, disobey their decrees, then they exclude him from the sacrifices. This is with them the severest punishment. The persons who are thus laid under interdict are regarded as impious and wicked people; everybody recoils from them, and shuns their society and conversation, lest he should be injured by associating with them. They cannot obtain legal redress when they ask for it, nor are they admitted to any honourable office. All these Druids have one chief, who enjoys the highest authority amongst them. When he dies, he is succeeded by the member of the order who is most prominent amongst the others, if there be any such single individual; if, however, there are several men equally distinguished, the successor is elected by the Druids. Sometimes they even go to war about this supremacy. At a certain time of the year, the Druids assemble on the territory of the Carnutes, which is believed to be the centre of all Gaul, in a sacred place. To that spot are gathered from everywhere all persons that have quarrels, and they abide by their judgments and decrees. It is believed that this institution was founded in Britannia, and thence transplanted into Gaul. Even nowadays, those who wish to become more intimately acquainted with the institution generally go to Britannia for instruction's sake.

'The Druids take no part in warfare; nor do they pay taxes like the rest of the people; they are exempt from military service, and from all public burdens. Attracted by such rewards, many come to be instructed by their own choice, while others are sent by their parents. They are reported to learn in the school a great number of verses, so that some remain there twenty years. They think it an unhallowed thing to commit their lore to writing, though in the other public and private affairs of life they frequently make use of the Greek alphabet. . . . Beyond all things, they are desirous to inspire a belief that men's souls do not perish, but transmigrate after death from one individual to another; and they hold that people are thereby most strongly urged to bravery, as the fear of death is thus destroyed. Besides, they hold a great many discourses about the stars and their motion, about the size of the world and of various countries, about the nature of things, about the power and might of the immortal gods; and they instruct the youths in these subjects.'

It is easy to comprehend that this powerful priesthood did all it could to uphold the national cause against the Roman conquerors, and urged the people to rebellion; so much so, that the Emperor Claudius found it necessary to interdict formally the practising of Druidical rites, which seem, however, to have continued down to the extinction of paganism. Besides being priests and teachers of religion, the Druids appear also to have been adepts in the magic arts, and were versed in the mysterious powers of animals and plants. The oak-tree was especially sacred among the Druids. In oak-groves they frequently performed their rites, and many have even derived their name from this custom. They also had a special reverence for the mistletoe, when growing on an oak. According to Pliny, a Druid, clothed in white, mounted the tree, and with a knife of gold, cut the mistletoe, which was received by another, standing on the ground, in his white robe. The same author gives a curious account of the 'serpent's egg,' worn as a distinguishing badge by the Druids. It was formed, he says, by the poisonous spittle of a great many serpents twined together. Gathered at moonlight, and afterwards worn in the bosom, it was a mighty talisman. All these particulars refer properly to the Druids of Gaul, but Cæsar's testimony leaves no doubt that the Druidism of Britain was essentially the same. According to Whitley Stokes, the Druids never were in Ireland a hierarchy or separate class, as they are said to have been in Britain; but merely a species of wizards, enchanters, or sorcerers.

In all the countries anciently inhabited by Celts, there are found rude structures of stone, one of the most common forms of which is the so-called *Dolmen* (q.v.). The older archæologists—e.g. Stukeley—assumed that these were Druidical altars, but there is no proof that such was their destination or origin: similar structures are found in Scandinavia and other parts of the Continent. The same doubts prevail as to the larger monuments of this kind—the supposed Druidical temples of Carnac in Brittany, and of Stonehenge (q.v.; and see STANDING STONES). Speaking more generally, the historians and archæologists of the present day do not profess to know nearly so much about the Druids as did those who wrote concerning them in a previous generation. See Professor Rhys's *Celtic Heathendom* (1888).

Drum (Ger. *trommel*; Fr. *tambour*, a modification of *tabour*; *timbrel* and *tambourine* are other forms of the word *tabour* or *tambour*), an instrument of percussion, in which a skin of parchment, stretched on a frame of wood or metal, is beaten with an instrument called a drumstick. There are three varieties of the drum: the kettle-drum, the side-drum, and the bass-drum. The first is the only one which can really claim to be a musical instrument, playing a definite note in harmony with the music it accompanies. The kettle-drum (Fr. *timbale*, Ger. *pauke*, Ital. *timpano*) consists of a kettle, or shell, of brass or copper, generally

hemispherical, over the mouth of which the skin is stretched by means of an iron ring, which is also provided with screws and keys for tightening the skin to tune it to any note within its compass. Two (and sometimes three) are required in a full orchestra; the larger should have a compass from F to C, the smaller from B♭ to F on the bass stave; and they require to be tuned to the proper notes, as indicated in the music. They are played upon with whalebone sticks, having at one end a wooden button covered with sponge or other soft material. The *roll*, a most effective part of its music, is performed with single alternate and very rapid strokes of the sticks, about one-fourth of the diameter from one side. The only military use made of the kettle-drum is in cavalry bands, which carry two, possibly because two are more easily balanced on a horse's shoulders than one, rather than from any musical reason.

The side-drum, or snare-drum, is more essentially a military instrument, though sometimes also used in orchestras. It consists of a brass or wood cylinder, with a skin *head* at each end. These are tightened by means of hoops over the heads, laced with an endless cord passing zigzagwise from head to head, and braced with leather braces, or more usually with rods and screws. Across the lower end several catgut cords, or snares, are tightly stretched in contact with the skin, causing a rattle when the other end is beaten. When anything is put between these snares and the skin to prevent the rattle, the drum is said to be *muffled*, and is so used at funerals. It is played upon on the centre of the upper end by means of two hard wood sticks with a knob at one end. The *roll* for the side-drum consists in striking two blows alternately with each stick. It is called daddy-mammy, from the sound. The side-drum was formerly used as a signal instrument, and the *drummer* is still an army institution (see BAND); but the Bugle (q.v.) does the signalling, the drum only being used with the music in marching.

The bass-drum (Ital. *gran tamburo* or *gran cassa*, Fr. *grosse caisse*) is of similar construction, having two heads, played with a stick having a soft round knob, the centre of the head being struck. The side and bass drums being only used to mark the rhythm of the music, are not tuned to any particular note. The orchestral bass-drum is very often made much larger in diameter than the military instrument, and with a shorter cylinder.

A *Drum-head Court-martial*, so called because originally held round the big drum, is a hasty council or court-martial held in the field when it is necessary to punish an offender on the spot and without delay. By the Army Act of 1881 a *Summary Court-martial* was instituted to take its place in the British army.

The Tambourine (q.v.) is another species of drum. The ancient Romans used small hand-drums—some resembling tambourines and others kettle-drums—in their religious dances; and the Parthians are said to have used them in war to give signals. They are believed to have been first introduced to western Europe by the Crusaders.

Drum, a Celtic word meaning the back, and applied to a small hill or ridge of hills, enters into the composition of many place-names, especially in Ireland and Scotland, as *Drum*condra, *Drum*glass, *Drum*sheugh.

Drumclog, a moorland tract in Lanarkshire, on the borders of Ayrshire, 6 miles SE. of Strathaven. Here, 2½ miles E. of Loudon Hill, Claverhouse was defeated on the 11th June 1679 in a skirmish with a party of 200 Covenanters, vividly described in Scott's *Old Mortality*. A monument marks the scene of the encounter.

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Drum-major was not a recognised rank in the English army till the time of Charles I., though previously there had been an officer in the royal household called the *drum-major general*, without whose license no one except royal troops might use a drum. The drum-major, besides other duties, received orders from the major of the battalion concerning the necessary beats or signals, and communicated them to the drummers. The title was changed in 1878 to 'sergeant-drummer,' but the teaching and control of the drummers still devolve upon this non-commissioned officer, who also marches at the head of the battalion and sets the pace. 'Sergeant-trumpeter' in the cavalry and artillery, and 'sergeant-piper' in Highland regiments are corresponding ranks. See BAND.

Drummond, CAPTAIN THOMAS, R.E., was born at Edinburgh in 1797, and in 1820 joined Colonel Colby in the work of the ordnance survey, which was immensely facilitated by his two inventions—an improved heliostat or mirror for throwing rays of light in a given direction, and a lime-light, better known as the Drummond Light (see LIME-LIGHT). Drummond was appointed head of the boundary commission under the Reform Bill; private secretary to Lord Althorp, Chancellor of the Exchequer, in 1833; and Under-secretary for Ireland in 1835. Here, by his impartiality, sound judgment, conciliatory disposition, indefatigable energy, and hearty devotion to the work before him, he at once gained the confidence and affection of the people, restored order, and obtained the willing assistance of all classes in advancing the best interests of the country. His memorable saying, 'Property has its duties as well as its rights,' which occurred in a letter to the Tipperary magistrates in 1838, was stigmatised by the *Times* of that date as the 'insolence' of a Jack-in-office. Worn out by his multiplied labours, he died, 15th April 1840, in Dublin, where a statue by Hogan was erected to his memory by public subscription, and where, alone of English secretaries, he lies in a grave of his own choosing among the people he was sent to govern. See the Life by Barry O'Brien (1889).

Drummond, WILLIAM, OF HAWTHORNDEN, a poet of considerable celebrity, was descended from an ancient Scottish family, and was born at his father's seat at Hawthornden, near Edinburgh, 13th December 1585. He was educated at the High School of Edinburgh, and afterwards at the university of that city, where he graduated Master of Arts in 1605. He next studied law and general literature at Bourges and Paris, and on his father's death in 1610 retired to Hawthornden, which, according to the learned Ruddiman, 'was a sweet and solitary seat, and very fit and proper for the muses.' There he married (1614), but lost his wife within the year, married again eighteen years later, and spent the rest of his life there between poetry and mechanical experiments. He had to subscribe to the Covenant, but abhorred the cause, and witnessed its triumph with a sinking of heart that the most sarcastic verses in manuscript could not relieve. He died 4th December 1649; his death, it is said, being hastened by his excessive grief for the fate of Charles I. Drummond enjoyed the friendship of many of his contemporaries, including Drayton, Montrose, and the great Ben Jonson, the latter of whom paid him a memorable visit at Hawthornden in 1619. The two men were unlike in everything save that both were genuine poets, and Drummond's notes of the greater man's conversation (printed 1842) is one of the most interesting chapters of literary history. His principal works are *Tears on the Death of Mœliades*—Prince Henry, son of James I.—(1613); *Poems: Amorous, Funerall, Divine, Pastorall, in Sonnets, Songs, Sextains,*

Madrigals (1616); *Forth Feasting* (1617); and *Flowers of Zion* (1623). His prose writings include a History of Scotland, known as the *History of the Five Jameses*, as well as some political tracts.

Drummond's verse abounds in the conceits, antitheses, and hyperboles of the period, and gives indication of a mind given to the luxury of melancholy. His sonnets are the best specimens of his muse, although even in these one looks in vain for sustained harmony or great originality of thought. His mastery of different rhythms reveals his learning and the labour he gave to his verse.

Re-issues of his poems appeared in 1832 (Maitland Club), in 1833 (by Peter Cunningham), and in 1857 (by W. D. Turnbull). See the learned and exhaustive Life by Professor Masson (1873).

Drummond Island, the most westerly of the Manitoulin chain, in Lake Huron, belongs to Chippewa county, Michigan. It measures 20 miles by 10.

Drummond Light. See LIME-LIGHT.

Drunkenness. See INTOXICATION, ALCOHOLISM, INEBRIATES (RETREATS FOR), TEMPERANCE.

Drupe, in Botany, a succulent fruit containing a single seed or kernel, usually inclosed in a hard 'stone,' the *endocarp*. The succulent part is the *mesocarp*, the skin of the epicarp. Examples are familiar in the fruits generally known as stone-fruits, the peach, plum, cherry, &c. The fruits of the genus Rubus (Raspberry, Bramble) are composed of many small aggregated drupes upon a common receptacle. See FRUIT.

Drury, DRU, a silversmith of London, was born 4th February 1725. He was devoted to the study of entomology and to collecting exotic insects, and published *Illustrations of Natural History* (3 vols. 1770–82, with upwards of 240 figures of exotic insects). His *Illustrations of Exotic Entomology* was edited in 1837 by J. O. Westwood, and appeared with nearly 700 figures by Moses Harris. Drury died 15th December 1803.

Drury-lane Theatre was first opened in 1663, and the present edifice, the fourth, in 1812, with a prologue by Lord Byron, the advertisement for which gave rise to the famous *Rejected Addresses*. Garrick opened the theatre in 1747 with Dr Johnson's prologue; and most of the great English actors have trod the boards which are now given over for the most part to pantomimes and spectacular pieces.

Druses, a remarkable people who inhabit a district in the north of Syria, comprising the whole of the southern range of Mount Lebanon and the western slope of Anti-Lebanon. Nearly half the Druse nation inhabit the Jebel Druse, a mountainous district to the south-west of Damascus, where they maintain a quasi-independence, refusing either conscription or taxation to the Turkish government. Those in the Lebanon and Anti-Lebanon are subjects to the Règlement du Liban, which releases them from conscription, and provides a settled annual payment from that section of the nation which collects its own taxes. Sixteen villages are in northern Galilee; and do not enjoy any of the privileges of the other two sections, but are more oppressed than either Moslems or Christians. According to their own tradition, they were Arab tribes from Yemen who migrated to Mesopotamia, thence to the neighbourhood of Aleppo, where Darazi found them, from whence they came south. Another tradition connects them with China. A third theory traces their origin to the Cuthites (Karduchi or Kurds), with whom, after the second captivity of Israel, Esarhaddon re-peopled the wasted strongholds of Samaria. More than a thousand years later, the Mardi, a warlike tribe of Persian extraction, were transplanted thither by Constantine IV., in 686 A.D., to the number of 12,000, to act as a bulwark against Mohammedan invasion. The Arabs also, in sweeping through the mountain-fastnesses, left a permanent impression there. Thus, according to this view, Cuthites, Mardi, and Arabs, or rather Mohammedans of various races, combined to form that strange being—the modern Druse.

The nationality of these mountaineers having been consolidated, their peculiar and mysterious religion began gradually to be developed. Hakim Biamr Allah, or Biamrillah, one of the Fatimite califs of Egypt, and a Nero in cruelty, was the author of this system. He affirmed that he was the representative of God, and, having enlisted his confessor, Darazi, in his cause, he prepared to propound his doctrine. In the 407th year of the Hegira (1029 A.D.), the divine nature of Hakim, or rather the incarnation of the Spirit of God in him, was publicly announced at Cairo. This revelation, however, was unfavourably received by the mob. Hakim's confessor, Darazi, narrowly escaped the fate of a martyr to the impostures of his master. Retiring, however, he established himself on the western slopes of Hermon near Hasbeya, and there began to inculcate the principles of the new faith; and although he never acquired any mastery over the sympathies of the mountaineers, he at least in all probability left his name to them. Hamzé, a Persian mystic, and successively the disciple and vizier of Hakim, introduced into the newly promulgated religion all the elements of attraction and strength which it possesses; and him the Druses venerate as the actual founder of their faith.

The Druses form one of the very few sects among whom proselytism is discouraged. They are remarkable conservatists. For 800 years they have maintained a distinct religious and political independence and nationality. Into their faith the doctrines of the Pentateuch, the Christian gospel, the Koran, and the Sufi allegories are wonderfully interwoven. The following are their seven great principles: (1) Veracity (to each other only); (2) mutual protection and resistance; (3) renunciation of all other religions; (4) separation from all who are in error; (5) recognition of the unity of God; (6) resignation to his will; (7) obedience to the commands of God. They believe in one God in whom there are no parts, to whom they ascribe no attributes, before whom the tongue ceases to utter, the eyes to behold, but who has revealed himself ten times upon the earth under the form and name of mortal men. In Hakim, so Hamzé taught, had God revealed himself for the tenth and last time; there have been sixty-nine minor manifestations. They also believe that the number of existing souls never varies, and that all the souls in life now have lived, vested in some human form, from the beginning of the world, and will so continue to exist till the end of it; that when a man dies, his soul puts on a fresh humanity, which occupies a rank in moral dignity corresponding to the purity or impurity of the past life. When the soul has been purified from every stain, there will come a period of rest. Prayer is looked upon as an interference with the work of the Creator. The resurrection will be ushered in by war between the Mohammedans and Christians, and the Druses only wait for an Armageddon in which they believe they are destined to take a prominent part. As a religious body, the Druses are divided into two classes; the Akals, or those initiated into the Druse mysteries; and the Djahils, the uninitiated. The former do not adorn themselves with gold, or wear silk, or embroidered garments; they forbear using wine,

spirits, tobacco, and other luxuries. Yet the Akal is taught that when necessary, equivocation, or even falsehood, may be practised.

The most remarkable man produced by the Druses in the beginning of the 17th century has been the Emir Fakr-ed-din, who annexed Beyrout and Sidon, and threatened Damascus, and who was executed by the Turks. When Emir Beshir was chosen sheikh of the Druses in 1789, the authority of the Porte was only nominal in the Lebanon; by the help of Egypt he subdued his rival sheikh Beshir. The Turks instigated the Druses to revolt against Egypt, and the final struggle between the Turks and Egyptians culminated in the defeat of the latter, owing to the assistance rendered to the Sultan by England, and Emir Beshir was exiled to Malta. After this, the Maronite Christians and the Druses took to murdering each other, and the strife reached its climax in 1860. From May to October of that year, accounts of the fearful barbarities practised by the Druses upon the Maronites followed each other with appalling frequency, until the indignation of Europe was roused against them. A conference of the five Powers which had guaranteed the independence of Turkey met at Paris, and it was resolved that a force of 20,000 men, one-half of which were French, should proceed to Syria to chastise the Druses, and that a European Commission should, on the spot, make inquiry as to the facts. The troops reached Syria in August 1860. They could not, however, get at the Druses, who retired into the Desert of the Hauran. It was ascertained beyond all doubt that the Turks and the low fanatical mob of Damascus were mainly chargeable with the crimes that had been committed; and that the retaliations of the Maronites were equally vindictive and horrible. Punishment was inflicted on those who were most to blame. In June 1861 the troops returned to France, and the commissioners drew up a new constitution for the Lebanon (1864), under which it was to be ruled by a Christian governor, appointed by the Porte; and to be divided into seven districts, under chiefs of the prevalent religion in each. The result was the appointment as governor of Daoud Pasha, under whom and Rustem Pasha (1880) disturbing elements have been kept in check. The Druses are estimated at 70,000 in number, the population of the Lebanon at 13,000, that of the Hauran about 50,000. In feeling they are friendly to England, and some have learned a little English. English missionaries have laboured amongst them. They are a brave, handsome, and industrious people, can almost all read and write, and have many characteristics in common with the Scottish Highlanders. They abstain from excesses, never taste wine or tobacco, polygamy is unknown, the women are virtuous, and divorces are uncommon though simple enough, consisting in the husband telling his wife three times that she had better go back to her mother. They had no superior educational establishment until Daoud Pasha founded and endowed one at Abey. They have, with incredible toil, carried the soil of the valleys up and along the hillsides, which are laid out in terraces, planted with mulberry, olive, and vine. Their chief trade is the manufacture of silk, chiefly at Shimlan, 3000 feet above sea-level; the manufacture employs about 6000 hands. Corn is also raised, though in very small quantity. Deir-el-kamar (q.v.) is the principal town, but of late, Bakhlin, 6 miles distant, has been the Druse headquarters. Kunawat is the chief town of the Druses of the Hauran. See the Earl of Carnarvon's *Druses of the Lebanon* (1860); De Sacy's *Exposé de la Religion des Druses* (1828); Churchill's *Ten Years' Residence in Mount Lebanon* (3 vols. 1853), and *Druses and Maronites* (1862); Laurence Oliphant's *Land of Gilead* (1880), and *Haifa* (1887).

Drusus, the name of a distinguished family of the gens Livia, and of some members of the Claudian gens. The most conspicuous of the Drusi were (1) M. Livius Drusus, tribune of the people in 122 B.C., the opponent of the democratic policy of his colleague, C. Gracchus. (2) His son of the same name, who, though identified by birth and sympathy with the patricians, renewed some of the most liberal measures of the Gracchi, and advocated the claims of the Italians to Roman citizenship. He was assassinated in 91 B.C., just before the outbreak of the Social War. (3) The most illustrious of the Drusi was Nero Claudius Drusus, commonly called Drusus Senior, the stepson of the Emperor Augustus, and younger brother of the Emperor Tiberius. His campaign against the Rhæti and other Alpine tribes (15 B.C.) is celebrated by Horace (*Odes*, iv. 4). Until his death in 9 B.C. he was engaged chiefly in establishing the Roman supremacy in Germany. The 'Fossa Drusiana,' a canal joining the Rhine with the Yssel, and other engineering works were constructed by his direction. For his exploits in Germany, Drusus was rewarded with the title of Germanicus, but care must be taken not to confound him with the celebrated Germanicus (q.v.), his own son.

Dryads, wood-nymphs in Greek mythology. See NYMPHS.

Dryburgh, a beautiful ruined Premonstratensian abbey, in Berwickshire, 5 miles ESE. of Melrose, on the Tweed, here crossed by a suspension bridge. It contains the dust of Sir Walter Scott and his son-in-law Lockhart; whilst Ebenezer Erskine (q.v.) is said to have been born close by. The abbey was founded in 1150 by David I., and not, as is commonly stated, by Hugh de Morville. It is said to have been more or less destroyed in 1322 and 1385; by Bowes and Latoun in 1544, and by the Earl of Hertford in 1545. See Spottiswoode's *Liber de Dryburgh* (Bannatyne Club, 1847).

Dryden, JOHN, was born at Aldwinkle, in Northamptonshire, on the 9th of August 1631. His father, Erasmus Dryden (the name until the poet's manhood was more usually spelt Driden), was a cadet of a family of Border origin, which some generations before had settled at Canons Ashby, in the same county, but at some distance from Aldwinkle. The poet's mother was Mary Pickering, and it was at her father's house (the vicarage of the parish of Aldwinkle All Saints) that Dryden was born. Very little is known of his early youth, but he seems to have passed it chiefly at Tichmarsh, near Aldwinkle, where his maternal grandfather also had property. He was entered at Westminster School when he was twelve years old, and proceeded to Trinity College, Cambridge, when he was nineteen, being matriculated on July 16, and elected to a Westminster scholarship on October 2. On July 19, 1652, he was punished slightly for some offence against discipline, and this is all that is positively known about his Cambridge career, except that he took his bachelor's degree in 1654. He never proceeded to the M.A., preferring to take that degree from Lambeth, and he seems on the whole to have had little affection for Cambridge. His father died in the same year (1654), and Dryden succeeded to two-thirds, and after his mother's death to the whole, of a small estate at Blakesley near Canons Ashby, then worth £60 a year, where he seems never to have resided. He, after the fashion of the time, continued to live at Cambridge till 1657, and then he went to London. Both the Drydens and the Pickerings were strong parliamentarians, and

Dryden seems to have had some, but vain, hopes of patronage from his cousin Sir Gilbert Pickering, a favourite of Cromwell. It is thought that he began early to do work for the booksellers, especially Herringman, a then frequent employer of young authors; but again we have little or no positive information respecting him till December 1, 1663, when he married Lady Elizabeth Howard, eldest daughter of the Earl of Berkshire, and sister of two not unknown men of letters who were Dryden's friends. Much scandal has been talked about this marriage on absolutely no solid ground, but it seems probable that it was not wholly happy, and that Lady Elizabeth, whose intellect was certainly not strong, may have had a bad temper. Three sons, Charles, John, and Erasmus Henry, were the offspring, and from this time Dryden occasionally resided at his father-in-law's Wiltshire seat of Charlton. He had several London residences, the best known of which was in Gerrard Street, Soho, a house now marked with a tablet. Very shortly after the wedding, Pepys on the 3d of February 1664 met Dryden, 'the poet I knew at Cambridge,' at Will's Coffee-house, and this is the first of the personal notices (very few in number) that we have of the poet.

The dramatic work of which further notice will be taken shortly now occupied Dryden almost entirely for many years—for no less than fourteen he wrote next to nothing but drama. He was made poet-laureate and historiographer-royal in 1670, the emoluments of which places (£200 a year) were increased by a pension of £100 in 1679. Some literary disputes and a quarrel with the malevolent Rochester, which brought Dryden on the 8th December 1679 a cudgelling by masked bravoes, are almost the only events of importance in this long period. The disturbances in public opinion which followed the Popish Plot provoked the splendid series of satires beginning with *Absalom and Achitophel*, and brought an increasing storm of libels in prose and verse on Dryden's head from the other side. In 1683, as part compensation for great arrears in his salary, and perhaps also as reward for his political services, a collectorship of customs in the port of London was granted him, but the value of this place is not known. In the epidemic of conversion which followed the accession of James II., Dryden was one of the chief seceders from the Church of England, and his sincerity in this act has been violently impugned. Controversy on such a point being here impossible, it must be sufficient to say that his previous state of mind on the subject appears to have been exactly that half-scepticism, with a kind of yearning for authoritative certainty, which has constantly disposed men to Roman Catholicism; that he gained (as can be proved) not one penny by the change of faith; and that he adhered to it when others 'reverted,' and when his own constancy inflicted the heaviest loss upon him. At the Revolution he did not take the oaths, and thus lost all his places and pensions. To supply this loss, he then returned to play-writing, and to the less uncongenial, if not quite so profitable work of translation. During the last ten years of his life (which saw the production of his famous translation of *Virgil*, and of the collection of his most accomplished verse called the *Fables*) we have, thanks to the accidental preservation of letters, a few more personal details about Dryden than at other times. Almost immediately after the publication of the last-named volume (at the end of 1699), an attack of gout, from which disease he had always suffered much, set in, and resulting in mortification of the toe, carried him off on May-day 1700. He was splendidly buried in Westminster Abbey. All his sons died before their mother, who lived till 1714, and was insane at the time of her death. The youngest, however, Erasmus Henry, had succeeded to the family honours and baronetcy, and to the estate of Canons Ashby, which, by a female descent, are still in the name.

Dryden's great literary work began early, though not plentifully or very promisingly, with some poems in the 'metaphysical' manner of Donne and Cleveland; but his stanzas on the death of Cromwell, though lacking ease and flow, have great merit, and the group of panegyrical poems, written after the Restoration, beginning with *Astræa Redux* and ending with *Annus Mirabilis*, exhibit wonderful command of a style of verse not hitherto attempted. Then, as has been said, Dryden turned all his energies for many years into dramatic work, which he confesses to have been distasteful to him, and which was done for profit simply. Between *The Wild Gallant* (1663) and *Love Triumphant* (1694) he produced a great number of plays, the best of which are the *Conquest of Granada* (1670), *Marriage à la Mode* (1672), *Aurungzebe* (1675), *All for Love* (1677), *The Spanish Friar* (1681), and *Don Sebastian* (1689). The comedies are disfigured by a double portion of the license in language and situation which was common at the time, and the earlier tragedies by their unnatural rhymed dialogue, and by the frantic rant of style which was fashionable; but they occasionally contain, especially in interspersed lyrics, and in a few set speeches, extremely fine poetry. It was Dryden's practice, too, to prefix or append to the published versions of these plays, essays which developed his astonishing talent for prose, which may be said to have produced English literary criticism, and which contain passages unsurpassed of their kind. It can hardly, however, be said that his full powers were shown till the appearance, in his fiftieth year, of *Absalom and Achitophel*. This, with his contribution to its second part, *The Medal*, *Macflecknoe* (a satire on the whig Shadwell), and with the didactic poems of *Religio Laici* (exhibiting the sentiments of a half-sceptical Anglican), and *The Hind and the Panther*, written after, and to justify his conversion, contain by far the most powerful work of the satiric and didactic kind in English. The rhymed heroic couplet is here adjusted to the purposes of invective, insinuation, and argument with unmatched dexterity, and is charged with an overwhelming force.

Besides these, Dryden exercised himself in various minor kinds, such, for instance, as the preparation of prologues and epilogues for other men's plays as well as his own, and in the composition of Pindaric odes, one of which, that on Mrs Anne Killigrew, shares with his own later 'Alexander's Feast' the position of the best work of this particular kind. He also began the practice of translating the classics, which led finally to the great translation of *Virgil* already referred to, and to his scarcely less popular *Juvenal*; and this in its turn led him to what he also called 'translation' of authors other than the classics, such as Chaucer and Boccaccio. These later paraphrases formed the nucleus of the *Fables*, in which the magnificence, the variety, and the flexibility of his poetical style appear as clearly as its vigour and weight appear in the satires and didactic pieces. The dedication of the *Fables* in particular, addressed to the Duchess of Ormond, when the author was nearly seventy, has a stately beauty nowhere exceeded. His general poetical characteristics, as far as they can be summed up in a very brief space, may be said to be the faculty of clothing in splendid verse of a pattern quite unknown before him, and never in its own way equalled since, almost any subject that presented itself for treatment. Of inventive, or rather creative origin-

ality he had, save as to matters of form, little; and the finest and most ethereal graces of poetry were not his. But he is hardly to be excelled in massive yet not ungraceful splendour of style, and not to be excelled at all in variety of accomplishment. His prose, less splendid than his poetry, is of equal merit as a vehicle of literature, and like his verse, is almost entirely of his own finding out. For a combination of familiarity and finish it has not yet been surpassed.

Dryden's plays appeared in two folio volumes in the year of his death, and were afterwards re-edited by his friend Congreve, in six duodecimos. The *Fables*, supplemented by most, though not all, of his earlier non-dramatic verse, make another folio volume of the same date. One or two somewhat imperfect editions of his poems appeared during the 18th century; and Malone gave an admirable collection of the prose in four volumes. But all editions were superseded by that of Sir Walter (then Mr) Scott in 1808. This was reprinted in 1821, and has been since 1884 re-edited with some additions and corrections. Scott's *Life* is excellent, and is the standard; but the editions of Bell, Mitford, and Christie (especially the latter) are useful. The volume on *Dryden* in the 'English Men of Letters' series by the writer of the present article may be consulted; while valuable critical notices of Dryden will be found in Johnson's *Lives*, in Hazlitt's *English Poets*, and in the first series of Mr Lowell's *Among my Books*.

Drying-machines. There are several kinds of these in use. For the drying of long webs of calico and other fabrics, a machine, consisting of a series of metal cylinders revolving in an iron frame, and heated internally with steam, is employed. Sometimes the rollers are arranged in vertical, sometimes in horizontal lines, and the cloth passes over them in a continuous web.

Centrifugal drying-machines or hydro-extractors consist of a circular wire-basket mounted on a shaft and set in a close metal jacket. The fabrics or stuffs to be dried are placed in the basket, which revolves at a speed varying from 700 to 2000 revolutions per minute. The water flies off by the centrifugal action, and escapes from the inclosing cylinder by a discharge pipe. This form of drying-machine, which has several modifications, is very largely used and for a great variety of purposes.

A recent method of drying wool and other textile material is by the Blackman air-propeller. The wool is spread over a perforated surface which is in connection with a revolving propeller, with peculiarly shaped blades, placed at the top of a vertical trunk or shaft. This apparatus dries the wool by drawing heated air through it and expelling the air at the top through a turret in the roof of the building in which it is placed.

Yarns are frequently dried by passing them slowly through a hot chamber, by means of continuous chains, upon which rollers carrying the hanks are placed.

The drying-apparatus in connection with a paper-making machine consists of a series of drums with wooden spars on their circumference. These are mounted horizontally on an iron frame, and move at a slow speed as the web of paper passes over them. There are fanners within the drums which drive heated air against the inner surface of the paper.

Dryobalanops. See CAMPHOR.

Dryophis, a genus of non-venomous snakes in the sub-order Colubriformes, allied to Dendrophis; and, like that genus, of very elongated form, and mostly arboreal in habit. They are distinguished by a curious prolongation of the snout, which in some is slender, in some leaf-like. They are natives of tropical America and West Africa. The elongated snout is very marked in the associated genus Langaha, of Madagascar.

Dry-point, a sharp etching-needle, used to incise fine lines in copper, without the plate being covered with etching-ground, or the lines bit in by acid (see ENGRAVING, ETCHING). The work produced by the dry-point is not only very delicate, but it wears less in printing than lines produced by the action of acid.

Dry Rot, a kind of decay, often very rapid, to which timber is subject. Its name is misleading, since this decay is associated with the presence of water, such as is found in unseasoned wood. It has proved ruinous to many valuable edifices, and has been the cause of many serious accidents. The ends of joists are often affected by it, so that upon being burdened with even a slight additional load, they are ready to break off by the wall; and the process of destruction has often gone far without a suspicion being entertained of anything wrong. Dry rot is occasioned by Fungi, the *mycelium* of which penetrates the substance of the timber, destroying its texture, and reducing it to a fragile or even friable mass. *Merulius lacrymans* and *Polyporus destructor* are species very commonly productive of this mischief; the first being by far the most common and formidable. Its German name is *Hausschwamm*. Other fungi, however, produce the same effects; and there are some forms of mycelium not unfrequently occurring as dry rot, of which it is uncertain to what fungus they ought to be referred, since they have not been observed to develop themselves in any perfect form. The different modifications of appearance which the mycelium of the same fungus may exhibit in different circumstances are also imperfectly known. Very destructive ravages have been ascribed, without much probability, to different species of Sporotrichum, particularly in the naval yards of Britain; but the genus is altogether a doubtful one, and not improbably consists of mere forms of undeveloped mycelium. Several species of fungi are often present together in timber affected with dry rot. *Merulius lacrymans* first appears in small white points; a filamentous substance radiating from these gradually forms broad patches, sometimes many feet in diameter; from these long creeping shoots often proceed, and a network of filaments penetrates into every crevice, filling the whole mass of the timber with delicate filaments, which destroy the cohesion of its fibres. It often appears in the form of leathery laminæ.

Of the causes of dry rot, stagnation of air, as behind a wainscot or under a floor, is certainly one of the chief, and a knowledge of this fact suggests means of prevention which may often be easily and most advantageously employed. Another principal cause is insufficient drying of the timber itself; and much of the prevalence of dry rot is not improbably due to the practice of felling trees in spring when the wood is full of sap. Any circumstance which may tend to render the sap acidulous greatly increases the liability to dry rot. The production of fungi takes place with unusual rapidity when by fermentation or otherwise an acidulous condition of organic substances is produced. A fermentation and chemical change in the albuminous constituents of the wood is not improbably the immediate cause of dry rot, providing a soil suitable for the vegetation of fungi.

For the prevention of dry rot various processes have been employed, the object of which is to fill the pores of the wood with some chemical substance. Active inquiry as to methods of preservation of timber began about the middle of last century, and the matter was rendered urgent by the

premature decay of the ships of the royal navy at a time of long-maintained conflict. No satisfactory method was discovered, however, until the development of the railway and telegraph system led to further inquiry with the view of preventing the destruction of sleepers and telegraph poles. The various processes of kyanising (corrosive sublimate or bichloride of mercury), margarysing (sulphate of copper), burnettising (chloride of zinc), have been replaced by the effective method of creasoting, invented by Mr John Bethell in 1838. But without the use of any such means we have abundant evidence that well-seasoned timber, in favourable circumstances, may remain unassailed by fungi for many centuries.

See Britten's treatise on the subject (1875); Boulton on the 'Antiseptic Treatment of Timber' in the *Proceedings of the Institution of Civil Engineers* (1884); Murray on 'Dry Rot' in *Architect* (January 1885); Marshall Ward on 'Diseases of Timber,' *Nature* (1888); and Goeppert, *Der Hausschwamm* (Breslau, 1885).

Dual, in Grammar, is the form given in some languages to a noun or a verb, when only two things are spoken of. Thus, in Greek, *pater* is 'father;' *patere*, 'two fathers;' *pateres*, 'fathers.' Sanskrit, ancient Greek, Arabic, and Hebrew have the dual number, the last only in nouns. Modern Greek has lost the dual. The only trace of it in Latin is in the two words *duo*, 'two,' and *ambo*, 'both.' It is wanting in the Teutonic languages, with the exception of the ancient Gothic, which had a dual form of the verb. In Anglo-Saxon there was a separate form of pronoun for 'we two' (*wit*) and 'ye two' (*git*).

Dual Control. See EGYPT.

Dualism is the name given to a philosophical theory, according to which some two principles, of different nature, original, and incapable of being derived the one from the other, lie at the bottom of everything; as, for example, the ideal and the real, or the material and the thinking substance. In a narrower and theological sense, dualism means the assumption of two original beings, a good and an evil, as in the doctrine of Zoroaster (q.v.), or of two distinct principles in man, a bodily and a spiritual. The opposite of dualism is Monism.

Du Barry, MARIE JEANNE GOMARD DE VAUBERNIER, COMTESSE, favourite of Louis XV., was born August 19, 1746, at Vaucouleurs, the daughter of a dressmaker. Coming very young to Paris as Mademoiselle Lange, she became a milliner of more than dubious character, next the mistress of the disreputable Jean, Comte du Barry, by whose means she was presented to Louis XV., already, at sixty years of age, in his dotage of shame. Her handsome face, but still more her piquant if vulgar wit, amused the worn-out dotard, who procured her presentation at court as Comtesse du Barry, in 1769, by marrying her to Guillaume, Comte du Barry, the reprobate brother of her earlier reprobate protector. Her influence henceforth reigned supreme, and the greatest courtiers were content to abase themselves before her. The Duc de Choiseul attempted to resist her influence, but was soon displaced, while she, with her confidant the Duc d'Aiguillon, governed France. On the death of Louis (1774) she was dismissed from court, but was allowed to live on in her house at Luciennes. In 1792 she went to London to dispose of her jewels, but on her return next year was arrested, tried before the Revolutionary Tribunal for having wasted the treasures of the state, and worn in London mourning for the late king. She was guillotined, 7th December 1793. It has been estimated that Du Barry cost France 35,000,000 francs: her one merit was that she was liberal to artists and men of letters, probably from a dread of epigram and caricature. Her *Mémoires* (6 vols. Paris, 1829–30) are unreliable; not so Vatel's *Histoire de Mademoiselle Du Barry* (3 vols. 1882–84).

Du Bellay. See BELLAY.

Dubitza, a fortified town on the northern frontier of Bosnia, on the right bank of the Unna, about 10 miles from its confluence with the Save. During the 16th and 17th centuries it was a bone of contention between Austria and the Porte; and with the rest of Bosnia it passed under Austrian administration in 1879. Pop. 3000.

Dublin, a maritime county in the province of Leinster, Ireland, and containing the metropolis of that country; bounded, N. by Meath, E. by the Irish Sea, S. by Wicklow, and W. by Kildare and Meath. It is the smallest but two of the Irish counties, having an area of 354 sq. m., of which $\frac{6}{7}$ths are arable, and $\frac{1}{17}$th in wood. The coast, from its indentations with creeks and bays, is 70 miles long, and off it lie several islands. Dublin Bay, one of the finest in the kingdom, is 6 miles broad, with a sweep of 16 miles, and is generally deep. There are precipitous hills, about 500 feet high, both at the north and south ends; and the bay is remarkably picturesque. The coast of Dublin is practically undefended by fortifications. The surface of the country inland is mostly a level rich plain, with slight undulations, but rising in the south in a hill-range, the highest point of which is Kippure, 2473 feet. North of this range the only prominent eminence is the Hill of Howth, 503 feet. The only river of note is the Liffey, which runs through Dublin city into Dublin Bay. The Royal and Grand Canals, starting from docks in Dublin, unite the Liffey and the Shannon. The chief rocks are carboniferous limestone, granite, of great beauty and value, and some metamorphic rocks and greenstones. There are copper and lead mines near the Scalp. Granite and limestone are much used in building. There are many mineral springs, the most important of which—resembling that of Harrogate—is at Lucan. The climate is mild. The soil is generally a calcareous gravelly clay. In the north and west are grazing and meadow farms, and around Dublin city, villas, dairy-farms, and nursery-gardens. Dublin is the best cultivated county in Ireland. In 1888 about 89,000 acres, not very much under half the county, were in crop. Along the coast there are important fisheries of herrings, turbot, brill, sole, plaice, cod, haddock, whiting, and oysters. The manufactures are few and unimportant, save at Balbriggan, which is famed for its hosiery. Dublin is divided into nine baronies, with two parliamentary and nineteen electoral divisions. The towns are Dublin, the capital of Ireland, and Kingstown. Pop. (1861) 410,252; (1881) 418,910; (1891) 429,111, of whom 76·5 per cent. are Catholics and 19·3 Episcopalians. At the end of 1888 the county had 66,366 pupils on the rolls of its National schools. The county sends seven members to parliament—two for Dublin county, three for Dublin city, and two for Dublin University. There are numerous antiquities in different parts of the county.

Dublin (Irish *Dubh-linn*, 'black pool;' the *Eblana* of Ptolemy), the capital of Ireland, stands on the river Liffey, where it falls into Dublin Bay, in 53° 20′ 38″ N. lat., and 6° 17′ 30″ W. long. It is 64 miles W. of Holyhead, 138 W. of Liverpool, 223 SSW. of Glasgow, and 245 NW. of Bristol. The city covers an area of 1300 acres, but its parliamentary boundary comprises an area of about 5000 acres, and its municipal boundary 3808 acres. Some of Dublin is built on land reclaimed from the sea, and the ground is generally flat. The river, running from west to east, divides the city

into two almost equal portions. The fashionable quarter is to the south-east of the city; and the principal shops are in the centre of the town; there are many good private houses in the suburbs. In the south-west, where were situated the ancient 'Liberties' of St Patrick's, the streets are narrow, crooked, and irregular, while in the fashionable and business portions they are broad, clean, and well kept. The city is surrounded by a 'Circular Road' of nearly 9 miles in length.

The most important street is Sackville Street, which is 120 feet broad and 700 yards long; at its north end stands the Rotunda, with Rutland Square; in its centre the beautiful Ionic portico of the General Post-office, and Nelson's Monument (upwards of 130 feet high); while on the south it is terminated by O'Connell Bridge, and a wedge-like block of houses formed by the converging sides of Westmoreland and D'Olier Streets. A peculiar feature of Dublin is its squares, which are very numerous, spacious, and well kept. St Stephen's Green, the largest, lately laid out with great taste as a People's Park by the munificence of the Guinness family, occupies an area of nearly 20 acres, and is about a mile in circuit. Somewhat smaller, but more fashionable, are Merrion Square (13 acres), and Fitzwilliam Square. The large park and quadrangles of Trinity College occupy more than 40 acres. Leinster House, once the town mansion of the Dukes of Leinster, now the home of the Royal Dublin Society, has lately been added to by the erection of a National Art Gallery and a Museum of Natural History; and new buildings for a Science and Art Museum and a National Library are at present in course of construction by the imperial government at a cost of over £100,000.

Among the public buildings of Dublin may be mentioned the Bank of Ireland (formerly the Houses of Parliament), Trinity College, the Custom-house, and the Four Courts, which, from the boldness of their design, and the massiveness of their proportions, have a very imposing effect. The Castle has no pretensions to architectural beauty. The Chapel is interesting, and contains some fine carved work of Grinling Gibbons, now barbarously painted white! There are monuments of William III. in College Green (once a *green*, but now a paved street); of Nelson, the Duke of Wellington, Goldsmith, Burke, Grattan, O'Connell, and many others, in various public sites.

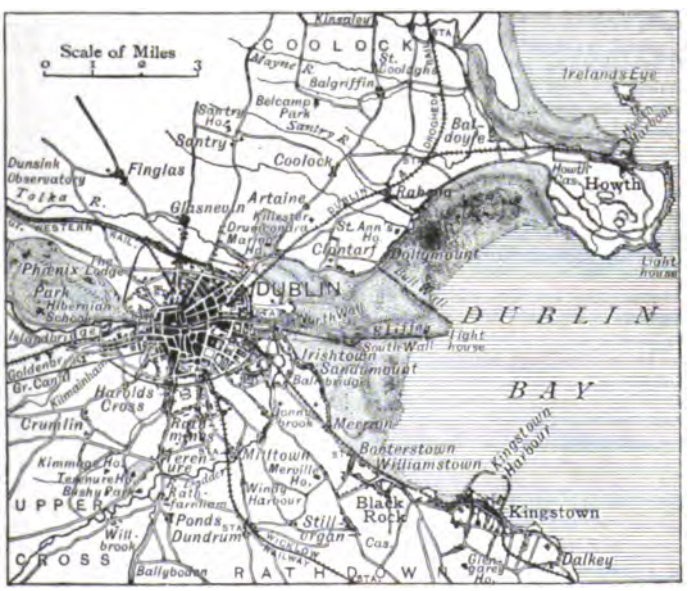
Within the limits of the Circular Road, the Liffey is crossed by nine bridges (two of iron), and throughout the whole extent of the city the banks of the river are faced with granite walls and parapets. On each side of these 'quays,' 2½ miles long, there is a roadway, with houses and shops. The quay proper extends eastward from Carlisle Bridge. Near the Custom-house, a strikingly handsome classic building of native granite, there are several large docks for the accommodation of vessels from distant ports with excisable cargoes, and in communication with the Royal and Grand Canals; the former connecting Dublin with the North Shannon and the west of Ireland, the latter with the southerly portion of the same river and the sea. A large basin, the 'Spencer Dock,' was opened in 1873; and the harbour has been much improved in late years by the completion of two large breakwaters, the North and South 'Walls.' There is a bar at the mouth of the harbour, but even there the least depth at low tide is about 11 feet.

The chief manufacture of Dublin is porter, of which nearly half a million hogsheads are annually exported, 'Guinness' being, of course, the most important, the capital engaged in Guinness's Company being £5,200,000, and the number of hands employed being over 1400. Next in order is whisky, and then poplin, which is much celebrated. The principal banks are the Bank of Ireland, the Royal, National, Provincial, Hibernian, and Northern.

The great educational institution of Dublin is Trinity College (see below). There is also a Roman Catholic university (since 1854). The Royal University of Ireland, which superseded in 1880 the Queen's University, is not a teaching body, but resembles the University of London; it has its seat here. For the humbler classes much has been done by the National Board (whose model schools are attended by large numbers of children), by the Church Education Society, Roman Catholic brotherhoods and sisterhoods, such as the Christian Brothers, and other agencies. There are many literary and scientific societies dealing with subjects of general knowledge, or with matters of local or national interest. There are two botanic gardens—one at Glasnevin, belonging to the Royal Dublin Society, and one near Donnybrook, connected with the university. The hospitals, asylums, orphanages, and other charitable institutions are numerous, and liberally maintained.

The municipal affairs are under the control of a town-council, which consists of a lord mayor, fifteen aldermen, and forty-five councillors. The city police—under government control and supervision—is excellent. The city sends three members to parliament. The population has risen from 64,500 in 1688 to 167,899 in 1804, 232,726 in 1841, 249,602 in 1881, and 278,896 in 1891.

The environs of Dublin are especially beautiful.



Environs of Dublin.

Rathmines, a southern suburb, has become a large township, and, together with Monkstown, Kingstown, and Killiney, is the favourite residence of the wealthier part of the mercantile community. Glas-

nevin, on the north, deserves special notice as the favourite residence of the poet Tickell, of Addison, Steele, Parnell, Swift, Sheridan, and many other celebrated men; in the cemetery lie the remains of Curran, O'Connell, and others. The Phœnix Park is a magnificent area of nearly 2000 acres, in some parts level, in others with broken ground, very finely timbered, and well stocked with fallow deer. It affords a splendid field for military reviews, and is used by the inhabitants of Dublin of all classes for recreation. Dublin, as a whole, with its fine bay—which has often been compared to the Bay of Naples—its splendid park, massive public buildings, wide streets, spacious and well-kept squares, regular quays, and beautiful environs, is one of the handsomest capitals in Europe.

There are numerous places of worship, monasteries, convents, friaries, and a Jewish synagogue. Dublin is remarkable in possessing two Protestant cathedrals. St Patrick's, founded in 1190, was restored in 1865 by the munificence of a single individual, Sir Benjamin Lee Guinness; and Christ Church, dating from 1038, but not raised to cathedral rank till 1541, is a smaller but more beautiful edifice, also restored in 1878 by Mr Henry Roe.

The ancient history of Dublin is mainly legend, but we know that in the 9th century the Danes took the place, and it was in their hands for the most part until the English Conquest. Henry II. held his court there in 1171; the English residents were almost extirpated in the rising of 'Black Monday' in 1207. In 1689 James II. held a parliament in Dublin, and the town was immediately afterwards occupied by William III. Since then, Dublin has as capital continued to be the centre of Irish history. See IRELAND.

UNIVERSITY OF DUBLIN.—The first university of Dublin was established in connection with St Patrick's Cathedral in 1320. The existing university, with a single college, Trinity, was founded in 1591. Queen Elizabeth provided the charter, the corporation of Dublin bestowed the ground and ruins of the suppressed monastery of All-Hallows, and the Irish gentry supplied by subscription the funds necessary for the erection of the buildings. James I. gave additional endowments. By Queen Elizabeth's charter, the governing body of Trinity College was to consist of a provost, three fellows, and three scholars. The new statutes of Archbishop Laud, definitively published in 1637, are in the main still in force. In 1613 James I. conferred on the university the right of sending two members to the Irish parliament. One of these was taken away at the Union in 1800, but was again restored by the Reform Bill of 1832. The electors were formerly the provost, fellows, and scholars of Trinity College; but in 1832 the privilege was extended to masters of arts and those of higher degree. The last Reform Bill has left the representation of the university unchanged.

The provost and senior fellows form the board of management of the college; and by letters-patent of 1874, a council was established to co-operate with the board in the regulation of the studies of the university, and in the appointment and regulation of the tenure of office and duties of professors. This council consists of seventeen members—viz. the provost of Trinity College, four members elected by the senior fellows, four elected by the junior fellows, four by the professors, and four by the senate of the university.

The government and working of the university are in the hands of the chancellor, vice-chancellor, the provost of Trinity College, two proctors (one chosen from the senior and one from the junior fellows), a senior lecturer (who regulates the public examinations), two deans, and a censor, a librarian, registrar, auditor, professors, and examiners. The chancellor (or, in his absence, the vice-chancellor or *pro* vice-chancellor), all masters of arts, and doctors of the three faculties, whose names are on the college books, form the senate of the university. The senate elects the chancellor, and confers degrees. The provost of Trinity College, who is appointed by the crown, may be a layman, and of any religious denomination. The junior fellows are elected by examination. They form the great teaching staff of the college, and perform all the duties of lecturing and examining the undergraduates. Most of them are tutors, and their income, which may average £600 a year, is derived partly from a salary given by the college, and partly from their duties as tutors, lecturers, and examiners. Fellowships were formerly tenable only by members of the Episcopal Church, but by the recent act all religious restrictions were abolished. The number of the junior fellows is now twenty-six. The rule of celibacy, imposed in the reign of Charles I., was repealed in 1840. The senior fellows (seven) enjoy considerably larger emoluments, and are 'co-opted' by seniority from among the junior fellows.

There is a very complete staff of professors in divinity, natural philosophy, mathematics, law, and medicine; there are also professors of ancient, oriental, and modern languages, including Irish; moral philosophy, oratory, and English literature, modern history, political economy, natural history, botany, geology, mineralogy, civil engineering, &c.

The scholars, seventy in number, are elected from among the undergraduates. They are members of the corporation, and enjoy the university franchise. Scholarships (which are tenable for five years) are gained by public competition—some being assigned to classics, and others to science. The various emoluments of a scholar, arising from salary, remission of fees, rooms, commons, &c., amount to about £50 per annum. There are also minor scholarships for the encouragement of the study of divinity and of the Irish language; while others are connected with the royal and endowed schools.

There are four grades of students. (1) Noblemen, sons of noblemen, and baronets, who have certain special privileges; the first two being allowed the degree of B.A. *per specialem gratiam*. (2) Fellow-commoners, who dine at the fellows' table. (3) Pensioners, who form the great body of the students. (4) Sizars, who have rooms and commons free. The sizars are limited to thirty; they are elected by competitive examination, and hold their sizarships (worth about £37 per annum) for four years. Each rank has a dress peculiar to itself. Students are admitted to the college after an examination. Each student must at entrance place himself under one of the eighteen junior fellows who are tutors. In 1859 fourteen university studentships were founded, worth £100 a year each, tenable for seven years, to encourage graduates in the pursuit of some special branch of study.

To proceed to the degree of A.B., a student must keep terms for four years, two terms at least being necessary in each year. Terms may be kept either by residence, by attendance at lectures, or by simply appearing on a stated day in the public hall, and passing a creditable examination in a prescribed course. Lectures are delivered on the different subjects of each term examination by the tutors, the honour examiners, and the university professors; and money prizes and parchment 'honours' are awarded to the most successful candidates at the Term examinations. Classes or schools—viz. of the first and second years, are compelled to take up classics, mathematics, and logic; but after passing the 'Little-go' at the

end of the second year, undergraduates may confine their attention to certain studies in seven different courses: Classics, mathematics, ethics, experimental science (mathematical physics), natural science, history, modern literature. Degrees are conferred in arts, divinity, law, medicine, music, and engineering. The teaching staff is numerous, and in the actual work of tuition the tutorial and professorial elements are more largely combined than in any other British college or university. Many distinguished men are counted among the *alumni* of Trinity. The names of Usher and Berkeley; of Tate, Brady, Toplady; of Magee, Sir W. R. Hamilton, Archer Butler, Lord Cairns; and of Burke, Congreve, Farquhar, Curran, Swift, Goldsmith, and Moore, with a host of others celebrated in politics, in law, in science, and in literature, are sufficient to indicate the success which has attended her sons.

See histories of the City, by J. Warburton (2 vols. 1818) and J. T. Gilbert (3 vols. 1854–59); of the University, by W. Taylor (1845), D. C. Heron (1847), and T. W. Stubbs (1889); and the *Trinity College Calendar*.

Dubois, GUILLAUME, Cardinal, born 6th September 1656, was the son of an apothecary, and became tutor to the young Duc de Chartres. Although of an ugly exterior, he contrived, by his mixture of wit and hypocrisy, to win the esteem of the boy's mother and the confidence of his pupil. His public career commenced after the marriage of his pupil, in 1692, with Mademoiselle Blois, a natural but legitimised daughter of Louis XIV. He was attached to the French embassy at the court of London, where he formed some important political connections. On his return he became private secretary to his old pupil; and when the latter (now Duke of Orleans) became regent in 1715, Dubois became virtually the most powerful man in France. In 1717 he succeeded in forming the Triple Alliance between England, Holland, and France, which, with the accession of the emperor in 1718, became the Quadruple Alliance. He was appointed foreign minister and Archbishop of Cambrai; in 1721 he obtained the cardinal's hat, and in the following year he became prime-minister of France, with unbounded authority. He died 10th August 1723, a victim to hard work and the wildest debauchery.

Du Bois-Reymond, EMIL, physiologist, was born in Berlin in 1818, and in 1841 began the researches in animal electricity with which his name is chiefly identified. The results of his labours in this field are contained in several valuable publications, the most important of which is his great work, *Untersuchungen über tierische Elektrizität* (Berlin, 2 vols. 1848–84). In 1858 he succeeded Joh. Müller in the chair of Physiology at Berlin, and in 1867 he was elected permanent secretary of the Academy of Sciences. Two volumes of his collected memoirs and addresses appeared at Leipzig in 1885–87.

Dubovka, a town in the Russian province of Saratov, on the Volga, with tanneries and a large trade in mustard and salt. Pop. 13,300.

Dubuque, a city and port of Iowa, on the right bank of the Mississippi, built partly on bluffs rising 200 feet above the river, which is here crossed by an iron railway bridge, 198 miles WNW. of Chicago. It is the seat of an Episcopal and of a Roman Catholic bishop, and contains numerous churches, a city hall, a custom-house of marble, and a German Presbyterian seminary. It has a number of manufactures, and a large river and railway trade, and is the chief centre of the great lead region of the North-west. The town is the oldest in the state. Julien Dubuque, a French trader, engaged in lead-mining here as early as 1788; but the first permanent settlement was made in 1833. Pop. (1870) 18,434; (1880) 22,254; (1890) 30,311.

Ducamp, MAXIME, miscellaneous writer, was born at Paris, 8th February 1822, made repeated journeys in the East, and ultimately settled in Paris. Besides works on his Eastern travels, he wrote poems, romances, literary souvenirs, a history of the Commune (*Les Convulsions de Paris*, 1879), and a great work on *Paris, ses Organes, ses Fonctions, et sa Vie* (6 vols. 1875). Died February 9, 1894.

Du Cange, CHARLES DUFRESNE, SIEUR DU CANGE, generally styled Ducange, one of the greatest of French scholars, was born at Amiens, 18th December 1610, and became a parliamentary advocate in Paris, where he died, 23d October 1688. There was scarcely any branch of science with which he was unacquainted, but his favourite studies were classical philology and history. He wrote and edited several works on Byzantine and French history; but his principal productions are the *Glossarium ad Scriptores Mediæ et Infimæ Latinitatis* (3 vols. folio, Paris, 1678; much enlarged by the Benedictines of St Maur, 6 vols. folio, Paris, 1733–36, to which four supplementary volumes were afterwards added by Carpentier, a Benedictine) and the *Glossarium ad Scriptores Mediæ et Infimæ Græcitatis* (Paris, 1688), which are indispensable to the student of the history and literature of the middle ages. A new edition of the Latin Glossary was published by G. A. Henschel (7 vols. Paris, 1840-50), and final supplements were added by Diefenbach (Frankf. 1857 and 1867); a completely new edition in 10 volumes began to appear in 1883. Du Cange left a large quantity of valuable manuscripts, which have been preserved.

Ducat, a gold coin, formerly in extensive use on the Continent, deriving its name, which first appears about the year 1100, either from *Dukas*, the family name of the Byzantine emperors Constantine X. and Michael; or else, according to Skeat, from the legend on Apulian coins of 1140—*Sit tibi, Christe, datus, quem tu regis, iste Ducatus* ('Be this *duchy*, which thou rulest, dedicated to thee, O Christ'). Such coins were extensively issued after the 12th century in Italy, especially at Venice, where they were called *zecchini* or sequins (from *zecca*, 'a mint'). Early in the 14th century the ducat was introduced into Hungary and Bohemia; it was adopted in 1559 by the imperial diet of Germany into the currency of the empire, and was afterwards coined in the several German states, and over the whole of the north of the European continent, Russia included. The ducat varied in weight and fineness; by far the most common, which was current in Austria, Russia, Hamburg, &c., was worth about 9s. 4d. The modern Italian ducat was of much less value. There were silver ducats in Italy, worth 3s. 4d. sterling; and in Holland a *daalder* (4s. 2d.) was also called a ducat.

Ducato, CAPE (ancient *Leukatē*), an abrupt headland at the south-west extremity of Leukas or Santa Maura, one of the Ionian Islands, dreaded by sailors for the fierce currents around it. On the summit are remains of a temple of Apollo, and from here criminals were anciently cast into the sea. Here, too, tradition fixes the scene of Sappho's fatal leap, and that of Artemisia (q.v.) of Halicarnassus.

Du Chaillu, PAUL BELLONI, a distinguished traveller, was born in Louisiana in July 1837, and went to school in Paris for a while. Ere he was twenty years old he was already noted as an African traveller, a series of letters on the Gaboon country which he contributed to the *New York Tribune*—a foretaste of the final fruits of his first great journey—having long ere his return from it excited much interest. In 1855 he sailed from

New York to West Africa, where he spent four years in exploring the region two degrees on each side of the equator, making many interesting discoveries, and travelling about 8000 miles, always on foot, and unaccompanied by white men. He returned to New York in 1859, where he afterwards resided, and lectured frequently. The results of his African travels he published in his work, *Explorations and Adventures in Equatorial Africa* (1861; revised ed. 1871), containing very important contributions to geographical, ethnological, and zoological science. Thus he gave valuable information about the then unknown Ogoway (q.v.) River, and about the cannibal tribe of the Fans. His contributions to zoology related mainly to the gorilla and other remarkable apes. He shot more than 2000 birds, 60 of which were previously unknown, and killed over 1000 quadrupeds. Many of his specimens were purchased by the British Museum. The volume was, however, received with much distrust; and some critics asserted their belief that Du Chaillu's stories about the gorilla were entirely fabulous, and that he had never seen the animal alive, but had purchased his specimens. Du Chaillu's credit was, however, maintained by some men of the highest eminence, and particularly by Sir Roderick Murchison and Professor Owen. The substantial accuracy of his statements was soon confirmed by a French expedition which explored the Ogoway River in 1862. In 1863–65 Du Chaillu revisited some of the scenes of his former explorations, vindicated the truthfulness of his former discoveries, and gave an account of his second expedition in *A Journey to Ashango-Land* (1867). He has published a series of books for the young, founded on his varied adventures, amongst which are *Stories of the Gorilla Country* (1868), *Wild Life under the Equator* (1869), *Lost in the Jungle* (1869), *My Apingi Kingdom* (1870), and *The Country of the Dwarfs* (1871). His *Land of the Midnight Sun* (1881) is a record of a stay during 1872–78 in Norway and Sweden. *The Viking Age* appeared in 1889.

Duchesne, ANDRÉ (in Latin, Chesnius, Duchesnius, or Quercetanus), French historian, was born in Touraine in 1584, and died in 1640. History and geography were his favourite studies from his youth, and under Richelieu's ministry he was appointed royal geographer and historiographer. His most important works are the histories of England, Scotland, and Ireland, of the popes down to Paul V., and of the House of Burgundy, and his collections of the early Norman and French histories. His industry was extraordinary; he is said to have left more than a hundred folios in manuscript.

Duchesne, PÈRE. See HÉBERT.

Duchobortzi ('Warriors of the Spirit'), a sect of Russian mystics, traceable to the middle of the 18th century, who depend upon an inward light, like the Quakers, attach little importance to the sacraments, priesthood, and services of the church, refuse military service, and reject the doctrine of the Trinity and the divinity of Christ. The Emperor Alexander I. allowed them to settle in Taurida, in South Russia; Nicholas I., in 1841, transferred them to Transcaucasia. See RASKOLNIKS.

Duck, a name given to any member of the family Anatidæ, included under the order Anseres or goose-like birds. The prominent characteristics of the family are very familiar: the short webbed feet, with a small hind-toe which does not reach the ground; the netted scales in front of the lower leg; the bill, about as long as the head, straight or slightly curved, rounded at the tip, and bearing the nostrils towards the broad root. There are over fifty species, which have a wide distribution, especially in the northern hemisphere. They are characteristically aquatic birds, swimming with much agility, diving comparatively little, preferring to grub in the shallows for water-plants, worms, and small animals. The waddling, awkward walk is well known in its exaggerated condition in the domesticated duck. Great flocks are often seen in migratory flight to and from their northern homes. The males (drakes) are in winter and spring markedly distinguished from the females, whose plumage is less handsome. In summer, however, the males generally resemble the females.

The most important genus is Anas, which includes the Common Wild Duck (*A. boschas*), with its domesticated form (*A. domestica*), and numerous other species. The Mallard or Wild Duck is very widely distributed from Britain to Japan, and also occurs in North America as far south as Florida and the West Indies. They abound in Britain, though ousted from some parts by increased drainage of marshes. Their food is very varied, from seeds and roots to worms and frogs. They are often seen, with submerged head and upturned tail, grubbing in the mud by the loch side. Along with other 'wild ducks,' they breed in Britain, sometimes near the lakes or rivers which they frequent, sometimes in more elevated moorland districts. The parents often bring their very young brood to the lower waters, by swimming down the streams when swollen by rain, and it is interesting to see the little creatures hurried on, without injury, by the current, and passing along narrow rapids and over waterfalls of considerable height, much as pieces of cork might do, and with as little apparent injury. The nest is composed of grass, intermixed and lined with down, and the eggs are usually nine to twelve in number. The female shows marked parental care and affection for her brood.

The male (drake) of the common duck has the four middle tail-feathers recurved. The deep emerald green of the head and upper part of the neck, the white collar which separates the green from the dark chestnut of the lower part of the neck, and the deep blue iridescent *speculum* of the wing are marked characteristics of this beautiful bird. The plumage exhibits greater brightness of colours in the wild than in the domestic variety. At the close of the breeding season, the male of the wild duck assumes for a time a plumage more sober, and resembling that of the female; but before winter recovers the splendid plumage proper to his sex.

The Domestic Duck.—According to Mr Darwin and most naturalists, the various breeds of domestic duck are all descended from the wild species above described. In domestication the excellence of the plumage and the elegance of the carriage are lost in a few generations, and more momentous changes follow in consequence of altered nutrition and the like, and largely from the decreased use of the wings and increased use of the legs. The size also increases. It is well known that the nest-building instinct has been unlearned, and even the brooding impulses are usually degenerate. Darwin distinguishes four breeds: the Common Domestic Duck, the Hook-billed Duck, the Call-duck, and the Penguin Duck. Of the first, several sub-breeds are well known—e.g. the Aylesbury—large and white; the Rouen—large, and coloured like the wild duck; the tufted ducks—with top-knots of downy feathers; the black Labradors. 'The duck was unknown to the ancient Egyptians, to the Jews of the Old Testament, and to the Greeks of the Homeric period,' but was kept eighteen centuries ago in Roman poultry-yards. See Darwin's *Variation of Animals and Plants under Domestication* (1868). For ducks as egg-producers, see POULTRY.

There are many other European wild ducks—e.g. the small *A. crecca*, extending to North Africa; *A. acuta*, also found in North America; *A. strepera*, a distinctly north European form; *A. querquedula*, from middle and south Europe to Central Asia; *A. penelope*, in north Europe and Asia. Some closely related genera may be noted. The beautiful North American *Aix sponsa* is often brought to Europe; the Spoon-billed Ducks (*Spatula clypeata*, &c.), occurring in the temperate zones of both hemispheres, have markedly elongated bills; the Musk-duck (*Cairina moschata*), from Brazil and Paraguay, sometimes domesticated, is remarkable for the musk-like smell of the male preen-gland. Less nearly related to the true ducks are the Geese (see GOOSE), Swans (q.v.), Eiders (q.v.), and the stiff-tailed ducks, such as the wide-headed *Erismatura leucocephala*, rather like a diver in flight and habit.

Many wild ducks are shot for the market; the plumage is also used for decorative purposes. The uses of the domesticated variety are well known. See also TEAL, CANVAS-BACK, WILDFOWL.

Duck (akin to Ger. *tuch*, 'cloth'), a coarse cloth or canvas, highly glazed, used for sails, sacking, smock-frocks, overalls, trousers, &c.

Duckbill, or DUCKMOLE. See ORNITHORHYNCHUS.

Ducking-stool, an apparatus at one time in use in England for the punishment of scolding wives. The *cucking-stool*, *ducking-stool*, and *tumbrel* have often been confounded, and indeed most writers appear to consider them but different names for the same thing, but, as Mr Llewellynn Jewitt points out, they are all three distinct varieties of punishment. The cucking-stool is mentioned in Domesday Book as having been in use in Chester, and the name (*cathedra stercoris*) casts a light upon the degrading nature of its origin. In it the culprit, who might be of either sex, was placed, usually before his own door, to be pelted and insulted by the mob. On the tumbrel again he was drawn round the town or village, seated in the chair, which was sometimes so constructed as to be suitable also for ducking; but the ducking-stool *par excellence* was specially made for purposes of immersion. There were various examples of the ducking-stool. Sometimes it 'consisted of a rough strong chair attached to one end of a beam, which worked on a pivot on a post bedded into the ground at the edge of the dam,' or the river, as the case might be. 'The woman was placed in the chair with her arms drawn downwards; a bar was placed across her back and in front of her elbows;' another bar held her upright, and there were cords to tie her securely in. The executers of the punishment then took hold of a chain at the opposite end, and gave her a ducking on the 'see-saw' principle. Many ducking-stools and chairs are still in existence; that at Leominster was used as recently as 1809. The beam to which the chair was attached was 23½ feet in length, the ducking being administered in the manner previously described. Some ducking-stools consisted of an upright and transverse beam, either movable or fixed, from which the chair was suspended by a rope or chain. The practice of ducking commenced in the latter part of the 15th century, and prevailed generally throughout the kingdom until the first part of the 18th century, and in isolated cases, as we have seen, even into the 19th century. See an excellent paper by Llewellynn Jewitt in the *Reliquary* (vol. i. 1860–61).

Duckweed, or DUCK-MEAT (*Lemna*), is the type of Lemnaceæ, a small order of very degenerate monocotyledons, probably allied to Araceæ. They are chiefly floating plants, mere flat green fronds, with roots hanging loosely in the water, and unisexual flowers—destitute of calyx and corolla—bursting through a membranous spathe in their margin. The Lemnaceæ are distributed throughout all parts of the world. Several species of duckweed are British, and cover the surface of stagnant ponds with green vegetation. Their flowers and fruit are rarely to be seen, but they spread rapidly by budding from their margins.

Ductility is that property of solids in virtue of which they can be drawn out so as to increase their length at the expense of their cross dimensions. Thus silver is a very ductile metal, while platinum is not so ductile. But although platinum cannot be drawn out to any very great extent by the ordinary process of wire-drawing, it may be drawn out by Wollaston's process. Wollaston fitted a platinum wire into the interior of a hollow rod of silver, and then drew out the compound rod to an extent limited only by the ductility of silver. He then dissolved off the silver, and so obtained an excessively fine platinum wire, the diameter of which was, according to Leslie, $\frac{1}{30000}$ inch. Leslie also says that, by drawing out a thickly-gilt silver rod, a film of gold only $\frac{1}{1000000}$ inch in diameter could be obtained. See MALLEABILITY, WIRE.

Du Deffand. See DEFFAND.

Dudevant, MADAME. See SAND (GEORGE).

Dudley, a parliamentary borough in a detached part of Worcestershire and the south of Staffordshire, 26 miles NNE. of Worcester, and 8½ WNW. of Birmingham. Situated in the heart of the 'Black Country,' it is a thriving town with coal-mining, busy brass and iron foundries, glass and brick works, besides tanning and brewing. One of the largest single iron industries is nail-making. A chief ornament of the place is the Renaissance drinking-fountain, erected in 1867 by the late Earl of Dudley, a statue of whom was erected in 1888. On a hill to the north-east are the beautiful ruins of an old castle, said to have been founded in the 8th century by Dodo, a Saxon prince, and the keep of which dates from the 13th century. It was burned in 1750. Near it are remains of a Cluniac priory (1161). The vicinity yields abundant limestone, which is Silurian and full of organic remains; it is wrought out of caverns, and brought to the kilns through a tunnel one mile and three-quarters long, which is carried through the basalt of the Castle Hill. Pop. of parliamentary borough (1851) 37,962; (1881) 87,527; (1891) 90,223, of whom 45,740 were in the municipal. Dudley has returned one member since 1832, the parliamentary boundary being extended in 1867; the municipal borough dates from 1865. See Twamley's *History of Dudley Castle and Priory* (1867).

Dudley Limestone, a highly fossiliferous Silurian limestone belonging to the Wenlock Series (q.v.), which forms some of the most picturesque eminences around the town of Dudley. The masses of corals, shells, and trilobites which abound in this rock, form, when weathered, extremely beautiful cabinet specimens.—*Dudley Locust* is the popular name for a trilobite (*Calymene Blumenbachii*), which is very abundant in the Dudley limestone.

Dudley, EDMUND (1462?–1510), lawyer and privy-councillor, was Empson's partner in carrying out the detested policy of Henry VII., whose son and successor sent him to the block. He was father of John Dudley, first Duke of Northumberland. See also LEICESTER, EARL OF.

Duelling. The duello (from the Lat. *duellum*, an old form of *bellum*) belongs to every age and country, uncivilised as well as civilised. The old 'ordeal by battle,' a sort of judicial decision, implied that the Almighty would give victory to the just cause, and was in vogue in England down to the reign of Elizabeth (see BATTLE, WAGER OF).

Neither this nor the chance quarrel of two gentlemen carrying swords can be strictly considered a duel, which implies deliberation. The modern duel is prompted by the worst passions, hatred, revenge, jealousy, and often by the merest trifle. In France, where it has long flourished, it was punished severely by kings and parliaments, and Henry II., Henry IV., and Louis XIV. took stringent measures to put duelling down. Francis I., however, was in its favour, and even challenged Charles V. to single combat. It is said that during the earlier years of Henry IV.'s reign no less than 4000 gentlemen lost their lives in this way. In Louis XIV.'s day, duels of four and five a side were common, but his edict of 1679 completely suppressed it.

It is remarkable that at this moment there is but one group of countries—viz. the English-speaking lands—where duelling is not merely scouted and put down by law, but actually ridiculed. This cannot be explained by English respect for the laws, or from a strict religious sense; both these feelings being as strong when duelling was in high fashion. In the reign of William III. a severe act against it was passed, and in 1712 it again engaged the attention of the parliament.

Duels with the pistol prevailed in England for nearly a century; to within living memory, ministers and politicians resorted freely to this mode of settling a quarrel. Wilkes met Lord Talbot, and also Mr Martin, in 1763, by whom he was severely wounded. Mr Pitt was challenged by Mr Tierney for charging him with 'obstructing the defences of the country.' The day fixed for the encounter was a Sunday of May 1796, and at three o'clock the parties were found on Putney Heath, close to the Kingston Road. The duellists fired twice at each other; but on the second occasion Pitt discharged his pistol in the air. Pitt's great rival, Charles Fox, had been particularly severe on the powder supplied by the War Office. Mr Adam took offence at this charge, and challenged him. The parties met, and Fox was wounded. The buoyant humour of the man, which made him so many friends, was shown in his first remark, 'Adam, you'd have killed me if you hadn't used government powder.'

Another political duel took place in September 1809, between Mr Canning and Lord Castlereagh (q.v.); a yet more remarkable duel was that of the Duke of Wellington with Lord Winchilsea in the exciting year 1829. Lord Winchilsea charged the duke with the 'insidious design of introducing Popery.' The duke at once sent Sir Henry Hardinge to demand an apology. The meeting was at Battersea Fields. Lord Winchilsea was attended by Lord Falmouth, a second so completely unnerved that he had to be assisted in loading his pistols. The duke was gay and unconcerned. When their men were placed, the duke's second advanced with a paper in his hand. 'As for myself,' said he, 'if I do not express my open disgust for the whole affair, it is because I wish to imitate the moderation of the Duke of Wellington.' Lord Winchilsea was quite overwhelmed by this irregular lecture, his second faltered out that 'nothing had ever given him so much pain,' &c. To whom Sir Henry: 'Indeed, my lord, I don't envy your feelings.' A crowd had collected to see the sport. The duke hesitated a little and fired; Lord Winchilsea then fired in the air. Lord Falmouth now came forward with a paper. The duke, who had drawn near to listen, said in a low voice, 'This won't do: it is no apology.' Sir Henry pulled out his paper, and reading it, said: 'This is what we require; the word apology must be used.' At last the required word was furnished. Then Sir Henry gave the guilty pair a last rebuke. 'And now, gentlemen,' he said, 'without making any invidious reflections, I cannot help remarking that, whether wisely or unwisely the world will judge, you have been the cause of bringing this man into the field, where, during the whole course of a long military career, he never was before.' Here Lord Falmouth turned on his unhappy principal to tell him that 'he always thought, and had told him so, that he was completely in the wrong.' Lord Falmouth then attempted to vindicate himself. 'My Lord Falmouth,' was the duke's haughty reply, 'I have nothing to do with these matters.' He then touched his hat with two fingers, saying: 'Good morning, my Lord Winchilsea; good morning, my Lord Falmouth,' and rode away. It is remarkable that most of these fire-eating politicians —viz. Wellington, Castlereagh, Canning, Tierney— were of Irish extraction.

There have been three notable duels, each attended with fatal issue, and each arising out of a political quarrel. One was that of Mr Scott, editor of the *Champion*, killed by Mr Christie in 1821; the second was that of Sir A. Boswell in 1822, killed by Mr James Stuart of Dunearn, the quarrel arising out of a foolish ballad written by the former; the third was the well-known fatal encounter of Mr O'Connell with D'Esterre, in which the latter fell. Another fatal duel was that of Lord Camelford and Mr Best in 1804. In Ireland, before and after the union, there was a mania for duelling; and personages of the highest position, lord chancellors, judges, provosts, and all fought, or as the phrase went, 'blazed.' Of modern duels the most notable was that of Lord Cardigan with Captain Harvey Tuckett, in which the latter was wounded (1840). Up to 1843 duelling was almost recognised as an obligation, but in that year it received its *quietus*, owing to the fatal contest between Colonel Fawcett and Lieutenant Munro, his brother-in-law, in which the former was killed. Since that date only one fatal duel has been fought in England, between Lieutenants Hawkey and Seton, in May 1845, when the latter was killed. The last duel in Ireland (February 1851), between the mayor of Sligo and a lawyer, was a bloodless one.

In most countries, as we have said, duelling is still resorted to as reparation for personal insult or injury. In France, fencing is studied, as a necessary part of education and protection, by most public men and journalists. The encounters are generally harmless, and often *pour rire*. Two recent political duels excited the merriment of Europe, that of Gambetta and M. Fourtou, who 'fought' in a foggy morning at thirty or forty paces distance (1878), and that of General Boulanger who 'spitted' himself on the rapier of a retired attorney, M. Floquet, then first minister (1888). Perhaps the most notable political duel was that of Armand Carrel with Emile de Girardin (1836), when the former fell mortally wounded. In France, two seconds on each side regulate the proceedings, and one stands beside the combatants, ready with a walking-stick to beat down the weapons in case of unfair fighting. This precaution is not unnecessary, as recently one of the parties seized his adversary's sword with one hand, and tried to 'finish' him. In Belgium the duel occurs seldom, though still enforced by social law, but the country is often selected by Frenchmen and others, as the *terrain* of their encounters.

In other countries duels are comparatively rare. In the United States, where they were at one time fought with a savage ferocity and originality combined (in some sections, with bowie-knives), they are now practically unknown, save in the very backward states. None has been more famous than one of the earliest, in 1804, when Aaron Burr, the vice-president, killed Alexander Hamilton, the leader of

the opposition. Later duels were those between Henry Clay and John Randolph, Andrew Jackson and Charles Dickinson, Thomas H. Benton and Lucas. By the common law, the survivor and the seconds are guilty of murder when one of the parties to a duel is killed.

The question of insult, the form of reparation, withdrawals, &c., led naturally to some complication, and there have been attempts to draw up rules and regulations. Towards the end of the 18th century, a number of duelling gentlemen ('delegates') met at Clonmel, and drew up a 'code,' conceived in a highly logical spirit. One specimen will suffice: 'Where the *lie direct* is the first offence, the aggressor must exchange two shots previous to apology, or three shots followed by explanation, or *fire on* until one is hit. The only satisfaction for a blow is to offer a cane which is to be laid on the offender's shoulders. If a blow be an answer to giving the lie, the lie is merged in the blow, which becomes the sole offence,' &c. There are so-called duels, in which lots are cast, and the party to whom the lot falls is bound to put an end to his own life. There have been cases of duels with sword and pistol between women.

By the laws of the German empire, duelling is an offence punishable with fortress-imprisonment, the length of which is proportioned to the nature and consequences of the encounter. Students' duels, which range in seriousness from mere fencing matches to dangerous or even fatal encounters, have long been a prominent feature in university life. Formerly they were treated as mere 'disciplinary offences,' unless the consequences were very serious. But of late, public feeling has been tending against them; and since 1883 the imperial courts impose fortress-imprisonment. In contradiction to the spirit of the public laws, duelling is recognised in the German army, whence an officer was expelled in 1887 for refusing to challenge one who had insulted him. The late Emperor William, 'pious' as he was, felt constrained to draw up regulations on the subject, introducing courts of honour, which, however, in serious cases, might authorise the encounter. In 1844 the English War Office, moved thereto by Prince Albert, put a summary stop to the practice—issuing a number of regulations which threatened all concerned in a duel with court-martial and cashiering. For the law of the land makes no distinction between any of the methods of taking another's life, though the old attitude of the law to affairs of honour was fairly expressed by an Irish judge, who, when charging in a fatal case, declared that it was his duty to tell the jury it was murder according to the law, 'but that for his part a fairer duel he had never met in his life.' In a work revised by him in 1853, Lord Cockburn similarly expressed his opinion that 'murder may be committed in duel required by society, and provoked by intolerable insult.'

See Dr Millingen, *History of Duelling* (2 vols. 1841); A. Steinmetz, *The Romance of Duelling* (2 vols. 1868); Rödenbeck, *Der Zweikampf* (1883); Constard de Massi, *History of Duelling in all Countries* (Eng. trans. 1880); Major Truman, *The Field of Honour* (New York, 1884); William Douglas, *Duelling Days in the Army* (1887).

Duet, a composition in music for two voices or instruments.

Duff, ALEXANDER, a great Indian missionary, was born 26th April 1806, at a farm near Pitlochry, in Perthshire. When a student at St Andrews his character was powerfully influenced by Chalmers, and in 1829 he was ordained the first missionary from the Church of Scotland to India. On the passage out he was twice shipwrecked, and did not reach Calcutta till May 1830. He commenced his work as a missionary on an entirely new plan, freely opening up Western science and learning to the natives of India as well as purely religious teaching—an innovation that marked the beginning of a real era in the social history of that country. In spite of much misapprehension and not a little violent opposition, his English school flourished, and in the course of time its indomitable promoter was cheered by the warm encouragement of some of the highest personages in the government. In 1834 Duff was obliged to return home, already invalided by his enthusiastic and restless energy; but he returned in 1840 to find his college maintaining its success, with an attendance of between six and seven hundred pupils. At the Disruption within the Church of Scotland in 1843, Duff, with the other missionaries in India, cast in his lot with the seceding body that formed the Free Church, and of course had in consequence to give his college into other hands, and begin his work again from the beginning. But for this the enormous energy of the man was adequate, and ere long his whole educational and missionary work was completely reorganised, and that on a much ampler scale than before. In 1844 Duff helped to start the *Calcutta Review*, and in 1849 was again obliged by ill-health to return home, traversing India on the journey. He was moderator of the Free Church General Assembly in 1851, and his opinions on Indian matters, especially education, were often solicited by the government in London. His apostolic fervour in his missionary tour through the United States (1854) called forth extraordinary enthusiasm. The university of New York gave him the degree of LL.D.; that of Aberdeen had already made him D.D. In 1856 Duff returned to India, and guided his mission safely through the troublous time of the Mutiny. He was one of the founders of the university of Calcutta, and was for a few years its virtual governor, though he declined the vice-chancellorship in 1863, being obliged by persistent ill-health to leave India permanently. Among the many evidences of general esteem heaped upon him was a gift of £11,000, the capital sum of which he destined as a fund for invalided missionaries of his church. On his way home Duff visited the mission stations of South Africa, and after his arrival in Scotland laboured much to infuse missionary zeal throughout the community; he raised £10,000 to endow a missionary chair in the New College, Edinburgh, of which he consented to be the first occupier. In 1873, to avert a threatening crisis within the Free Church, he was called a second time to the moderator's chair, and here his elevation of character did much to lift the Assembly above the heated air of an embittered controversy. He died in Edinburgh, 12th February 1878, leaving his money to found a missionary lectureship. His writings were almost all larger or smaller pamphlets devoted to the great interests of his life. See his Life by Dr George Smith (2 vols. 1879), and the short life by Professor Thomas Smith (1883).

Dufferin and Ava, FREDERICK TEMPLE HAMILTON TEMPLE BLACKWOOD, MARQUIS OF, G.C.B., G.C.M.G., the son of the fourth Baron Dufferin, was born on June 21, 1826, and succeeded his father in the peerage in 1841. Educated at Eton and Christ Church, Oxford, he first distinguished himself by contributions to literature, and published the popular *Letters from High Latitudes* in 1859. In 1860 he was sent by Lord Palmerston to Syria, to investigate the questions arising from the religious massacres, and on his return was created K.C.B. Lord Dufferin was successively Under-secretary for India (1864–66), and for War (1866). He was Chancellor of the Duchy of Lancaster from 1868 to 1872; in 1871 was created an earl; and was Governor-general of Canada (1872–78). His brilliant administration was remarkable for the wonderful development of the province of Manitoba. From 1879 to 1881 Lord

Dufferin was ambassador at St Petersburg, whence he was transferred to Constantinople. After the collapse of the rebellion of Arabi Pasha, Lord Dufferin went to Cairo to restore order in Egypt. To him was due the abolition of the Dual Control, and he formulated a series of reforms which were carried out with some success. In 1884 he succeeded Lord Ripon as Viceroy of India. Lord Dufferin's tenure of office was made memorable by measures for strengthening the Indian frontier; by the various attempts to delimit the Afghan frontier, which, though interrupted by the Russian attack on Penjdeh, were eventually brought to a successful issue by the Anglo-Russian commission; and, above all, by the annexation of Upper Burmah in December 1885. That province had been reduced to submission, and the Tibetans had been defeated by the Sikkim expeditions, when Lord Dufferin resigned in 1888. He became successively ambassador at Rome, marquis (1888), and ambassador to France (1891). — His mother, Helen Selina Sheridan (1807–67), was the author of 'The Emigrant's Farewell,' 'O Bay of Dublin,' and other touching songs.

Duffy, Sir Charles Gavan, Irish patriot, was born in County Monaghan in 1816, and early devoted himself to journalism in Dublin and Belfast, returning to the former in 1842 to start along with Thomas Davis and John Dillon the famous *Nation* newspaper, as the organ of the Young Ireland party. Tried and convicted for sedition with O'Connell in 1844, but saved by the House of Lords quashing the conviction, he aided his great chief in the agitation for repeal, next helped him to found the Irish Confederation, and gave his heartiest sympathy to the patriotic dreams of Smith O'Brien. Again tried in 1848 for 'treason-felony,' he was acquitted, next revived the *Nation*, and carried in 1852 the borough of New Ross in the teeth of the Under-secretary for Ireland. He had an active share in promoting the Tenant League and the Independent Irish party, and on the break up of the latter, emigrated to Australia in 1856. After some time of practice at the Melbourne bar, he drifted into politics, and after the establishment of the Victorian constitution, rose in 1857 to be Minister of Public Works, of Lands in 1858 and 1862, and prime-minister in 1871. He was defeated next year, was knighted in 1873, and in 1877 elected Speaker of the Legislative Assembly. His little work, *The Ballad Poetry of Ireland*, had been for thirty years a household book in his native country, when in 1880 he published his striking *Young Ireland; a Fragment of Irish History, 1840–50*, which was followed in 1883 by its sequel, *Four Years of Irish History, 1845–49*.

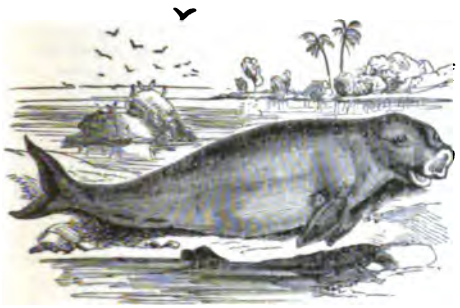
Dufresne, Charles. See Du Cange.

Dugdale, Sir William, antiquary, was born at Shustoke, near Coleshill, Warwickshire, 12th September 1605. He spent more than four years at Coventry free school, and then studied law and history under his father, to please whom, aged and palsied, he married before he was eighteen, and soon after whose death he purchased the neighbouring manor of Blythe (1625). Inspired with the notion of writing a history of Warwickshire, he came in 1635 to London, where, making the acquaintance of Spelman and other antiquaries, in 1638 he was created a pursuivant-at-arms extraordinary, with the title of Blanch Lyon, and in 1640 Rouge Croix pursuivant. During the Great Rebellion he adhered to the royalist cause, and from 1642 to 1646 was at Oxford, the king's headquarters, being made an M.A. and Chester herald, while pursuing his antiquarian researches. 'All the while that the power of the usurpers continued he was compelled to live depressed in a very low estate; but, as the darkest night hath its morning, so,' on the Restoration Clarendon got him the office of Norroy. In 1677 he was promoted to be Garter Principal King of Arms, at the same time receiving the honour of knighthood, 'much against his will, by reason of his small estate.' Evelyn describes him in 1685 as 'having his sight and his memory perfect;' but on 10th February 1686 he died in his chair at Blythe Hall. The *Monasticon Anglicanum* (3 vols. 1655–61–73), a history of English religious foundations, with their charters, &c., though planned and in part compiled by another antiquary, Roger Dodsworth (1585–1654), was concluded, arranged, indexed, and revised by Dugdale; there is a noble English edition of it by Bandinel, Caley, and Sir Henry Ellis (6 vols. 1817–30). The *Antiquities of Warwickshire* (1656; 3d ed. 1763–65) has been the model of every subsequent county history; of Dugdale's nine other works the chief are the *History of St Paul's Cathedral* (1658), *History of Imbanking and Drayning* (1662), *Origines Juridiciales* (1666), and *Baronage of England* (3 vols. 1675–76). In Anthony à Wood's words, 'What Dugdale hath done is prodigious. His memory ought to be venerated and had in everlasting remembrance.' See his *Life, Diary, and Correspondence*, edited by William Hamper (1827).

Dugong (*Halicore*), a genus of marine mammals in the order Sirenia. Along with the manatees, the dugongs exhibit the following general characteristics. The form of the body is fish-like, but somewhat depressed; the head is rounded, distinct, and not out of proportion to the body; there is hardly any neck; the tail is horizontally flattened; there are no hind-limbs, nor is there a dorsal fin. In relation to the aquatic habit, the fore-limbs are paddle-shaped flippers, the skin is almost hairless except about the mouth, there are no external ears, and the nostrils have valves. The very small eyes, with imperfect lids, have a nictitating membrane, which is absent in Cetaceans. The nostrils are at the end of the snout. The lips are thick and bristly. The bones of the skeleton are very massive and heavy, a condition which, as Professor Flower notes, must help these animals to keep to the bottom while feeding on algæ. The skull is in many ways peculiar, but is not like that of Cetaceans. The usual separate terminal ossifications or epiphyses on the vertebræ are absent; so too are the clavicles; there is no fused sacrum, and a most rudimentary hip-girdle, without trace of hind-limbs. There are no canine teeth. The brain is relatively small, with few convolutions. The tongue is small, fixed, and very rough. The stomach is chambered; the long muscular intestine is provided with a cæcum. The two ventricles of the heart are partly separated by a deep cleft, and the arteries form complex networks (*retia mirabilia*), which may aid the animals when under water. The larynx is not modified as in Cetaceans. The lungs are very long and narrow, and the diaphragm is very oblique. The teats are two in number, behind the arm-pits. The placenta is diffuse. The animals are sluggish, herbivorous, inoffensive, and gregarious. Halicore and Manatus are the only living genera; Rhytina is recently extinct; Halitherium is an important fossil form referable to this now moribund but once flourishing order.

The dugong differs in many important respects from the manatee. A few of its numerous peculiarities must be noticed. The upper jaw is very massive and turned sharply downwards, overlapping the lower, which is also crooked. The males possess two tusk-like projecting incisors, but the corresponding teeth abort in the females. The front-teeth of the lower jaw abort, and are absorbed. The jaws both bear rough horny plates. There are five to six molar teeth of a primitive sort, with

persisting pulps and no enamel. Only two or three are in use at a time. The dark, elephant-like, tough skin bears short sparse bristles. The tail is deeply notched. The fingers are nailless. The



Dugong (*Halicore dugong*).

cæcum is thick and simple. Of the three species of Halicore, one (*H. tabernaculi*) is restricted to the East African coast and the Red Sea; another (*H. dugong*) inhabits the Indian and Pacific oceans, eastward from the home of the last to the Philippines; and the third (*H. australis*), the waters of Eastern and Northern Australia.

The dugongs keep to the water, rising to the surface to breathe. They never venture ashore, but graze at the bottom in shallow water. Their food consists chiefly of seaweeds, which they gather in with their thick lips. They are sociable but stupid, often to their own undoing. They are known to attain a length of about 10 feet, but larger sizes are alleged. The habit the dugong has of lifting its round head out of the water, and of carrying its baby under its arm, is suggested as a possible foundation for the mermaid myth, which the name of the order (Sirenia) recalls. Their peculiar, feeble cry may also have aided the imagination of early observers. The female bears one young one at a time, and exhibits an affection said to be proverbial. When the young one is speared, the mother is readily taken. The flesh of the dugong is eaten and esteemed, especially when young. The Australian species is killed for the sake of its oil, which is free from disagreeable smell, and said to have the medicinal qualities of the cod-liver equivalent. According to Rüppell, it was with the skin of the Red Sea dugong (not 'badger-skins,' as in A.V.) that the Jews were directed to veil the tabernacle.

Cuvier called the Sirenia herbivorous Cetaceans, De Blainville emphasised their connection with elephant types, and some modern zoologists maintain their affinity with Ungulates. No conclusion is yet possible, except that they have no direct connection with Cetaceans. Even the fossil forms, Flower observes, have not in this case helped much towards solving the riddle of Sirenian affinities. All that can be certainly said is that the order is at once peculiar and primitive.

See the articles MANATEE, RHYTINA; J. F. Brandt, *Symbolæ Sirenologicæ* (St Petersburg, 1846–68); Huxley's *Anatomy of the Vertebrates*; Flower's *Osteology of the Mammalia*, &c.

Duguay-Trouin, RENÉ, one of the most celebrated naval officers of France, was born 10th June 1673, at St Malo. From 1689 to 1697 he cruised about as a sort of privateer, inflicting immense damage on the enemies of France. Louis XIV., as a reward for his daring exploits, admitted him into the state navy, and gave him the command of a frigate. In 1707 he engaged a part of the English fleet at the entrance of the Channel, burned one ship, captured three others, and about sixty transports; but the most glorious of his triumphs was the attack and capture of Rio Janeiro in 1711, with a small fleet, after hostilities had lasted for eleven days. The city was ransomed for 610,000 crusados (£96,000). For this he was ennobled, and was successively named *chef d'escadre*, member of the council of state, lieutenant-general, and naval commandant at Brest. In 1731 he was sent into the Levant, to obtain reparation for the damages done to French commerce. He died 27th September 1736. See his *Mémoires* by Beauchamps (4 vols. Paris, 1740; Eng. trans. 1742), and Life by La Landelle (2d ed. 1876).

Du Guesclin. See GUESCLIN.

Duisburg, a town of Rhenish Prussia, 16 miles N. of Düsseldorf by rail, in a fertile district between the Ruhr and the Rhine, with both of which it is connected by a canal. One of its five churches, St Salvator's, is notable, dating from the 15th century. Its manufactures are numerous and important, including tobacco, soda, sulphuric acid and other chemicals, soap, candles, starch, and sugar; and in and near the place are great ironworks and coal-mines. There is considerable river shipping. Pop. (1816) 4508; (1885) 47,561; (1890) 59,285 (nearly half of whom are Protestants). Duisburg is an ancient town. In the 13th century it was a member of the Hanseatic League, and afterwards a free town of the German empire, but at the close of the war in 1815 it became finally Prussian.

Dujardin, FÉLIX (1801–60), professor of Zoology, is notable for his investigation of organisms such as Helmintha and Foraminifera, and as the establisher of the views now current as to the nature of Protoplasm (q.v.).

Duke (Fr. *duc*, Lat. *dux*, from *ducere*, 'to lead'), a term applied originally to any military leader. The title came first into formal use when Constantine separated the civil and the military commands in the provinces. From that time forth, the military governors of provinces were either counts or dukes. But these titles originally stood to each other in an opposite relation to that which they afterwards assumed. 'All provincial generals,' according to Gibbon, 'were *dukes*, but no more than ten among them were dignified with the rank of *counts*, or companions, a title of honour, or rather of favour, which had been recently invented in the court of Constantine.' See COUNT. Both were strictly prohibited from interfering in any matter which related to the administration of justice or the revenue. When the Germanic barbarians invaded the provinces of the empire, the military chiefs of their tribes (called by names cognate with *heretoga* or *herzog*) were sometimes identified with the *duces;* but amongst the Franks and Longobards, the functions of the so-called *dux* were rather those of the old German *Graf* (Lat. *Comes;* see COUNT). By-and-by the ordinary count became the lieutenant of the duke, and the government of the latter extended to several provinces; whereas that of the former was confined to one province, or even to a single locality. The power of the dukes grew so rapidly, in consequence of the dissensions of the Merovingians, that, towards the end of the 6th century, they arrogated to themselves the right to dispose of the crown. In the 10th century, the East Frankish empire fell into the five hereditary dukedoms of Franconia, Swabia, Bavaria, Saxony, and Lorraine. In the west, the dukes of the Isle of France, Aquitaine, Burgundy, Normandy, Gascony, and others assumed the crown and sceptre, promulgated laws for their subjects, struck money with their own image, and made war in their own name against the crown. The confederation of the feudal lords had assumed such dimensions, that about the period of the Norman invasion of England nothing

remained directly under the crown except a few towns, of which Rheims and Laon were the chief. The rest of the kingdom was divided amongst the dukes and the counts, under an obligation, which they almost always evaded, of service and fidelity to the crown. But by 1514 these regal duchies had been either extinguished or reunited to the crown.

The duchies which were granted to members of the royal family—that of Bourbon, erected in 1327; of Orleans, in 1344; of Auvergne, Berri, Touraine, Valois, and Alençon at later periods—enjoyed none of the privileges of independent sovereignty which had belonged to the ancient duchies; and when the Montmorencies were created dukes in 1551, they enjoyed no other privileges than those of titled nobles. The duke-peers, as they were called, were simply the first class of nobles in France, just as dukes are in England. Several prelates enjoyed this rank—as, for example, the Archbishop-duke of Rheims. There were also in France dukes for life, or patent dukes, who dated only from the reign of Louis XIV. Swept away by the Revolution, the title was restored by Napoleon, who conferred it, with rich endowments, on his marshals. Several ducal peers were created by Louis XVIII. and Charles X. In Germany, the dukedom passed through phases very similar to those which it exhibited in the earlier history of France. The title of grand-duke was first bestowed on Cosmo de Media, Grand-duke of Tuscany, by Pope Pius V. in 1569; it is assumed by the princes of the imperial family of Russia, and also adopted by certain German reigning princes. Archduke (q.v.) is Austrian only.

William the Conqueror, Duke of Normandy, may be held to have brought the title as a separate dignity into England; but it was merged in the crown until the reign of Edward III., who, in 1337, conferred the dukedom of Cornwall on the Black Prince, his eldest son, and in 1351 that of Lancaster on Henry Plantagenet, his cousin. These were dukedoms by tenure, Cornwall (q.v.) being in the one case erected into a duchy, and palatine jurisdiction being in the other conferred within the county of Lancaster. In later cases the dignity of duke was personal, and unaccompanied with grants of lands and annuities. In 1362 Edward III. conferred the dukedom of Clarence on Lionel, his third son, and the dukedom of Lancaster on John of Gaunt, his fourth son and husband of the then heiress of the former Duke of Lancaster. Two other sons of Edward III. were in 1385 made Dukes of York and Gloucester respectively by their nephew Richard II. This king first extended the title beyond the royal house. In 1386 he made his favourite, Robert de Vere, Duke of Ireland, and in 1397 he created five dukes and a duchess in one day—viz. the Dukes of Hereford, Surrey, Exeter, Albemarle, and the Duke and Duchess of Norfolk. The creation of dukes was at that time by patent, there being an inaugural ceremony of girding with the sword in parliament. In the reign of Henry VI., the recipients of dukedoms included Humphrey Stafford, Duke of Buckingham, Henry de Beauchamp, Duke of Warwick, and William de la Pole, Duke of Suffolk. Henry VIII. made his illegitimate son, Henry Fitzroy, Duke of Richmond, and his brother-in-law, Charles Brandon, Duke of Suffolk. Three dukes were created by Edward VI., Edward Seymour (the Protector and king's uncle) being made Duke of Somerset; Henry Grey, Duke of Suffolk; and John Dudley, Duke of Northumberland. Yet on Elizabeth's accession, in consequence of attainders and extinctions, the only remaining duke was Thomas Howard, Duke of Norfolk; and on his execution and attainder, the title of duke was non-existent in England. James I. in 1623 made the Scottish Duke of Lennox Duke of Richmond, and his favourite, George Villiers, Duke of Buckingham. Charles I. conferred the dukedom of Cumberland on Prince Rupert. Charles II. (q.v.), besides creating General Monk Duke of Albemarle, and the Marquis of Worcester Duke of Beaufort, bestowed the dukedoms of Monmouth, Grafton, Northumberland, and St Albans on four of his natural sons. Under William, Anne, and George I. a number of holders of lower dignities in the peerage were advanced to the rank of duke. From the accession of George II. comparatively few dukedoms have been created, except those conferred on younger members of the royal house. Since the accession of Henry IV., the dukedom of Lancaster has been merged in the crown; there has been no Duke of York since 1827; and the dukedom of Cornwall is held by the heir-apparent. Of the presently existing dukes of England, Great Britain, and the United Kingdom (twenty-two in number, exclusive of princes of the blood-royal), only two, Norfolk and Somerset, date before the Civil War.

The introduction of the title duke into Scotland seems to have arisen out of the claims of precedency made by Henry IV., when Duke of Lancaster, over the Scottish princes, who were merely earls, at international congresses. The first Scottish dukes were made in 1398—viz. David, eldest son of Robert III., who was made Duke of Rothesay; and the king's brother, Robert, Earl of Fife and Menteith, who was made Duke of Albany (q.v.). The dukedom of Albany (the old name for Scotland) was an empty honour unconnected with lands, and the only instance of a Scottish dukedom that did not possess more or less of a territorial character. David, Duke of Rothesay, died without issue in Falkland Castle, in 1402, and in virtue, it has been assumed, of the original constitution of that dukedom, the title in later times belonged to the heir-apparent of the Scottish crown. Prince Henry, eldest son of James VI., was, at his baptism in the Chapel Royal at Stirling, invested with the dignity of Duke of Rothesay, with appropriate solemnities, including the imposition of a ducal crown. The title of Duke of Ross was given by James III. to his second son, James, who became Archbishop of St Andrews; and the same king, on the eve of the rebellion in which he lost his life, bestowed on his devoted adherent, David, Earl of Crawford, the title of Duke of Montrose. The dukedoms of Ross, conferred on Henry, Lord Darnley; of Orkney, bestowed on the Earl of Bothwell on his marriage with Queen Mary; and of Lennox, given to Esmé Stewart, Earl of Lennox, cousin-german of Darnley, were the only other Scottish creations before the union of the crowns. Hitherto the jealousy of the feudal nobles had been so great an obstacle to the extension of this title beyond the near relations of the royal house, that James, Earl of Arran, though regent of Scotland and next heir to the throne in Queen Mary's minority, had to derive his title of duke (Châtellerault) from France. Ten Scottish dukedoms appear on the Union Roll of 1707, of which Hamilton alone dated before the Civil War. Rothesay, which had been overlooked, was added in 1714. Of these eleven dukedoms, two are extinct, and Queensberry is conjoined with Buccleuch, reducing the present number of dukes in the peerage of Scotland to eight. A duke (except a royal duke) in the peerage of the United Kingdom is styled 'Your Grace' and 'The Most Noble.' His wife is a duchess. For the designation of his sons and daughters, see COURTESY TITLES. His parliamentary robe is of scarlet, with four doublings of ermine. For the form of his coronet, see CORONET.

The translators of the Old Testament introduced the term duke into the English authorised version as an appropriate designation for certain Eastern potentates.

Duke of York's School, an alternative name for the Royal Military Asylum (q.v.) at Chelsea.

Dukinfield, a Cheshire sub-district, mostly within the parliamentary borough of Stalybridge (q.v.). Pop. (1881) 29,675; (1891) 39,974.

Dukery, The. See Worksop.

Dulce, a lagoon of Guatemala (q.v.), communicating with the Atlantic.

Dulce Domum, the famous song still sung, with the aid of a band, at Winchester College, on the eve of the break-up day for the summer holidays. The origin of both words and music is very uncertain—it is usual to ascribe the former to one Turner, probably him who became Bishop of Ely and was one of the Seven Bishops under James II.; the latter, to Johannes Reading, organist of the college from 1681 to 1689. A school tradition makes both the work of a home-sick Wykehamist, who was kept at school during the holidays for a misdemeanour, and who played it incessantly until he pined away and died. See vol. ii. (pp. 576–579) of Chappell's *Popular Music of the Olden Time*, where, with the Latin text and the music, a good translation by Bishop Charles Wordsworth is given.

Dulcigno (Serb *Ultschin*, Albanian *Ulkun*), a port of Montenegro, 20 miles SW. of Scutari, and till 1880 a Turkish town. Pop. about 4000. Old Dulcigno fell into the hands of the Turks in 1571. In the 16th and 17th centuries it was the most famous den of pirates on the Adriatic. In 1880, with the approval of Turkey, the representatives of the Western powers arranged that Dulcigno and its territories should become Montenegrin. The despatch, in September 1880, of a fleet representing the great powers, did not immediately secure the transfer; and it was not till the end of November that, after endless procrastination, the Turks expelled the Albanian troops by force, and the Montenegrins were able to take possession.

Dulcimer, a musical instrument resembling a flat box, with sounding-board and bridges, across which run wires tuned by pegs at the sides, and played on by striking the wires with a small piece of wood in each hand, or more usually with two cork-headed hammers. The dulcimer in its simplest shape (closely akin to the psaltery, which, instead of standing on a table or on legs of its own, was carried in the hand like a harp) is one of the most ancient of instruments, appearing in Assyrian sculptures; and may be regarded as the ancestor of the piano. The czimbalom of Hungarian bands is essentially a dulcimer.

Dulong and Petit's Law. See Atomic Theory.

Dulse (*Rhodymenia palmata*), a seaweed, one of the Florideæ (see Seaweeds), growing on rocks in the sea, and used as food by the poor on the coasts of Scotland, Ireland, and other northern countries. It is eaten raw or roasted, and with vinegar. It is an important plant to the Icelanders, and after being washed and dried, is stored in casks, to be eaten with fish or boiled with milk. In Kamchatka, a fermented liquor is made from it. Sheep are fond of it.—One or two other edible Florideæ bear the same name on different parts of the coast, and the pungent *Laurencia pinnatifida* is known as pepper dulse.

Duluth, a prosperous city and the chief port of entry of Minnesota, and capital of St Louis county, is picturesquely situated at the west end of Lake Superior, 156 miles NNE. of St Paul, and is the terminus of a number of important railways. It has one of the finest harbours in the United States, protected by a natural breakwater known as Minnesota Point, which is 7 miles long and about 750 feet broad. It has more than 100 miles of dock line, and, by slight improvement, deep-water navigation will soon be extended to the falls of the St Louis River, 15 miles from the lake. The United States government has expended liberal sums of money in the improvement of the harbour, by dredging and the construction of piers. The ship-canal (depth about 23 feet) through Minnesota Point forms the chief entrance way between Lake Superior and the harbour. In 1886 the vessels arriving and clearing numbered 2181, with a tonnage of 1,694,364; 17,981,935 bushels of wheat were shipped, and 736,000 tons of coal received. Duluth contains a custom-house, United States land office, a good system of public schools, large steam sawmills, a steam-forge, flouring-mill, stock-yards, and a slaughtering and cold storage establishment. Advantageously situated at the head of navigation of the great chain of lakes, and with immense deposits of iron, granite, and freestone in the immediate vicinity, the town has rapidly increased in population and in wealth. Pop. (1880) 3483; (1890) 33,115.

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Dulwich, a beautiful suburb of London, in the north-east of Surrey, 4½ miles SSE. of St Paul's Cathedral, and a little to the west of Sydenham. Pop. 5590. It consists chiefly of villa residences, and is noted for its college and picture-gallery.

Dulwich College, or 'College of God's Gift at Dulwich,' was founded in 1619 by Edward Alleyn (q.v.), the actor. The old college buildings occupy three sides of a quadrangle, and comprise the chapel, chaplain's house, alms-rooms, and the Lower School, in which 160 boys receive a second-grade education at the nominal fee of £1 per annum. The Upper School, giving a first-grade education, was, in 1870, transferred to new buildings in the Italian style of the 13th century, erected at a cost of nearly £100,000. It provides accommodation for about 600 boys. The foundation also includes an almshouse for the maintenance of twelve poor brethren, twelve poor sisters, and twelve out-pensioners. The picture-gallery, specially rich in Dutch paintings, had been collected for Stanislaus, king of Poland, and was bequeathed by the painter, Sir Peter Francis Bourgeois (1756–1811). The annual revenue amounts to £20,000, derived from Dulwich manor. In 1885 Dulwich was included in Camberwell parliamentary borough. See works by Hovenden (1873), Blanch (1877), Warner (*Catalogue*, 1881), Galer (1891), Young (College, 1891).

Dum Palm. See Doom.

Dumas Davy de la Pailleterie, Alexandre (1802–70), was the grandson of a certain Count (or Marquis) Alexandre Davy de la Pailleterie and Marie-Cessette Dumas, a pure-bred Haytian negress, and the son of General Alexandre Davy-Dumas—a brilliant and daring cavalry officer, 'the Horatius Cocles of the Tyrol'—and Marie-Louise-Elizabeth Labouret, daughter of a tavern-keeper and small landowner at Villers-Cotterêts, and was technically, therefore, a quadroon. He was born and reared at Villers-Cotterêts. The general, who had been put on half-pay by Napoleon, died when his son was four years old; and as the Emperor continued to behave as meanly to his widow and children as the First Consul to himself, the first years of a most prodigal life were years of decent penury and thrift. Dumas, who was afterwards an omnivorous reader, was an idle and unscholarly lad, and the local teachers could make nothing of him; but he had the run of the great forest about his native hamlet, he became an expert woodman, he developed a magnificent constitution, a turn for letters, and a very pretty talent at billiards, and when, at twenty or so, he

got at last to Paris, he was physically as fit for the struggle for existence as any of the strong and ardent generation to which he belonged.

He began, through the influence of General Foy, as a clerk in the bureau of the Duc d'Orléans (afterwards Louis-Philippe); but his mind still ran on literature, and he spent some years in reading and in trying to learn to write. He had only published a volume of short stories, and collaborated—with Ph. Rousseau and young Adolphe de Leuven—in a couple of farces, when at seven-and-twenty he forced the door of the Théâtre Français with his first five-act play, *Henri Trois et sa Cour* (1829), and at one stroke operated that revolution in the theory and practice of historical drama which the Hugolater is fond of ascribing to the poet of *Hernani* (1830). In 1831 he did the same for domestic tragedy—the *pièce* of MM. Augier and Sardou—with *Antony*, perhaps the boldest, adroitest, and completest achievement in plan, construction, and effect in the literature of the modern theatre; failed in verse with *Charles VII. chez ses Grand Vassaux*—an excellent play; and scored a tremendous success (in collaboration with Goubaux and Dinant) with *Richard Darlington*; and in 1832 he carried the romantic 'history' to what seems to be its culmination in *La Tour de Nesle* (in collaboration with Gaillardet). He was, indeed, the very genius of the stage. He broke ground with the ease, the assurance, the insight into essentials, and the technical accomplishment of a master, and he retained these qualities until the days of *Mme. de Chamblay* (1868) and *Les Blancs et les Bleus* (1869). His dialogue is bright, appropriate, vivid, eminently constructive and explanatory; he never eludes or tampers with his situation, but faces his problem boldly, and wrings his interest from the clash of character and the presentation of emotion in action; his plots are made and conducted with admirable adroitness and lucidity; his expositions are models of clarity; his effects are brought off with surprising certainty and vigour. 'All I needed,' he said of himself, 'was'—not scenery, nor choruses of monks, nor Hernani's horn, nor any merely decorative stuff of that sort—but 'four trestles, four boards, two actors, and a passion;' and the vaunt was absolutely justified. Dumas is the soundest influence in drama of the century, and to his example is owing not a little of the best of Barrière and Augier and the dramatist of *Monsieur Alphonse* and *Denise*.

The *romantiques* were a Byronic set, and Dumas, whose good temper was exuberant, and whose sense of the liveableness of life remained unalterable, was at first as Byronic as the rest. In 1832, however, he fell ill of cholera, went to Switzerland to recuperate, and wrote for the *Revue des Deux Mondes* the first of his famous and delightful *Impressions de Voyage*. He was fond of adventure and change; his capacity of producing agreeable and brilliant 'copy' was amazing; and these traveller's notes of his—in which a good deal of history and romance is worked in with abounding vivacity and wit—were among the best liked of his many benefactions to the public. He kept them going almost to the end. A prodigious worker (he would write for weeks on end, at the rate of sixteen or eighteen hours a day), he was wont, after months of production, to renew himself with a round of hundreds, or thousands, of miles; and he never failed to put the experience into print. Thus, *En Suisse* (1832) was followed by *Le Midi de la France* (1840), by *Les Bords du Rhin* and *Une Année à Florence* (1841), by *Le Speronare* and *Le Capitaine Arena* (1842), by *Le Corricolo* (1843)—it was of the last two it was said that Dumas had discovered the Mediterranean—by *De Paris à Cadix* and *Le Véloce* (1845), and, finally, after years of work on other lines, by *Le Caucase* (1859), *De Paris à Astrakhan* (1860), and *En Russie* (1865). All these are certainly his own. Of those that he redacted from the MSS. of other men it is unnecessary here to speak.

But it was as a story-teller pure and simple that Dumas was destined to gain the better and larger part of his abounding and enduring success. And this is perhaps the place to discuss the question of what is his own share in his own work. He exhausted, it appears, some ninety several collaborators, and his debates with certain among them—with Gaillardet and Maquet, for example—by no means redounded to his credit. But it is none the less a fact that apart from him his assistants were mostly unreadable, while in conjunction with him they were Alexandre Dumas—that is to say, perhaps the most popular among modern novelists, and assuredly one of the greatest masters of the art of narrative in all literature. The truth, as stated by Edmond About, appears to be that Dumas took whatever he could get from whomsoever he could get it; that, the thing being carefully devised in consultation, the collaborator of the period was told off to prepare a first draft; and that Dumas re-wrote the result—'En y semant l'esprit à pleines mains,' says About—thus minting it in his own die, and informing it with his own immense and radiant personality. 'What a gainer you would be,' exclaims his son of him: 'rien qu'à reprendre ce que tu as donné!' and there is no doubt—for the present writer at least—that Dumas gave a vast deal more than he took. At the same time it is undeniable that his thefts were many and flagrant. Trelawney's *Adventures of a Younger Son*—to take but a single instance—appears in his collected works; and it is even told of him that he was with difficulty restrained from signing a book of the *Iliad*, which somebody else had run into prose to fill a gap in the columns of *Le Mousquetaire*.

He has told us that from the first it was a purpose of his life to put the history of France into novels; and his earliest essay was the *Isabelle de Bavière* of 1836. It was followed by *Pauline*, *Le Capitaine Paul*, and *Pascal Bruno* in 1838; by *Acté* in 1839; and by *Othon l'Archer*, *Le Capitaine Pamphile*, and *Maître Adam le Calabrais* in 1840—all on other lines; and then the historical vein cropped up anew in *Le Chevalier d'Harmenthal* and *Ascanio*, both produced in 1843. For the amazing decade that was next to come there is no parallel in the story of literature except the first ten years of the author of *Waverley*. In 1844, with a number of digressions and excursions into new provinces—as *Cécile*, *Fernande*, *Amaury*, *Sylvandire*, *Monte Cristo*—appeared *Les Trois Mousquetaires*; in 1845 *Vingt Ans après*, *La Fille du Régent*, and *La Reine Margot*; in 1846 *La Guerre des Femmes*, *Maison-Rouge*, *Le Bâtard de Mauléon*, *La Dame de Monsoreau*, and *Les Mémoires d'un Médecin*; in 1848—the Théâtre-Historique and a run through Spain, Algiers, and a part of Morocco having absorbed the greater part of 1847—*Les Quarante-Cinq* and the beginnings of *Bragelonne*, which was finished in 1850; and in 1849 *Le Collier de la Reine*. The next two years witnessed the production of work so varied as *La Tulipe Noire* and *Le Trou de l'Enfer* (1850), and *La Femme au Collier de Velours* (1851); but in 1852 the historical inspiration was again turned on, and the result was the masterpiece called *Olympe de Clèves*. Between that year and 1854 were produced the ten delightful volumes of *Mes Mémoires*, with *Ange Pitou* and *La Comtesse de Charny*, which were the work of 1853. Other achievements in the romance of French history were *Ingénue* (1854), *Les Compagnons de Jéhu* (1857), *Les Louves de*

Machecoul (1859), and *Les Blancs et les Bleus* (1867–68), in which last the sequence at length found end. Other works of the same period, but done on other lines, were *Isaac Laquedem* (1858), which promised to be one of Dumas's best works; *Catherine Blum* (1854); *Les Mohicans de Paris* and *Salvator* (1854–59), in which is formulated the type of the French detective as he appeared to Gaboriau, Féval, and Ponson du Terrail; *Le Meneur de Loups* (1857); *Black* and *Le Capitaine Richard* (1858); *Le Père Gigogne* and *Le Père la Ruine* (1860); *Jane, Mme. de Chamblay* and *La Princesse Flora* (1861); *La San-Felice* (1864); and *La Terreur Prussienne* (1867). In most of these there are touches of good Dumas; but the best period is that which begins with the *Mousquetaires* and ends with *Isaac Laquedem* and *Les Mohicans de Paris*.

The list is nothing like complete, nor have we space to do more than refer in passing and in general terms to the cloud of drama (all the great historical novels were cut out into great historical plays: the *Mousquetaires* cycle supplied at least three: as also were *Monte Cristo*, which was played in four parts, *Gabriel Lambert*, *Mme. de Chamblay*, and so forth), history, *causerie*, journalism, redaction, in whose midst this enormous production went on. In the same way and for the same reason we can only note that Dumas took active and conspicuous part in the Days of July; that in 1837 he received the red ribbon; that in 1842 he married Mlle. Ida Ferrier, from whom he promptly separated; that in 1855 he went into exile at Brussels, and stayed there two years; that from 1860 to 1864 he was in Italy, helping Garibaldi (whose life he wrote and who made him Directeur des Fouilles at Pompeii) and conducting and writing a journal; and that in 1868 he founded the *D'Artagnan*, published the *Histoire de mes Bêtes*, which of its kind is as good narrative as the first volume of *Monte Cristo* itself, and produced the last but one of his plays. By this time the end was near. *Procumbit humi bos*, says his son of the way in which he sank under his work. He had got rid of a series of fortunes (three-fourths of them were given away), and he quitted Paris for the last time with only a couple of napoleons in his pocket. He went to his son's villa at Dieppe, and there, on 5th December 1870, he simply faded out of being.

In life he was very much of a scapegrace and a madcap, and even more of a prodigal. His morals were loose, he was vain as only a man of colour can be, his literary conscience was (to say the least) imperfect, his veracity was that of Hugo and Berlioz and the *romantiques* in general; he could—and did—commit astonishing offences in taste; but his humanity was boundless in degree and incorruptible in quality, he was generous to a fault, he is not known to have dealt a single foul blow. 'I love and admire you,' said Michelet, 'for you are a force of nature.' 'Foncièrement bon,' was George Sand's verdict, 'mais . . . trop souvent ivre de puissance;' and the fact is that he was a prodigy of gaiety, kindliness, and charm ('Il respirait la bonté,' M. Rodin told the present writer), and a prodigy of temperament and power and the capacity of life and invention and achievement. He talked still better than he wrote; and he wrote without any of those affectations of style which were the daily bread of many of the men of 1830, and with an ease, a gusto, a sincerity of mind, a completeness of method that are irresistible. And the lesson of his greater books—of the Valois cycle, for instance, and the long sequence of the *Mousquetaires*—is one by which the world may well have profited. Love, honour, friendship, loyalty, valour, the old chivalric virtues—these were his darling themes; and he treated them with a combination of energy and insight, of good sense and good feeling, of manliness of mind and beauty of heart, that has ranked him with the great benefactors of the race.

Alexandre Dumas (born 1824), son of the preceding, was born in Paris when his father was but twenty-one years old. He was soon legitimised, and at sixteen, after a thorough course of training at the Institution Goubaux, and the Collège Bourbon, he left school for the world and letters and the society to which his father, then almost at his apogee, belonged. He was essentially respectable, however, and having sown a certain quantity of wild oats, and made a few experiments in literature, he settled down to serious work, and began to take life in earnest. He started in fiction, and succeeded; he went on to drama, and succeeded; he took to theorising about art, morals, politics, religion even, and succeeded. He was made a member of the Institute in 1874, and is at this date the acknowledged best playwright and one of the greatest artists in words of latter-day France.

His novels—from *La Dame aux Camélias* (1848) to *L'Affaire Clémenceau* (1867)—are all readable, and more often than not are worth reading. His essays, letters, speeches, prefaces, and prelections generally are brilliant and admirable in form, and in matter daring, paradoxical, suggestive in a very high degree. Of his sixteen plays, there is scarce one that is not literature, while five or six of them, as *Le Demi-Monde* (1855), *Le Fils Naturel* (1856), *Les Idées de Mme. Aubray* (1867), *Une Visite de Noces* (1871), *Monsieur Alphonse* (1873), *Denise* (1885), are masterpieces of construction, characterisation, and writing. Other famous dramas in which he has had a share (and a very large one) are *Le Supplice d'une Femme* (1865), the chaotic original of which is due to Émile de Girardin; *Héloise Paranquet* (1866), in collaboration with M. Durantin; and *Les Danicheff* (1876). He is also believed to have assisted George Sand in preparing several of her novels for the stage—*Le Marquis de Villemer* among them—and known to have completed and produced his father's *Joseph Balsamo* (1878).

He is a brilliant yet dubious combination of African and French. At bottom he is fantastic, mystical, violent, with a passion for abnormal problems and desperate solutions. But it is not for nothing that his mother was a Parisian: his method is logical to a fault, he builds as for all time, he is an artificer even in theory, and his paradoxes are developed with scientific exactness and precision. A bitter and dazzling wit; an intelligence of uncommon energy, daring, and intensity; a morality that is so genuine as to be sometimes offensive; an incorruptible honesty; a style hard, polished, chaste, flexible as a perfect sword blade; and a dramatic gift as real as his father's—these are his qualities, and they have made him not only remarkable but distinguished.

Dumas, Jean Baptiste André, a great French chemist, was born at Alais, Gard, 14th July 1800. He studied at Geneva, and coming to Paris in 1821, was first a lecturer in the École Polytechnique, then professor of Chemistry in the Athénée, the École Centrale des Arts et Manufactures (founded by himself), and finally, the Sorbonne. He now wholly devoted himself to chemical studies; and his views on chemical equivalents, and especially his memoir on the atomic theory, soon attracted attention over all Europe. His views on the laws of substitutions involved him in a long discussion with the great Berzelius. His researches in organic Chemistry (q.v.), especially his masterly papers on the ethers, ethereal oils, indigo, and the alkaloids, placed him

in the first rank of chemists. From 1849 he came forward into public life, and held office under the Second Empire, in 1868 being appointed Master of the Mint. In 1875 he was called to fill Guizot's chair in the Academy; and he died at Cannes, 11th April 1884. His chief works are *Traité de Chimie appliquée aux Arts*, and *Leçons sur la Philosophie Chimique*. See a memoir by A. W. Hofmann, in *Nature* for 6th February 1880.

Du Maurier, GEORGE LOUIS PALMELLA BUSSON, an English author, caricaturist, and book-illustrator, descended from a French family who fled to England at the time of the Revolution, was born in Paris, 6th March 1834. In 1851 he came to London, and studied chemistry at University College, but returning to Paris he adopted art as a profession, studying under Gleyre, and in Antwerp and Düsseldorf. In England he rapidly acquired reputation as a designer of exceptional dexterity. He illustrated Thackeray's *Esmond* and *Ballads*, Foxe's *Book of Martyrs*, &c.; and much of his work is to be found in *Once a Week* and the *Cornhill Magazine*. Finally he joined the staff of *Punch*, and has become *par excellence* the gentle, graceful satirist of modern fashionable life, carrying into his work more completeness, more finished light and shade, and more suggestion of local colouring than has hitherto appeared in woodcut designing of the kind. He is an Associate of the Royal Society of Painters in Water-colours. In 1880 a collection of his *Punch* woodcuts was published in a volume entitled *English Society at Home;* and in 1885 an exhibition of his drawings was brought together by the Fine Arts Society. His novel *Trilby* (1894) is a work of exceptional ability.

Dumbarton, or DUNBARTON, the county town of Dumbartonshire, lies mainly on the left bank of the Leven, a little above its influx to the Clyde, and 15 miles WNW. of Glasgow. Its High Street curves for five furlongs parallel to the Leven; and its chief public building is the Burgh Hall and Academy, a French-Gothic pile of 1866, restored since the fire of 1883. There are gas-works (1832), water-works (1859), a pier on the Clyde (1875), and a public park of 32 acres (1885), gifted to the town at a cost of £20,000. In 1658 the magistrates of Glasgow are said to have wished to make Dumbarton their harbour, but the offer was declined on the ground that 'the influx of mariners would tend to raise the price of butter and eggs to the inhabitants;' and in 1700 the right of levying dues on all vessels navigating the Clyde was sold to Glasgow for £260. Dumbarton now ranks merely as a sub-port; but its shipbuilding, with the subsidiary industries, has attained important dimensions since the opening of the great shipyards of Messrs M'Millan (1834) and Messrs Denny (1844). Between the town and the Clyde rises the Rock of Dumbarton (280 feet), a double-peaked, basaltic eminence, which is crowned by the picturesque castle, a building of no great strength now or architectural merit, but one of the four Scottish fortresses that must be maintained in terms of the Treaty of Union. Dumbarton was made a free royal burgh in 1222, and unites with the other four Kilmarnock burghs to return one member to parliament. Pop. (1851) 5445; (1871) 11,404; (1891) 16,908. The capital of the Britons of Strathclyde, and termed by them *Alcluith* ('height on the Clyde'), by the Gaels *Dunbreatan* ('fort of the Britons'), Dumbarton has also been identified, more doubtfully, with the Roman *Theodosia*. Anyhow, the history of its Rock extends over more than a thousand years, from its capture by Picts and Northumbrians (756), by Vikings (870), to Wallace's captivity here (1305), the child Queen Mary's residence (1548), and its daring surprise by Craufurd of Jordanhill (1571). A younger son of the Marquis of Douglas was made Earl of Dumbarton in 1675, and he is referred to in the well-known song, 'Dumbarton's drums beat bonny, O!'

Dumbartonshire, a Scottish county, 25 miles long and 1¼ to 15½ miles broad, with an area of 270 sq. m., of which 30 belong to a detached south-eastern portion. Loch Lomond (22 by 5 miles) lies on the eastern boundary, and sends off the Leven 7 miles to the Clyde; the southern is washed by the Clyde's broadening estuary; and the western, for 17 miles by its offshoot, Loch Long, which forms with the Gare Loch (7 miles by 7 furlongs) the wooded Rosneath peninsula. The surface, almost everywhere hilly or mountainous, culminates in Ben Vorlich (3092 feet); and the scenery, with its sea-lochs, lake, woods, and glens, is lovely as that of few regions in Scotland. The rocks include mica-slate, sandstone, and limestone; and coal is mined in the detached portion, which nowhere exceeds 480 feet above sea-level. The climate is mild and humid. Barely a fourth of the entire area is in tillage; but many sheep and cattle are reared. Colquhoun of Luss is much the largest proprietor. Rosneath Castle is a seat of the Duke of Argyll. Since 1728 bleach and print fields, dyeing and cotton works, have multiplied in the Vale of Leven; shipbuilding is an important industry; and there is ample communication by steamboat and rail. The chief towns are Dumbarton, Helensburgh, Kirkintilloch (in the detached portion), Alexandria, Renton, and Bonhill. Dumbartonshire returns one member to parliament. Anciently part of the Levenach or Lennox, it retains some vestiges of Antoninus' Wall, and has memories of St Patrick, Bruce, Rob Roy, Smollett, and Henry Bell. Pop. (1801) 20,710; (1841) 44,296; (1881) 75,333; (1891) 94,511. See Joseph Irving's *History of Dumbartonshire* (1860) and *Book of Dumbartonshire* (1879), with Sir W. Fraser's *Chiefs of Colquhoun* (1860) and *The Lennox* (1874).

Dumb-bells, double-headed weights swung in the hands for the purpose of developing the arms, muscles of the chest, &c. See GYMNASTICS.

Dumb Cane (*Dieffenbachia seguina*), a plant of the order Araceæ, aberrant in its almost arborescent character, but agreeing with them in its acridity, which is in none of them more highly developed. It has a cylindrical stem, with ringed scars and oblongo-ovate leaves. It is a native of the West Indies, and has received its English name from the property which it has of producing dumbness when chewed, its acrid poisonous juice causing an immediate swelling of the tongue, accompanied with excruciating pain. It has, however, been used medicinally. Many species and varieties of Dieffenbachia are in cultivation as foliage plants.

Dumbness. There is hardly any condition of the vocal organs compatible with life in which speech is entirely prevented; for when the larynx is so diseased that no voice-sounds are produced there (Aphonia, q.v.), whispering is in general still possible. Even after complete removal of the tongue, tolerably good power of articulation may be recovered. Only when the larynx is completely obstructed, so that no air can pass by the mouth, and breathing is carried on entirely through a tracheotomy tube, is speech rendered impossible.

The usual causes of dumbness are, first and most important, deafness, congenital or occurring in early life; and even this, patient training by the 'oral method' (see DEAF AND DUMB) is able to overcome, showing clearly that it is the want of hearing the sounds to be imitated which leads to the absence of speech in so-called 'deaf-mutes:'

secondly, morbid conditions of the brain and nervous system, idiocy, hysteria and allied conditions, localised disease of the brain (see APHASIA). Lunatics and malingerers sometimes maintain silence for long periods. It occasionally happens that a child, obviously not deaf nor unintelligent, from diffidence or laziness, does not begin to speak till long past the usual age, but persists in expressing his meaning by signs. This condition can usually be remedied by sending him to live for a time among strangers, by whom his signs are not understood.

Dumdum (*Dam Damá*), a municipality and cantonment in Bengal, in the district of the Twenty-four Parganas, 4½ miles NE. of Calcutta, on the Eastern Bengal Railway. Pop. about 5000, with troops. The place is famous in connection with the mutiny of 1857, as the scene of the first open manifestation on the part of the sepoys against the greased cartridges.

Dumfries', the county town of Dumfriesshire, the 'Queen of the South,' stands on the Nith's left bank, and is connected with its suburb of Maxwelltown by three bridges, of which the middle one was founded about 1280 by Devorgilla Baliol. By rail it is 90 miles S. by W. of Edinburgh, and 33 WNW. of Carlisle. Corbelly Hill, in Maxwelltown, on which are a Catholic convent (1882) and an observatory, commands a splendid view of the surrounding hills, the Solway Firth, and the Cumberland mountains. Dumfries itself is scattered somewhat irregularly over a gentle elevation. It is built of red sandstone, and among its chief edifices are the Scottish baronial county buildings (1866); the new post-office (1887–88); the Mid Steeple (1707), ascribed to Inigo Jones, but really by one Tobias Bachup of Alloa; Greyfriars' Church (rebuilt 1867), with a spire of 164 feet; the Academy (1802); and, in St Michael's churchyard, the mausoleum (1815) of Robert Burns, who here spent his last five years in a small house still standing, and a statue of whom was erected in 1882. The Crichton Institution (1835–70) is a lunatic asylum; rather nearer is the infirmary (1871). The manufacture of tweeds, introduced in 1847, is the leading industry. Hosiery ranks next; and there is a busy trade, both local and transit, pork and live-stock being staple commodities. The opening, however, of the railways in 1850–69 has greatly diminished the river traffic, though large sums had previously been spent in improving the 14 miles of the Nith's channel between the town and the Solway. Dumfries was made a royal burgh by David I., and it unites with Annan, Kirkcudbright, Lochmaben, and Sanquhar in returning one member to parliament. Pop. (1851) 13,166; (1881) 17,092; (1891) 17,804. For the town's memories of Bruce and Burns, of Border wars, and of both the '15 and the '45, see W. M'Dowall's *History of Dumfries* (2d ed 1873).

Dumfriesshire, a Scottish Border county, bounded SE. by Cumberland, and S. for 21 miles by the Solway Firth. Its greatest length, from east to west, is 47 miles; its breadth varies between 13 and 32 miles; and its area is 1103 sq. m. From Clydesdale and Tweeddale it is shut off by a sinuous rim of high green rounded mountains—Lowther Hill (2377 feet), Queensberry (2285), Hartfell (2651), White Coomb (2695), and Ettrick Pen (2269). Thence, though broken by Cairnkinna (1813 feet), Birrenswark (920), and some lesser eminences, the surface has a general southward slope to the dead level of Lochar Moss, a peat bog, 10 by 3 miles, now largely reclaimed. Three beautiful rivers, the Nith, Annan, and Esk, all run to the Solway; and all but the first belong wholly to Dumfriesshire. At Moffat are mineral springs. Besides seven lakes round Lochmaben, there is 'dark Loch Skene' (¾ by ¼ mile; 1680 feet above sea-level), which has its outlet by a waterfall, the Grey Mare's Tail. The Enterkin Pass has been rendered famous by Defoe and Dr John Brown. The strata are Silurian, Old Red Sandstone, Carboniferous, and Permian, with intrusive igneous rock; reptilian footprints have been found in the sandstones of Corncockle Moor, in Annandale. The minerals include coal (at Sanquhar and Canonbie), limestone, antimony, and (at Wanlockhead) lead, silver, gold. The climate is mild, with a mean temperature of 45° F. Only 32 per cent. of the entire area is arable, the uplands being pastoral or waste. Sheep, cattle, and pigs are largely reared; and there are valuable salmon-fisheries. The county is traversed by two chief lines of railway, the Glasgow and South-Western (1850) and the Caledonian (1849). It returns one member to parliament. Towns and villages are Dumfries, Annan, Lochmaben, Sanquhar, Moffat, Lockerbie, Langholm, Ecclefechan, Thornhill, and Gretna Green. Drumlanrig Castle (1689), a seat of the Duke of Buccleuch, is the chief mansion. Among Dumfriesshire's numerous antiquities are the Roman station at Birrenswark, the Ruthwell Cross (a runic Anglo-Saxon monument), Lincluden convent (12th century), and the castles of Lochmaben and Caerlaverock. Among its families are the Maxwells, Johnstones, Jardines, Robert Kirkpatricks, and Douglases; among its worthies, Bruce, Allan Cunningham, Thomas Carlyle, and by a residence of a few years, Robert Burns. Pop. (1801) 54,597; (1841) 72,830; (1881) 76,140; (1891) 74,308.

Dumont, PIERRE ÉTIENNE LOUIS, the apostle of Benthamism, was born at Geneva, 18th July 1759, and in 1783 accepted the charge of the French Protestant Church at St Petersburg. In 1785 he became tutor in London to the sons of Lord Shelburne, afterwards Marquis of Lansdowne. His superior talents, liberal sentiments, and fine character soon recommended him to the illustrious Whigs of that period; with Romilly, in particular, he formed a close friendship. During the early years of the French Revolution, Dumont was at Paris, where he became greatly attached to Mirabeau, regarding whom he has given the world much valuable information in his posthumous *Souvenirs sur Mirabeau* (1832). In this work he claims to have composed for him many of Mirabeau's most eloquent speeches. In 1791 Dumont returned to England, and formed an intimacy with Bentham (q.v.). This was the event of his life. Deeply convinced of the value of Bentham's views on legislation, he requested him to allow him to arrange and edit his unpublished writings on this subject. Bentham gave him his manuscripts, which Dumont laboured earnestly to abridge, elucidate, correct, and simplify. The results appeared in his *Traité de Législation Civile et Penale* (1802), *Théorie des Peines et des Récompenses* (1811), *Tactique des Assemblées Législatives* (1816), *Preuves Judiciaires* (1823), and the *Organisation Judiciaire et Codification* (1828). Dumont returned to Geneva in 1814, and became a member of the representative council. He died at Milan, September 30, 1829.

Dumont d'Urville, JULES SÉBASTIEN CÉSAR, born at Condé in Calvados, 23d May 1790, and early entered the navy. Sent as captain of the corvette *Astrolabe* to obtain tidings of La Perouse, he made a three years' voyage in southern seas, and made surveys of parts of the coast of Australia, Tasmania, New Zealand, the Fijis, New Caledonia, &c. His *Voyage de Découvertes* (22 vols.) contains records of this voyage, and of his botanical and entomological observations. In 1837–40 he

made a great voyage of antarctic exploration, discovering Joinville Island and Adélie Land. The record of this *Voyage au Pole Sud* (1854) comprises 22 vols. He died a rear-admiral, 8th May 1842.

Dumouriez, CHARLES FRANÇOIS, a French general, was born at Cambrai, 25th January 1739, son of an army commissary who was also a fair poet. At eighteen he entered the army, and served with distinction during the Seven Years' War until the conclusion of hostilities in 1763. After some time spent in rambling travel, he was appointed by Choiseul army quartermaster-general, and was next employed on a secret mission to Poland. On his patron's fall, he was sent by D'Aiguillon to Sweden, but was flung into the Bastille on his return, whence he was set free by Louis XVI. and appointed commandant of Cherbourg. As the Revolution drew on, Dumouriez began to attach himself more closely to the popular party, and in 1790 became connected with the Jacobin Club, and during the same year was appointed commandant at Nantes. He now attached himself to the Girondists, and through their influence held for a short time the office of Minister of Foreign Affairs, which he resigned to take the field. The allies were advancing in great force. By a series of bold and rapid manœuvres, Dumouriez prevented the enemy from sweeping over the plains of Champagne, and finally took up his position at Grand-Pré. Succours quickly arrived, and the victory at Valmy (q.v.) compelled the invaders to retreat. It was mainly the admirable strategy of Dumouriez at this critical period that saved France. A winter campaign in Belgium followed, and on the 5th and 6th November 1792, he overthrew the Austrians in a great victory at Jemappes. The campaign of 1793, which aimed at the complete conquest of the Netherlands, was opened with the siege of Maestricht; Breda and other places were taken by the French; but at Neerwinde, Dumouriez sustained a severe defeat from the Austrians under Coburg. Though he had saved France from a foreign enemy, he could not save himself from the envious jealousy of the revolutionists of Paris who hated his leanings towards constitutional monarchy, and ere long he was openly denounced as a traitor and summoned to Paris. To save his head he obeyed by riding over into the Austrian camp. After wandering through many countries of Europe, he finally settled in England, where he died an exile at Turville Park, near Henley-upon-Thames, 14th March 1823. Besides a multitude of pamphlets, Dumouriez left *Mémoires* (Hamburg, 1794), and *La Vie et les Mémoires du Général Dumouriez* (3d ed. Paris, 1822–24). See also the Life by Monchanin (1884), and that in German by Boguslawski (2 vols. 1878–79).

Dun, a root common to the Celtic and Teutonic languages, signifying a hill or height. Besides giving rise to the Fr. *dunes*, Ger. *dünen*, Eng. *downs*, it enters extensively into the names of places (becoming often *dum*, *don*), as *Dun*kirk, *Dum*barton, *Done*gal. It is allied to the A.S. *tun*, *ton*, whence *town*. And see HILL-FORTS.

Düna. See DWINA.

Dünaburg, a strongly fortified town of Western Russia, with some manufactures and a considerable trade, is situated on the Düna, in the government of Vitebsk, 127 miles SE. of Riga by rail. It is of great military importance, owing to the strength of its fortifications. Pop. (1894) 72,286. Dünaburg was formerly the capital of Polish Livonia.

Dunbar, a town on the rocky coast of Haddingtonshire, backed by the Lammermuirs, 29 miles E. of Edinburgh by rail. Little remains of its sea-built castle, the stronghold from 1072 to 1435 of Gospatric and his descendants, the Earls of Dunbar and March. It stood many sieges, the most famous that of 1339, when 'Black Agnes' held it for six weeks against the English; but it was dismantled in 1568, the year after Queen Mary's abduction hither by Bothwell. Dunbar was the scene, too, of Cromwell's great victory over Leslie, 3d September 1650. Chief buildings are the militia barracks and the parish church, which, rebuilt in 1821, has a tower 108 feet high. Fishing is the principal industry, and the new Victoria Harbour was formed in 1844. Dunbar was created a royal burgh by David II., and till 1885 it united with North Berwick, Jedburgh, Haddington, and Lauder in sending one member to parliament. Pop. (1841) 3013; (1881) 3661; (1891) 3545. See James Miller's *History of Dunbar* (new ed. 1859).

Dunbar, WILLIAM, the greatest of the old Scottish poets, was born between 1460 and 1465, most probably in East Lothian. It is supposed that he went to St Andrews University in 1475, and graduated as Master of Arts four years later. Of his life for the next twenty years we know nothing save the hints we can gather from his own writings. It seems that he entered the order of St Francis, and was employed for some time as an itinerant or preaching friar. He tells us, in the words of Dr Irving's paraphrase from his autobiographic poem *The Visitation of St Francis:* 'In the habit of that order have I made good cheer in every flourishing town in England betwixt Berwick and Calais; in it also I ascended the pulpit at Dernton and Canterbury; and crossed the sea at Dover, and instructed the inhabitants of Picardy.' He appears next to have entered the king's service, and to have been retained as secretary to some of James's numerous embassies to foreign courts. In 1500 he obtained from the king a yearly pension of £10, afterwards increased to £20, then to £80. In 1501 he seems to have visited England, most likely in the train of the ambassadors sent thither to conclude the negotiations for the king's marriage. Early in 1503, before the queen's arrival, he composed in honour of the event his most famous poem, *The Thrissill and the Rois*, perhaps the happiest political allegory in English literature. He seems now to have lived chiefly about court, writing poems, and sustaining himself with the vain hope of preferment in the church. On the 17th March 1504, he received a gift for saying mass for the first time in the royal presence; in 1508 Chepman printed seven of his poems—the earliest specimen of Scottish typography. He is supposed to have visited the northern parts of Scotland in May 1511, in the train of Queen Margaret, and his name disappears altogether after the ruinous defeat at Flodden. He may have fallen there, in which case the *Orisone*, written not earlier than 1517, and usually ascribed to Dunbar, was the work of another poet; or he may have retired to some quiet church-living given him by the queen. He was certainly dead in 1530, but David Laing argued that he must have died before 1522, the year of Gavin Douglas's death, whom Lyndesay names eight years afterwards as the greatest poet *recently* dead.

As a poet, Dunbar possessed a wonderful variety of gifts; his genius comprised the excellences of many masters. He is at times as rich in fancy and colour as Spenser in the *Faerie Queen;* as homely, and shrewd, and coarse as Chaucer in the *Miller's Tale;* as pious and devotional as Cowper in his hymns; and as wildly grotesque in satire as Burns in his *Death and Doctor Hornbook.* He reaches his highest level in his masterly satires, *The Twa Marriit Wemen and the Wedo*, and *The Dance of the Sevin Deidly Synnis.* His *Lament for the Makaris* is a masterpiece of pathos. His one fault as a poet is a gratuitous grossness of phraseology

and ideas, which indeed often enhances his genius, but that at the expense of his character. A careful edition of Dunbar's works, by Dr David Laing, was published in 2 vols. in 1834; another by Small and Mackay, for the Scottish Text Society in 1884–89; a German edition, with a Life, by Schipper (1884). See also Irving's *History of Scottish Poetry* (1861), and Dr J. M. Ross's *Scottish History and Literature to the Reformation* (1884).

Dunbarton. See DUMBARTON.

Dunblane, an old-fashioned town of Perthshire, delightfully situated on the left bank of Allan Water, 5 miles N. of Stirling by rail. Founded by St Blane, a 7th-century bishop, its church was rebuilt in 1141 by David I. as a cathedral; but except for the Romanesque four lower stages of the steeple (128 feet), that cathedral is now a First Pointed edifice of a hundred years later—its glory the west window, than which Mr Ruskin knows 'nothing so perfect in its simplicity.' The choir, with its carved oak stalls, was restored in 1873; the ruinous nave in 1889. In 1661 the saintly Robert Leighton chose Dunblane as the poorest and smallest of Scotland's sees; his path near the river still bears the name of the Bishop's Walk, and the library which he bequeathed to his diocese is still preserved in the town. There are also an antique bridge, a mineral spring, and a fine hydropathic (1876); 2¼ miles to the east is the battlefield of Sheriffmuir. Pop. (1851) 1816; (1881) 2186; (1891) 2186.

Duncan, ADAM, VISCOUNT, admiral, was born at Dundee, 1st July 1731, and, entering the navy in 1746, commanded the *Valiant* at the reduction of Havana (1762). Save at the battle of Cape St Vincent (1780), he had little opportunity of distinguishing himself during thirty-three years, though he had risen to be admiral, when in 1795 he was appointed to the command of the North Sea squadron, with the special design of watching the Dutch fleet—Holland and France being both then at war with Britain. Duncan's blockade of the Texel was one of the most effective on record, and the Dutch trade was almost ruined. In the spring of 1797 the mutiny of the Nore spread to Duncan's seamen, and his position was for some weeks very critical. But the insubordination was ultimately quelled; and on the 11th of October he gained the brilliant victory of Camperdown (q.v.). He was rewarded with a pension of £2000 and the title of Viscount Duncan of Camperdown. He died suddenly at Cornhill Inn, near Coldstream, on his way north, 4th August 1804, having some years before succeeded his brother in the Lundie estates, and leaving two sons, the elder of whom was in 1831 made Earl of Camperdown. Duncan was 6 feet 4 inches high, of vast strength, and strikingly handsome.

Duncan, HENRY, D.D. (1774–1846), from 1798 was minister of Ruthwell, in Dumfriesshire, where, in 1810, he established the first savings-bank.

Duncan, THOMAS, R.S.A., and A.R.A., was born at Kinclaven, Perthshire, May 24, 1807. He studied in the Trustees' Academy, Edinburgh, under Sir William Allan; and was his successor as headmaster of that school, and one of the most distinguished members of the Royal Scottish Academy. His portraits, and historical and fancy subjects, evince delicate feeling for female beauty, and keen appreciation of the humorous in Scottish character. His drawing is always careful and correct, and his colouring is especially remarkable for delicacy and richness. Though he exhibited but few pictures in the Royal Academy of London, they at once attracted marked attention, and he was elected an Associate of that body in 1843. The principal works he exhibited there were: 'Anne Page and Slender;' an illustration from the ballad of *Auld Robin Gray;* 'Prince Charles's Entry into Edinburgh after the Battle of Prestonpans;' and the same Prince, when a fugitive, concealed in a cave. He was engaged on the studies for works, 'Wishart dispensing the Sacrament,' and 'Queen Victoria at Taymouth,' when he was seized with an illness which terminated fatally, 25th May 1845. One of his latest works was a portrait of himself; it is now in the National Gallery of Scotland, along with five other of his productions. Other pictures are 'Lucy Ashton,' 'Mary, Queen of Scots, signing her Abdication' (1836), and 'The Martyrdom of John Brown of Priesthill.'

Duncansbay Head (also DUNCANSBY), a promontory, 210 feet high, forming the north-east extremity of Caithness, 1¾ mile E. of John o' Groat's House, and 18 N. by E. of Wick.

Dunciad, THE, by Alexander Pope, was published in 1728, in three books, to which a fourth was added in 1742. Pope had been, during the greater part of his career, afflicted by a host of critics and detractors. His own genius had not been spared; the worst motives, personal and literary, had been imputed to him; and he resolved to mete unto his enemies the measure which had been meted unto himself. This he did in the *Dunciad.* Never was chastisement more complete. On its publication, a universal howl of rage and pain arose. The satire conferred immortality on his opponents. Pope was a good hater, and his hatred and contempt defy the tooth of time more completely than all the balsams of the Pharaohs.

Duncker, MAXIMILIAN WOLFGANG, an eminent historical writer, was born in 1811 at Berlin, son of the well-known bookseller, Karl Duncker (1781–1869). After studies at Bonn and Berlin, and six months out of a sentence of six years' political imprisonment, he settled to the study of history at Halle, became extraordinary professor there in 1842, next supported the right centre in the National Assembly in 1848, and the Old Liberal party in the Prussian chamber during the sessions from 1849 to 1852. He obeyed a call to a Tübingen chair in 1857, whence he was recalled to Berlin to fill a position in the ministry of state. In 1867 he became director of the state archives of Prussia, from which office he retired in 1874, but continued his lectures on history at the Academy of War and his functions as member of the Berlin and Munich Academies. His greatest work is his *History of Antiquity* (5th ed. 7 vols. 1878–83; new supplement, 1884 *et seq.*), which has been excellently Englished in 6 vols. by Evelyn Abbott (1877–82). This great work embraces the early history of the Egyptians, Babylonians, Lydians, Persians, and Indians, and bears throughout at once the stamp of monumental learning and minute accuracy. In 1883 was published the translation by Miss Alleyne of an only less admirable history of Greece to the battle of Salamis. Duncker's other works are mainly contributions to German and Prussian history. Besides these may here be named *Die Krisis der Reformation* (1845) and *Feudalität und Aristokratie* (1858). Died July 22, 1886.

Dundalk, a thriving Irish seaport-town, the capital of County Louth, situated on Dundalk Bay, 55 miles north of Dublin, and 58 south of Belfast by rail. It has salt-works, a distillery, an iron-foundry, flax-spinning, tanning, and shipbuilding. There is a brisk export trade, especially in the grain, dairy products, and live-stock of counties Louth, Monaghan, and Cavan, with Liverpool and Holyhead (79 miles across), and through its branch railway to Greenore, also with other ports. The harbour has been much improved. Pop. (1871) 11,327, nine-tenths Roman Catholics; (1891) 13,207. It

sent one member to parliament till 1885. Edward Bruce took Dundalk in 1315, and held his court here till killed in battle three years later. It was taken by Cromwell (1649) and by Schomberg (1689).

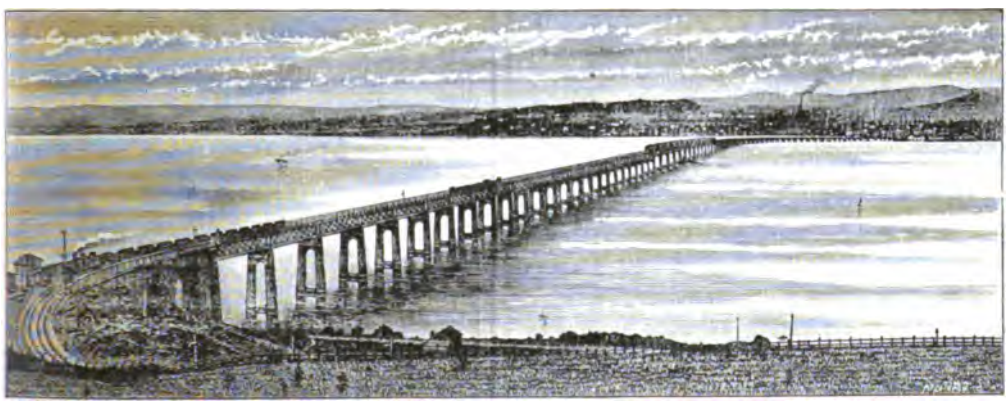
Dundas, (1) a baronial castle, dating from the 11th to 15th centuries, with modern additions, on the south bank of the Firth of Forth, near South Queensferry, the seat from about 1124 till 1875 of the family of Dundas.—(2) A town of Wentworth county, Ontario, at the head of Burlington Bay, at the west of Lake Ontario, with a number of mills and manufactories. Pop. 3709.—(3) An island of British Columbia, 40 miles NE. of Queen Charlotte Island, and separated by Chatham Sound from the most southerly of the Alaskan islands.—(4) A group of nearly 500 islets (also called the Juba Islands), all of coralline formation, lying off the east coast of Africa, in about 1° S. lat., with only one secure harbour.—(5) A strait in North Australia, separating Melville Island from Coburg Peninsula, about 18 miles broad.

Dundas (of Arniston), the name of a Scottish family singularly distinguished for legal and political talent. Sir James Dundas, the first of Arniston, received the honour of knighthood from James VI., and was governor of Berwick. His son, Sir James Dundas, was appointed a judge of the Court of Session in 1662, and took his seat on the bench under the title of Lord Arniston, but was soon after deprived of his office for refusing to abjure the 'National and Solemn League and Covenant.' He died in 1679. His eldest son, Sir Robert Dundas, who also rose to the bench, died in 1727.—ROBERT DUNDAS, the son of the preceding, was born 9th December 1685; became a member of the Faculty of Advocates in 1709; and in 1717 was appointed Solicitor-general for Scotland, an office which he filled with great ability in a period of much political confusion. In 1720 he was made Lord Advocate; and in 1722 was chosen to represent Midlothian in the British parliament, where he honourably distinguished himself by his attention to Scottish affairs. Sir Robert Walpole coming into power in 1725, Dundas resigned his office, when he was elected Dean of the Faculty of Advocates. In 1737 he was raised to the bench, when, like his father and grandfather, he took the title of Lord Arniston. On the death of Lord President Forbes of Culloden in 1748, he was appointed his successor. He died in 1753. As an advocate, Dundas was a powerful and ingenious reasoner, and though somewhat disliked on the bench, his ability was universally admitted.—ROBERT, his eldest son, was born 18th July 1713, studied at Edinburgh and Utrecht, was admitted to the Scottish bar in 1738, and rose to be Lord Advocate (1754) and President of the Court of Session (1760). He died at Edinburgh, 13th December 1787. See *The Arniston Memoirs*, by George W. T. Omond (1887).

Dundas, the RIGHT HON. HENRY, VISCOUNT MELVILLE and BARON DUNIRA, brother of the preceding, was born 28th April 1742, and educated at the High School and university of Edinburgh. He was admitted a member of the Scottish bar in 1763. As a younger son of a pretty numerous family, his circumstances were rather straitened; but his assiduity, his large share of the family talent and presumably also of the family influence, soon procured him advancement in his profession. He was successively appointed Depute-advocate and Solicitor-general. In 1774 he was returned to parliament for Midlothian, in 1775 was appointed Lord Advocate. Two years later, he was made keeper of the King's Signet for Scotland. Dundas's career in parliament was highly successful, though not very creditable to his political consistency. Although elected in opposition to ministerial influence, he soon allied himself with the party in power, and became a strenuous supporter of Lord North's administration, being one of the most obstinate defenders of the war with the American colonists. When Lord North resigned in 1781, Dundas continued to hold the office of Lord Advocate under the Rockingham ministry. On the question of the war with America, Dundas had been opposed to Pitt; but when the Coalition Ministry was formed by Fox and Lord North, he passed over to the side of his old opponent, and became Pitt's ablest coadjutor. When Pitt returned to power in 1784, Dundas was appointed President of the Board of Control. That same year he introduced a bill for restoring the estates in Scotland forfeited on account of the rebellion of 1745. In 1791 he was appointed principal Secretary of State for the Home Department. He also held a great number of other offices, one of which, the treasurership of the navy, involved him some years after in much trouble. Dundas's aptitude for business was undeniable. Many of the most important public measures originated with or were directly promoted by him. Among such were the formation of the fencible regiments, the supplementary militia, the volunteer corps, and the provisional cavalry; in short, the whole of that domestic military force raised during the war consequent on the French Revolution. When Pitt resigned in 1801, Dundas did the same. In 1802, under the administration of Mr Addington, he was made Viscount Melville and Baron Dunira. In 1805 he was accused of 'gross malversation and breach of duty' while acting as treasurer of the navy. The trial commenced 29th April 1806; but in spite of the splendid array of Whig talent against him, Dundas was acquitted on all charges involving his honour, 'though it must now be allowed,' says Lockhart, 'that the investigation brought out many circumstances by no means creditable to his discretion.' Thereafter he lived mostly at Dunira, his seat near Comrie. He died at Edinburgh, 28th May 1811. A stately column, surmounted by a statue, was erected to his memory in Edinburgh in 1821, by officers and seamen of the navy. See Omond's *Lord Advocates of Scotland* (1883).

Dundee (Lat. *Taodunum*, the 'hill or fort on the Tay'), a city in Forfarshire, on the left bank of the estuary of the Tay, here two miles broad, 10 miles from the entrance of that river into the sea, 50 miles NNE. of Edinburgh, 20 ENE. of Perth, and 14 S. by W. of Forfar. In population it is the third town in Scotland. It stands mostly on the slope between Dundee Law (571 feet high, composed of trap, and with traces of ancient vitrification) and Balgay Hill and the Tay. The new streets are wide and well laid out. The most striking architectural features of the town are the town-hall, in the Roman Ionic style, with a spire of 140 feet high, erected by the 'Elder Adam' in 1734; the Albert Institute and free library, in 15th-century Gothic, from designs by Sir Gilbert Scott, erected (1865–74) at a cost of £30,000; the Royal Exchange, built in the Flemish pointed style of the 15th century, at a cost of upwards of £12,000, and opened in 1856; the Eastern Club House; the Kinnaird Hall, capable of containing 2000 people; the infirmary; the Justiciary and Sheriff Court Buildings; the post-office; the high school; the Town's Churches, with the old tower, 156 feet high; St Paul's Episcopal Church; St Paul's and St Enoch's Free Churches; the Morgan Hospital for the maintenance and education of 100 boys (now acquired by the school board for secondary school purposes); the Harris Institute; and the Orphan Hospital. Dundee University College, instituted by the munificence of Miss Baxter for the education of both sexes, and the study of science, literature, and

the fine arts, was opened in 1883. It began with a clear endowment of £100,000 and a staff of five professors, and had over 350 students in its first session; in 1889 there were eight chairs and two lectureships. The scheme of the college includes evening classes for those who are unable to enter on a systematic course of training during the day. Dundee has several public parks, one of which, the gift of Sir David Baxter, on a beautiful slope to the eastward of the town, is 37 acres in extent; another of 60 acres, to the westward of the town, occupies the hill of Balgay. Dundee is the chief seat in Great Britain of the manufacture of coarse linen fabrics (Osnaburgs, sheetings, ducks, dowlas, drills, canvas, and cordage). Manufactures of jute are carried on here on an immense scale. The consumption in Dundee of this material, which is grown in India, amounts to fully 300,000 tons annually. The raw material costs in Dundee a little under 2d. per lb.; and the cloth made from it, reckoned by weight, is the cheapest textile fabric made in Great Britain. Of jute many varieties of fabric are made, from the coarsest nail-bagging to carpets of great beauty. This range includes packing-sheets for every species of merchandise, sacks for grain, wool, coffee, guano, &c. The annual value of the flax, hemp, and jute manufactures in Dundee is upwards of £5,500,000. Dundee is also famous for its manufacture of confectionery, which is exported to all parts of the world. One firm uses 250 tons of bitter oranges annually in the manufacture of marmalade. Dundee is the centre of the whale and seal fishing trade of Great Britain. Shipbuilding (both wood and iron) and machine-making are carried on to some extent. In addition to the tidal harbour, Dundee has several large and magnificent wet-docks, two graving-docks, and a slip for large vessels. The docks have been erected at a cost of upwards of £700,000; and the tonnage of vessels entering the port exceeds in some years half a million. The direct railway communication of Dundee with the south, established in 1878 by the Tay Bridge, two miles long, was interrupted by a sad disaster on 28th December 1879, when a great part of the bridge and a passenger-train passing over it were thrown into the river. A new and more substantial bridge was rebuilt, 60 feet higher up the river, at a somewhat lower elevation, and was opened for traffic in 1887. It is 3593 yards long, and contains eighty-five piers, the height above high-water mark averaging 77 feet clear; under four of the spans is the navigable channel. Pop. (1841) 63,732; (1871) 120,724; (1881) 142,154; (1891) 155,640. Dundee sends two members to parliament. It was an important place in the 12th century. Edward I. was here twice. Wallace is said to have taken the castle in 1297, and Bruce demolished it in 1313. The Duke of Lancaster



Tay Bridge, looking towards Dundee.

burned Dundee in 1385, and the Marquis of Montrose pillaged it in 1645. Charles II. lived here, after his coronation at Scone, in 1650. On the refusal of Dundee to submit to Cromwell, General Monk, in 1651, sacked and burned it, massacring 1000 citizens and soldiers, and filling 60 vessels with booty, which were totally wrecked on their voyage to England. Dundee was one of the first Scotch towns to adopt the Reformation. Wishart the martyr preached here during the plague of 1544. Since 1889 Dundee has been styled a city. See works by Thomson (1847), Beatts (1873–82), Maclaren (1874), Norrie (1876), Hay (1880), and Maxwell (1884–91); also Millar's *Roll of Eminent Burgesses of Dundee* (1887).

Dundee, Viscount. See Graham (John).

Dundonald, Thomas Cochrane, Earl of, seaman, was the eldest son of Archibald, ninth earl (1749–1831), who beggared himself over chemical discoveries. Born at Annsfield, Lanarkshire, on 14th December 1775, he was destined for the army, but, after a desultory education, was permitted to enter the navy (1793). He served in the fiords of Norway, for five years on the North American station, then in the Mediterranean, and in March 1800 received the command of a crazy little sloop of 14 *four-pounders* and 54 men. In a fifteen months' cruise he took or retook upwards of fifty privateers and merchantmen, 122 guns, and 534 prisoners; his most dashing achievement being the capture by boarding of a Spanish frigate of 32 heavy guns and 319 men, with a loss to himself of but 3 killed and 18 wounded. His own capture by three French line-of-battle ships followed shortly, his speedy exchange, his promotion to post-captain, a half-year of study at Edinburgh University, fifteen months on a 'collier,' protecting non-existent Orkney fisheries—at length, in February 1805, he returned to prize-taking, and in April came sailing into Plymouth Sound, with £75,000 of prize-money for his own share, and a tall gold candlestick at each mast-head.

The next four years were mainly spent in harassing the enemy's coasts—cutting out ships, blowing up semaphores and batteries, and in 1808, with 80 of his own men and as many Spaniards, defending for twelve days the almost untenable Fort Trinidad at Rosas. Meanwhile, in 1805 he had stood unsuccessfully for Honiton on 'patriotic' (no bribery) principles, but by rewarding his few supporters with double the current price, had secured a cheap

victory at next year's election. In May 1807 Westminster returned him at the head of the poll; and at once proceeding, with more zeal than discretion, to war against naval abuses, he was at once ordered off to the Mediterranean.

In April 1809 he was selected by the Admiralty for the hazardous service of burning the French fleet of fifteen sail (848 guns), then blockaded in Aix Roads by a stronger force under Lord Gambier. On the night of the 11th he led the way in an explosion-ship, whose 1500 barrels of powder successfully shattered the huge boom guarding the entrance; but of twenty-one fireships only four reached the enemy's position, and not one of them did any damage. Still, daylight showed almost the whole French fleet aground—an easy prey; it also showed Gambier fourteen miles away. Six urgent signals met with no response; at last, single-handed, Cochrane engaged the foe, and did destroy four of his ships. It was the last blow he was to strike for England.

He received the knighthood of the Bath; but to Gambier were voted the thanks of parliament, after 'a most honourable acquittal' by the friendly court-martial which ensued on Cochrane's protest against that vote. Thus discredited, put upon half-pay, Cochrane pursued his crusade against naval corruption, till in June 1814 he, the hero, the high-born, the Radical reformer, was placed in the dock as a fraudulent stock-jobber. A lying rumour of Napoleon's overthrow had sent up the funds; and he, with two others, was tried for propagating it, and selling out upwards of a million sterling with a gross profit of £10,000. Those two others—an uncle one—were certainly guilty, Lord Cochrane as certainly innocent. Yet, through the exertions of his judge, Lord Ellenborough, a verdict was procured against him; and he was sentenced to pay a fine of £1000, to suffer a year's imprisonment in the King's Bench, and to stand for an hour in the pillory. The last part of the sentence was remitted; but his name was struck off the navy list, and he was expelled from parliament, and formally degraded from his knighthood. Westminster re-elected him; and in March 1815 he broke out of gaol, and reappeared in the House, to be torn thence by tipstaves, lodged in the strong-room for the three months yet to run of his sentence, and next year mulcted anew in £100.

Weary of inactivity and of fruitless attempts at self-justification, in 1818 he once more girt on his sword, to rescue Peru and Chili from Spanish thraldom. As commander-in-chief of Chili's small, ill-equipped navy, he stormed with 300 men the fifteen strong forts of Valdivia (1819), and cut out a frigate from under the batteries of Callao (1820), in two and a half years making Chili mistress of her own waters, and her flag respected from Cape Horn to Panama. Himself he reaped no reward, as neither (beyond the marquisate of Maranham) for his services, only less brilliant, on behalf of the infant empire of Brazil (1823–25).

For the cause of Greek independence he could do little or nothing, through lack of both ships and men (1827–28); so, returning to England, he devoted himself to the task of procuring his reinstatement in the navy. But it was not till May 1832, under the 'Sailor king' and Lord Grey's Whig administration, that a 'free pardon' was granted to the Earl of Dundonald—he had succeeded to the title ten months earlier—and that he was gazetted a rear-admiral. Restored to the honour of knighthood (1847), commander-in-chief on the North American and West Indian station (1848–51), and rear-admiral of the United Kingdom (1854), he died at Kensington, 31st October 1860, in his eighty-fifth year, and was buried in Westminster Abbey. He had married in 1812 Miss Katherine Corbet Barnes—a runaway Scottish marriage; she bore him Thomas, the eleventh earl (1814–85), and three other sons, of whom two entered the navy.

Much might be written of Lord Dundonald's inventions, his application of steam-power and the screw-propeller to war-ships; still more of his 'secret war-plan,' a secret still, which he claimed at the time of the Crimean war would within four hours annihilate Cronstadt or Sebastopol. It was submitted to committees in 1812 and 1846, and condemned as too inhuman, though irresistible, infallible. But from the inventor one ever reverts to the tall, big, splendid sea-captain, brilliant, daring, cool, prompt, and sagacious, faultless afloat, though at home out of his element. He equalled the old Elizabethan adventurers; he might, had Fate suffered it, have rivalled Nelson.

See his own *Narrative of Services in the Liberation of Chili, Peru, and Brazil* (1859), and *Autobiography of a Seaman* (2 vols. 1860–61), which breaks off in 1814, and has been completed in the Life by the eleventh earl and H. R. Fox Bourne (2 vols. 1869).

Dundrum Bay, an inlet of the Irish Sea, on the east coast of Ireland, in County Down, 5 miles S. of Downpatrick. It is 13 miles wide at the entrance, and only 5 miles long to its inmost recess, forming a long curve into the shore. Here, in September 1846, the steam-ship *Great Britain* was stranded, but was got off eleven months later, comparatively uninjured.

Dunecht. See CRAWFORD (EARL OF).

Dunedin, capital of the provincial district of Otago, and the most important commercial city in New Zealand, is situated at the head of Otago Harbour, on the east side of South Island, towards its southern extremity. It is 190 miles by sea from Lyttelton, and 150 miles from Invercargill,

and 139 by rail. Since its foundation by an association of members of the Free Church of Scotland in 1848, the city has rapidly increased in importance; chiefly after the year 1861, when the discovery of extensive gold-fields in the neighbourhood caused a sudden increase of population. Dunedin, which is the seat of a judge of the supreme court, and of a resident minister, is divided into four wards, and municipal business is conducted by a mayor and twelve councillors. It is as well laid out as the hilly nature of its site will allow; it is well paved, lighted with gas, and supplied with water from the Water of Leith valley and the Silverstream. Dunedin is the seat of an Anglican and a Roman Catholic bishop. There are many

handsome churches and buildings; the new Bank of New Zealand, completed in 1882, is one of the finest in the city. Other edifices are the post-office, hospital, government buildings, mechanics' institute, lunatic asylum, &c.; and the inhabitants of the city possess places of recreation in the Botanical Gardens and the grounds of the Acclimatisation Society. The theatre, burned down in 1875, has been rebuilt. There is a carriage-drive through the reserve called the Town Belt, which encircles the city, and a fine racecourse, near Ocean Beach, 2 miles distant. The high school and the university, which is affiliated with that of New Zealand, are flourishing institutions. There are several daily papers, and numerous weeklies and monthlies. Woollens are manufactured. The street tramways are on the horse and cable system. Railways connect Dunedin with Christchurch to the north and Invercargill to the south. Dunedin has frequent communication with the other colonial ports, with Melbourne and the home country; and since the opening and deepening of the new Victoria Channel from Port Chalmers, large steamers can approach the wharf. For purposes of defence, two batteries have been erected on the headlands at Ocean Beach, and a third on Otago Heads. The city was originally to have been named New Edinburgh, but by a happy suggestion of Dr William Chambers of Edinburgh, its name was changed to Dunedin, the Celtic designation of the Scottish capital. Pop. of the city proper (1871) 14,857; (1881) 24,372; (1887) 24,334; of suburbs, largely adjacent boroughs (1886), 22,275; (1891), 22,376, or, with suburbs, 45,865.

Dunes, from the same root as Dun (q.v.), 'a hill,' the name given to the sandhills or mounds which stretch more or less along the sea-coast of the Netherlands and parts of the north of France. In the *Battle of the Dunes*, fought near Dunkirk in 1658, Turenne defeated a Spanish army under Don John of Austria and the great Condé. See DOWNS and DRIFT; also DUNKIRK.

Dunfermline, a 'city' of Fife, the chief town of its western district, 16 miles NW. of Edinburgh, and 20 E. by S. of Stirling. It stands on a long swelling ridge, 3 miles from and 300 feet above the Forth, and, backed by the Cleish Hills (1240 feet), presents a striking aspect from the south. It is a place of hoar antiquity, from 1057 till 1650 a frequent residence of Scotland's kings, and for more than two centuries their place of sepulture. Malcolm Canmore here founded in 1072 a priory, which David I. remodelled in 1124 as a Benedictine abbey. The nave alone of its church, Romanesque to Third Pointed in style, was spared at the Reformation, and now forms a stately vestibule to the New Abbey Church (1818–21), in building which Robert Bruce's grave was discovered. There are ruins of the 'frater-house' or refectory, of the 'pended tower,' and of the royal palace (*circa* 1540); but of Malcolm's Tower only a shapeless fragment is left, and the 'Queen's House' (1600) was wholly demolished in 1797. Nor otherwise is there anything older than the great fire of 1624; indeed, the churches and the public buildings are almost all of quite recent erection. There are the Gothic corporation buildings (1876–79), with their peaked clock-tower; the spired county building (1807–50); St Margaret's Hall (1878), with a fine organ; the Carnegie Public Library (1881); the Carnegie Baths (1877); and the handsome new high school, with its conspicuous belfry. The town has been lighted with gas since 1829, a drainage system was completed in 1877, and a new water-supply introduced in 1878. The staple industry is damask linen-weaving, which, dating from 1716, now in some years turns out goods to the value of a million sterling, nearly one-half being exported to the United States. St Leonard's (1851) is the largest of the factories, which in all employ some 6000 persons, and render Dunfermline the chief seat of the table-linen manufacture in the United Kingdom. Bleaching, iron-founding, &c. are also carried on; and in the neighbourhood are many collieries. Dunfermline was made a royal burgh in 1588, and unites with the other four Stirling burghs to return one member to parliament. Pop. (1801) 5484; (1841) 13,323; (1891) 22,365. For Dunfermline's worthies, reference may be made to our own articles on St Margaret, Robert Henrysoun, Charles I., Ralph Erskine, Sir Noel Paton, and Mr Andrew Carnegie; for its many memories, of kings, Scottish and English, of Cromwellian victory, and Jacobite skirmish, to Dr E. Henderson's *Annals of Dunfermline* (1879), and D. Beveridge's *Between the Ochils and the Forth* (1888).

Dungannon, a municipal borough in County Tyrone, 40 miles W. of Belfast by rail, and 8 W. of Lough Neagh. It has manufactures of linen and coarse earthenware; and in the vicinity are the largest lime-quarries and collieries in Ulster. Pop. (1851) 3835; (1881) 4081; (1891) 3812. Till 1885 it returned one member to parliament. Dungannon was the chief seat of the O'Neils till 1607. Its castle was destroyed in 1641.

Dungans. See ZUNGARIA.

Dungarvan, a seaport of County Waterford, 141 miles SW. of Dublin by rail. Pop. (1861) 8614; (1891) 5263, chiefly engaged in hake, cod, herring, and other fisheries. The exports are grain, butter, cattle, and fish. Dungarvan has the remains of an Augustinian abbey, founded in the 7th century by St Garvan. It has besides the remains of walls built by King John, who also built the castle, now used as barracks. Till 1885 Dungarvan returned one member to parliament. Dungarvan Bay is 3 miles wide, about the same in length, and one to five fathoms deep.

Dung-beetle, a name given to a number of lamellicorn beetles (in the sub-families Coprophaga and Arenicolæ), which live in great part on the dung of quadrupeds. One of the commonest, the Black Dor (*Geotrupes stercorarius*), is interesting in many ways, on account of its elaborate burrows and stores under cow-dung and the like, for the 'stridulating' noises made by both sexes by rubbing part of the abdomen against a ridge on the hindmost leg, for the little ticks (*Gamasus coleoptratorum*) by which they are generally infested, and for its association with another nearly-related beetle (*Aphodius porcus*) which finds its way into the burrow, eats the Geotrupes' eggs, and lays its own in the liberal supply of food thus thievishly appropriated. Among the other British species of Geotrupes, *G. typhœus*, with three horns on the front of the thorax in the males, is found especially on heaths where there are sheep. The sacred beetle or Scarabee (q.v.) (*Ateuchus* or *Scarabœus sacer*) is a well-known dung-beetle. They roll pellets of dung along with great industry, and often appear unable to resist stealing them from one another. A related form (*Sisyphus schäfferi*), the pill-rolling beetle, is said to lay its eggs inside the pellets of dung, and both sexes are described as taking part in rolling these to a place of safety. The scarabee used also to be credited with laying eggs within the pellets, but this appears

Dung-beetle (*Geotrupes stercorarius*).

to be erroneous. *Copris lunaris* is a common European dung-beetle, which makes burrows and stores dung for the larvæ. There are many other forms. The Dor and others feign death, stretching out their legs in rigid epileptic-like fashion. Crows and other birds are said to prefer them alive.

Dungeness, a headland on the south coast of Kent, 10¼ miles SE. of Rye, with a lighthouse.

Dungeon. See DONJON.

Dunkeld, a town of Perthshire, 16 miles NNW. of Perth. It lies in a deep romantic hollow, on the great east pass (of Birnam, q.v.) to the Highlands, on the left bank of the Tay, which here is spanned by Telford's handsome bridge (1805–9). It is environed by dark-wooded and craggy mountains. Dunkeld is a place of great antiquity, and a Culdee church was founded here about 815. In 1107 Alexander I. revived the bishopric, one of whose holders was Gawin Douglas (1474–1522), translator of Virgil's *Æneid*. The place was successfully held by a small Cameronian regiment, under Cleland, against 5000 Highlanders, 21st August 1689. The cathedral, mainly in Pointed style, was built between 1318 and 1501, and comprises nave, choir, chapter-house, and tower. At the Reformation it was unroofed, but the choir has been renovated, and is now the parish church. Of two or three ancient monuments, the most interesting is one to the Wolf of Badenoch (Alexander Stewart, Earl of Buchan, who died in 1394). The Duke of Athole's grounds, unsurpassed in Scotland for extent and beauty, lie on the west and north of Dunkeld, and include the cathedral; Craigvinean and Craig-y-Barns; 50 miles of walks, and 30 miles of drives; falls of the Bran (upper one 80 feet), near Ossian's Hall at the Rumbling Bridge; and 20 sq. m. of larch-wood, including what are claimed to be the first two larches planted in Britain (in 1738), although the point has been disputed. Pop. (1831) 1471; (1881) 768; (1891) 613.

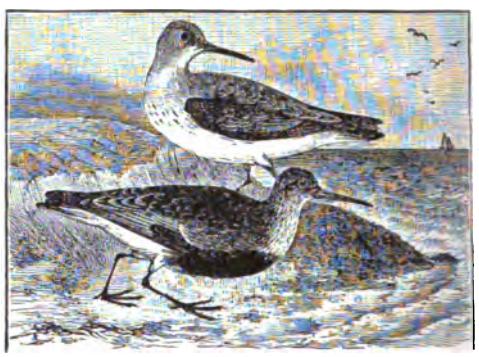
Dunkers. See TUNKERS.

Dunkirk, or DUNKERQUE, the most northerly seaport of France, on the Strait of Dover, in the department of Nord, 189 miles N. of Paris by rail, and 67 W. of Ghent. It is a very strong place, as well from recent fortification works, as from the ease with which the surrounding country can all be laid under water. As a seaport, both naval and mercantile, it is also a place of much consequence; and great harbour works have been carried out under the law of 1879, which authorised an expenditure of £2,000,000. The town itself is well built and cleanly, Flemish rather than French; its principal features, the Gothic church of St Eloi with a handsome though rather incongruous Corinthian portico, the fine detached belfry (196 feet), and the statue of Jean Barth (q.v.). Dunkirk has manufactures of linen, leather, cotton, soap, beet-root sugar, &c.; also metal-foundries, salt-refineries, and great shipbuilding-yards. Forming as it does the outlet for the great manufacturing department of Nord, its trade by sea is very considerable. Since becoming a free port in 1826, it has also carried on a good trade in wine and liqueurs. Its cod and herring fisheries are actively prosecuted. Pop. (1872) 34,342; (1886) 38,004; (1891) 39,498.

Dunkirk is said to owe its origin to the church built by St Eloi in the 7th century, in the midst of the dreary sandhills or dunes, and hence its name, 'Church of the Dunes.' It was burned by the English in 1388, taken by them under Oliver Cromwell in 1658, but sold to Louis XIV. by Charles II. for 5,000,000 francs in 1662. By the treaty of Utrecht in 1713, the French were compelled to destroy the fortifications of Dunkirk, which were again restored, however, in 1783. In 1793 the Duke of York laid siege to Dunkirk, but was forced to retire, with severe loss.

Dunkirk, a port of entry of New York, on Lake Erie, 40 miles SW. of Buffalo by rail, with a commodious harbour and a busy lake traffic. The terminus of a division of the Erie Railroad, Dunkirk contains large workshops and warehouses of the company, besides extensive locomotive works, a lumber-mill, and several ironworks. Pop. 9416.

Dunlin (*Pelidna alpina* or *cinclus*), one of the Sandpipers (q.v.), a common British shore-bird, occurring in great flocks. It generally breeds further north, and is widely distributed in Europe. The plumage varies considerably; in winter it is ashen-gray above and white beneath; in summer there is much less uniformity, more brown and black, and a black horseshoe band on the breast.



Dunlin, Summer and Winter Plumage.

It exhibits great activity in running about, searching and probing for its food. Another species (*P. temminckii*) is common in Europe and North America. The Curlew Sandpiper (*P. subarquata*), with a more curved bill and deep-red breast, also occurs on European and British shores. These three species are sometimes included in the genus Tringa, along with the Knot (*T. canutus*) and other Sandpipers (q.v.). 'When flying in great autumnal flocks, the aerial movements of the dunlin are extremely beautiful, each individual of the vast assemblage yielding so instantaneously to the same impulsion as to exhibit alternately the upper and the under surface of the body, so that we have for a time a living moving cloud of dusky brown, and then a brilliant flash of snowy whiteness.'

Dunmow, GREAT, a small market-town of Essex, on the Chelmer, 11 miles NNW. of Chelmsford, and 39 NNE. of London by rail. Pop. of parish, 3005.—At Little Dunmow, 2 miles ESE., are remains of a stately Augustinian priory, founded in 1104. The Dunmow Flitch of Bacon was a prize instituted in 1244, by Robert Fitzwalter, on the condition 'that whatever married couple will go to the priory, and kneeling on two sharp-pointed stones, will swear that they have not quarrelled nor repented of their marriage within a year and a day after its celebration, shall receive a flitch of bacon.' The prize was first claimed in 1445, two hundred years after it had been instituted. After 1751, up to which date only five presentations had taken place, the flitch was not again claimed till 1855; between 1860 and 1877 there were four awards; and three in 1891. See W. Andrews' *History of the Dunmow Flitch* (1877).

Dunnage, on shipboard, is a name applied to miscellaneous fagots, boughs, bamboos, odd mats or sails, and loose wood of any kind, laid in the

bottom of the hold to keep the cargo out of the bilge-water; or wedged between parts of the cargo to keep them steady.

Dunnottar Castle, the ancient seat, now in ruins, of the Keiths, the Earls Marischal of Scotland, on the Kincardineshire coast, 1½ miles S. of Stonehaven. It occupies the top of a rock 4½ acres in extent, and 160 feet high, overhanging the sea, with a deep though dry chasm between it and the mainland, and it is approached by a steep winding path. The area is surrounded by a wall, and covered with dismantled buildings of very various ages, the oldest the square tower and the chapel. Blind Harry records a fabulous story that Wallace in 1296 took the rock, and burned the castle together with the kirk and 4000 Englishmen. During the Commonwealth, the Regalia of Scotland were hid in the castle from the republican army, and before the garrison surrendered to Cromwell's troops in 1651, the Regalia were carried out through a clever stratagem by Mrs Granger, wife of the minister of Kinneff, a neighbouring parish, and buried under the flagstones of that church, where they lay in safety till the Restoration. Having obtained permission to visit the governor's wife in the castle, she carried out the crown in her lap, while the sword and sceptre were wrapped up like the distaff for the lint which she was busy spinning into thread as she rode. For three months in 1685 no fewer than 167 Covenanters were confined with the most barbarous cruelty in the 'Whigs' Vault.' Dunnottar Castle was dismantled after the rebellion of 1715, on the attainder of the last Earl Marischal.

Dunois, JEAN, called the Bastard of Orleans, Count of Dunois and Longueville, one of the most brilliant soldiers that France ever produced, was born in Paris, 23d November 1402, the natural son of Louis, Duke of Orleans, brother of Charles VI., and was brought up in the house of that prince along with his legitimate children. His first important military achievement was the overthrow of the English at Montargis (1427). He next threw himself into Orleans with a small body of men, and bravely defended the place till the arrival of the famous Joan of Arc, whose religious enthusiasm combined with the valour of Dunois restored the drooping spirits of the French, and compelled the English to raise the siege. This was the turning-point in the fortunes of the French nation. In 1429 Dunois and the Maid of Orleans won the battle of Patay, after which he marched, with a small body of men, through the provinces then overrun by the English, and took the fortified towns. The capture and death of Joan of Arc arrested for a moment the progress of the French arms, but the heroism of Dunois was irresistible. He took Chartres, the key of Paris, forced Bedford to raise the siege of Lagny, chased the enemy from Paris, and within a very short period deprived them of all their French conquests except Normandy and Guienne. In 1448–50 he drove the English from Normandy, and in 1455 he had swept them from Guienne also, and permanently secured the freedom of France from all external pressure. For his participation in the league of the nobles against Louis XI. he was deprived of all his offices and possessions, which were, however, restored to him under the treaty of Conflans (1465). He died 24th November 1468. There is no name so popular in France as that of Dunois; there is no hero so national; he laboured twenty-five years for the deliverance of his country, and this *alone*—his sword was never unsheathed, except against the English. He never had a force under him which could enable him to win a victory that might balance Agincourt or Crécy, but the multitude and constancy of his petty successes served the cause of France more effectively than greater and more dear-bought victories would have done.

Dunoon, a favourite watering-place of Argyllshire, extending, with Hunter's Quay and Kirn, 3 miles along the west shore of the Firth of Clyde, and 7 miles W. of Greenock. The seat for centuries of a castle of the Stewarts, in 1563 it received a visit from Queen Mary, and in 1643 was the place where thirty-six Lamonts were cruelly hanged by the Campbells. But the present well-built town has wholly arisen since 1822—with its steamboat-piers, its esplanade, its half-dozen churches, its numerous handsome villas, and the Convalescent Homes (1869). Pop. (1841) 1296; (1881) 4692; (1891) 5285—a number sometimes doubled by summer visitors.

Duns, a police-burgh of Berwickshire, 44 miles ESE. of Edinburgh (by rail 56), since 1853 has divided with Greenlaw the rank of county town, and has a town-hall, county buildings, and a corn exchange. Thomas Boston was a native; and on round turf-clad Duns Law, which rises 700 feet above the sea, and 280 above the town, General Leslie encamped with the Covenanting host in 1639. The form Dunse was altered in 1882 to Duns, the spelling till 1740. Pop. (1834) 2656; (1881) 2437; (1891) 2198.

Dunsinane, one of the Sidlaw Hills in Perthshire, 1012 feet high, 8½ miles NE. of Perth. On its top are remains of a prehistoric fortress—'Macbeth's Castle.'

Dunsink, a hill 4 miles NW. of Dublin, the site of the observatory of Trinity College.

Duns Scotus, JOHANNES, was one of the most influential of the medieval schoolmen. Little is known of his history. His name alone seems to be the chief reason for the different conjectures as to his birthplace, which is variously given as Dunstane, a village in Northumberland, Dun (now Down) in the north of Ireland, and Duns in Berwickshire. He was probably born about 1265 A.D., or, according to others, about 1274. While still young, he is said to have entered the Franciscan order, studied at Merton College, Oxford, and lectured there on philosophy and theology. The reports of the number of his auditors, and that 30,000 students then thronged to Oxford, may be taken as testifying in an exaggerated way to the popularity of his instructions. In 1304 he was transferred to Paris, then the intellectual centre of the world, and in 1308 to Cologne, where he died, in November of the same year, at the age of forty-three, or, according to the other account, thirty-four. His works consist chiefly of commentaries on the Bible, on Aristotle, and on the *Sentences* of Peter Lombard. The first are not contained in the collected edition (edited by Luke Wadding, Lyons, 1639). The last occupy seven out of its twelve vols. folio (vols. v.–x. called *Opus Oxoniense*, vol. xi. called *Opus Parisiense*—the latter edited from students' note-books, but containing the author's latest views).

Duns Scotus was at once the critic of preceding scholasticism and the founder of a new type of thought. The great schoolmen of the 13th century, especially Albertus Magnus and Thomas Aquinas, had systematised and defended the Christian theology by means of the forms and doctrines of the philosophy of Aristotle. In this way philosophy became the handmaid of religion, and the authority of Aristotle was recognised by orthodox teachers. On certain points indeed—such as the eternity of matter and of the world—his theological position compelled Aquinas to diverge from Aristotle. But the disagreement of Duns Scotus went much deeper. He contended that Aquinas was wrong in subor-

dinating the practical to the theoretical, and seeking in speculation instead of in practice for the foundation of Christian theology. This contention struck at the root of the whole Aristotelico-Christian philosophy. Theology, he holds, rests on faith, and faith is not speculative but practical—an act of will. Will is the moving principle of intellect, not intellect the basis of will. 'Will,' he says, 'is the mover in the whole kingdom of mind, and all things are subject to it.' The whole apparatus of proofs by which Aquinas had built up a system of Christian theology is subjected by Duns Scotus to a searching criticism, conducted with consummate dialectical skill, and abounding in refined distinctions, which gained for him the title of 'Doctor Subtilis.' In his own system Duns Scotus maintained a strict theological orthodoxy. He carried on a zealous controversy against the Dominicans (the order to which Aquinas belonged) in defence of the doctrine of the Immaculate Conception, a doctrine which gradually gained ground in the church, until in 1854 it was finally declared to be a necessary part of Catholic faith. In philosophy he was influenced not only by Aristotle, but also by Neoplatonic doctrines which reached him to a large extent through the *Fons Vitæ* of the Jewish Ibn Gebirol (Avicebron, q.v.). By this influence in particular, his mode of applying the realist doctrine of universals, and his explanation of the nature of things, were much modified. His psychological doctrine of the supremacy of will over intellect led to his treatment of morality as depending on the mere will of the Deity. The good is good, he held, because God commands it. See AQUINAS, FRANCISCANS.

The controversies between Thomists and Scotists were continued long after the deaths of their leaders. Among notable Scotists were Nicholaus de Lyra (1340) and Petrus de Aquila (1345); and William Occham, the Nominalist, was originally a disciple of Scotus, the apostle of Realism. See SCHOLASTICISM, NOMINALISM, REALISM. At a later period, when the followers of Duns Scotus or *Dunsmen* opposed the new classical studies, the name *dunce* came to be used contemptuously for an opponent of learning, an ignoramus.

For a further account of the views of Duns Scotus, the 'Doctor Subtilis' of the schools, see K. Werner's *J. D. Scotus* (Vienna, 1881); E. Pluzanski's *Essai sur la Philosophie de Duns Scot* (Paris, 1887); the histories of philosophy of Ritter, Erdmann, and Ueberweg; Prantl's *Geschichte der Logik;* and Hauréau's *Philosophie Scolastique.*

Dunstable, a town in the south of Bedfordshire, at the east base of the Chiltern chalk-hills or Dunstable Downs, 36 miles NW. of London by rail. An old-fashioned, brick-built place, with two main streets crossing at right angles, it has a fine priory church, partly Norman, which since 1865 has undergone restoration. In 1110 this Augustinian priory was the scene of the earliest Miracle Play (q.v.) on record, so that Dunstable claims to be the birthplace of the English drama. It has also an ancient celebrity for larks and for straw-plait, which still is the staple industry. Whiting is also made. The grammar-school (1715) was rebuilt in 1888, at a cost of £10,000. Dunstable, which stood at the intersection of Watling and Icknield Streets, was the site of an Eleanor Cross (demolished 1643), and the scene of Queen Catharine's divorce by Cranmer. It was made a municipal borough in 1864. Pop. (1851) 3589; (1881) 4627; (1891) 4513.

Dunstaffnage Castle. See ETIVE.

Dunstan, ST, Archbishop of Canterbury (960–988), was the son of a West Saxon noble, and was born near Glastonbury in 924. There at the abbey he was educated by some resident Irish scholars, and while still a boy he lived some time at the court of Athelstan, but seems to have been unpopular with his young companions, who ill-used him and procured his banishment on the charge of practising unlawful arts. After a stay at Winchester with his kinsman Bishop Ælfheah, to whom he made his profession as a monk, he retired to Glastonbury, where he gave himself entirely to study and to music. It was at this time of his life that he built himself a cell 5 feet long by 2½ feet broad, where he retired to pray, and where heavenly visions were vouchsafed to him. Here also he worked in metals, and it was while labouring at his forge that his famous temptation by the devil took place, which he ended by promptly seizing the fiend by the nose with his red-hot tongs. The accession of Athelstan's brother, Edmund, recalled him to court, from which he was soon driven—most likely to East Anglia—only to be soon restored to the king's favour, and appointed Abbot of Glastonbury (945). Here he began a great work of reformation, and soon his abbey grew to be a great school and a centre of religious influence. At the same time he became the treasurer, and in harmony with the queen-mother Eadgifu, the chief adviser of the young king, whose death at Frome in 955 led to the accession of Edwy and the fall of Dunstan's power before the influence of the young queen Ælfgifu, her mother Æthelgifu, and the leaders of the West Saxon party. He took refuge in Flanders, where Arnulf I., by his mother grandson of Alfred, received him kindly. At Ghent he first saw the Benedictine discipline which he was yet to introduce into England. Two years later he was recalled by Edgar, who had become, through a rebellion of the Mercians and Northumbrians, king of the country north of the Thames, and created Bishop of Worcester, to which was added a little later the see of London. In 959 Edwy's death made Edgar king of the whole country. One of his first acts was to annul Brithelm's appointment to the see of Canterbury, and, by advice of the witan, to appoint Dunstan in his room. The wise measures that made Edgar's reign so peaceful and prosperous was in great part due to the counsels of Dunstan. It was his policy to weld the Danes and the English into one nation, and his wise and liberal measures to this end were rewarded by the gratitude of the Danes. It is significant that Canute in 1017 ordered the universal observance of St Dunstan's mass-day. With Oswald, Archbishop of York, he solemnly crowned Edgar at Bath, on Whitsunday 973—a formal declaration of the unity of the kingdom. He was active in building churches, and sympathised heartily with the establishment of monastic life on the rigorous Benedictine rule. The secular clerks were turned out of the monasteries, but clerical celibacy was not made compulsory in any more direct manner than that a married priest lost the privilege of his order. Dunstan laboured to elevate the lives of the clergy, and make them the real teachers of the people in secular learning and skill in handicrafts, as well as in morals and religion. Himself a man of the severest purity of life, he was absolutely fearless in insisting upon the penances which he laid upon the great, but showed his wisdom in turning these into practical channels. He raised the social status of the clergy, and made obligatory the payment of tithes by landowners, while he did not entirely surrender the liberties of the church to Rome. Edgar's death in 975 opened up anew the struggle between the seculars and the monks, but Dunstan declared for Edward, elder son of the late king, and crowned him at Winchester. His triumph was complete, and the fall of the floor of the council-room at Calne (977), in which only his enemies were killed or injured, seemed to some like a divine judgment in his

favour. On Edward's murder in 978, the two archbishops crowned Ethelred king, whose hostility put an end to the great churchman's political career. Dunstan spent his later years at Canterbury, busily employed in the affairs of the church, in study, in private prayer, and the services of the church, varied with the handicraft of his earlier days. The memory of his gentleness and patience long survived him. He died in 988, and was buried near the altar of his church. His day is 19th May. See Bishop Stubbs' *Memorials of St Dunstan* (1875) in the Rolls Series, a collection of six early biographies of the saint.

Dunstanborough Castle, a picturesque ruin on the basaltic sea-cliffs of the Northumbrian coast, 8 miles NE. of Alnwick. Crystals of quartz found here are called Dunstanborough diamonds and amethysts.

Dunton, JOHN, bookseller, was born in 1659. Refusing to make the fourth in a direct line of clergymen, he was apprenticed to a London bookseller at fourteen, and managed to complete his time, and to acquire much varied knowledge, in spite of love, politics, and the thousand distractions incidental to a mind of such exceptional flightiness as his. He took a shop, married happily, made some lucky ventures, but was foolish enough to become security for the debts of some of his relatives, and had in consequence to fight a hard battle with financial troubles. He paid a visit to America, afterwards to Holland and Cologne, settled somehow with his creditors, and kept shop for ten years with fair prosperity, his *Athenian Gazette* being for a while especially successful. In 1692 he succeeded to a cousin's property, and became a freeman of the Stationers' Company. He married a second time unhappily, and under the real and imaginary troubles of his later years, his mind seems to have crossed the line between crackbrained flightiness and sheer lunacy. His extraordinary book, *Life and Errors of John Dunton*, appeared in 1705. Thereafter he wrote numerous papers and pamphlets, and died in 1733.

Dunwich, a village of 250 inhabitants, on the cliffs of the Suffolk coast, 4½ miles S. of Southwold. Made the episcopal see of the Anglic Southfolk in 630, it became a large and important place. Most of its ancient buildings have been swept away by the encroachment of the sea; in 1350 more than 400 were washed away at once. Dunwich sent two members to parliament till 1832, and till 1883 was a municipal borough.

Duodecimal Scale (Lat. *duodecim*, 'twelve') is the name given to the division of unity into twelve equal parts, as when the foot is divided into 12 inches, and the inch into 12 lines; or the pound is divided into 12 ounces. This plan of counting has some advantages, as 12 admits of so many divisions into equal parts—viz. by 2, 3, 4, and 6. But the decimal scale, or division into ten equal parts, is now universally recognised as preferable, from its coinciding with our decimal system of notation.—DUODECIMALS, a method of calculating the area of a rectangle when the length and breadth are stated in feet and inches.

Duodenum. See DIGESTION.

Dupanloup, FÉLIX ANTOINE PHILLIBERT, Bishop of Orleans, was born at St Félix, near Annecy in Savoy, 3d January 1802. He received priest's orders in 1825, and, after acting as tutor to the young Orleans princes, was appointed in 1837 superior of the Little Seminary in Paris. Here he had an opportunity of carrying out still further his favourite views as to education; and he remained fond of teaching even after his appointment as Bishop of Orleans in 1849. During the reign of Louis-Philippe he strove earnestly in behalf of freedom of education, and to secure tolerance for the Jesuits. The publication of the papal Encyclical and *Syllabus* in 1864, however, called forth from him *La Convention du 15 September et l'Encyclique du 8 Décember*, a pamphlet of which 34 editions had to be issued within a few weeks. In this little book, the eloquent bishop defends the temporal authority of the pope. Nevertheless he received with great reserve the first intimations of the pope's intention to summon a council for the purpose of proclaiming the dogma of papal infallibility; and after his arrival at Rome, to take part in the deliberations of the council, he protested openly against the doctrine; and when he found that all opposition was in vain, he left the Holy City on the evening prior to the promulgation of the decree by the council. Yet, once the dogma was published, he submitted to the will of the church, and signified his acceptance of it. In 1871 the bishop was elected deputy for Orleans to the new National Assembly, the only bishop who sat in it. From this time onwards to the date of his death, at Lacombe, near Lancey (Isère), 11th October 1879, he struggled manfully against the attacks which were being constantly made upon the church both in the Assembly and outside of it. He was nominated a senator in 1876, and from 1854 had been a member of the Institute. Of his numerous writings, it will suffice to mention two on education, his most important works—viz. *De l'Education* (1850; 10th ed. 1882), *De la Haute Education Intellectuelle* (3 vols. 1866); and the following: *Histoire de Jésus Christ* (1869), *Histoire de Madame Acarie* (1854), *Methode Générale du Catéchisme* (1841), and *Le Christianisme presenté aux Hommes du Monde* (1844). See *Life of Monseigneur Dupanloup*, by Lagrange, translated by Lady Herbert (Lond. 1885).

Dupin, FRANÇOIS-PIERRE-CHARLES, BARON, was born in 1784, and served as an engineer under the Empire. In 1816–19 he made several visits to England and Ireland; the results of his investigations appeared in his chief work, *Voyages dans la Grande Bretagne* (6 vols. Paris, 1820–24). He was made a baron in 1824, a peer in 1837, and filled several posts, which he resigned in 1852. He died in 1873. His elder brother, André (1783–1863), was a statesman and lawyer, the author of several important works on legal subjects, and 4 vols. of memoirs (1855–61).

Dupleix, JOSEPH FRANÇOIS, the celebrated governor of the French Indies, was born 1st January 1697, at Landrecies. At the age of eighteen he was sent to sea on board an East Indiaman, and in 1720 his father, a farmer-general of taxes, who was a shareholder in the French East India Company, had him appointed to a seat in the Council at Pondicherry, where he combined admirable official work with the amassing of wealth by legitimate trade speculations. Ten years later he became superintendent at Chandernagore in Bengal. The remarkable success of his administration here led to his being appointed, in 1741, governor-general of all the French Indies, with the title of Nawab. He now successfully pursued that policy of patient skilful diplomacy among the native princes, which at one time made the Carnatic almost a French province. His ostentation, the increase and discipline of his army, and his improvements in the defences of Pondicherry had already begun to alarm the English Company, when war broke out in Europe between France and England (1740). La Bourdonnais, the governor of Bourbon and the Isle of France, having sailed with a powerful squadron to the Coromandel coast, took Madras, but, without authority, and in considera-

tion of a bribe of £40,000 from the English Company, agreed to restore it to the English on payment of a ransom. This Dupleix refused to accede to, and violent disputes followed between the two governors, the result of which was that La Bourdonnais was recalled. Several brilliant engagements planned by Dupleix took place between the French garrison and the troops of the Nawab of the Carnatic, who endeavoured to take possession of Madras, but was precipitately forced to raise the siege. An attack on the English at Fort St David failed, but Dupleix's science and courage were eminently displayed in the defence of Pondicherry, which Admiral Boscawen in vain attacked for five weeks, with an apparently overwhelming force, but was forced to retire discomfited, although the defence was conducted by a civilian, unsupported by a single general of repute. The ambitious mind of Dupleix had long formed the project of founding a French empire in India on the ruins of the Mogul monarchy, and with this purpose he mixed ingeniously in all the intrigues of Southern and Central India, made himself master of the court of Hyderabad, and placed a creature of his own on the throne of the Carnatic, while he impressed the native imagination by adopting all the pomp and splendour of the Oriental. His military designs, however, able as they were, were frustrated by the energy and military genius of Clive and Lawrence; but the struggle continued until 1754, in which year Dupleix was recalled by Louis XV., who had patched up an agreement with England on the subject of the rival Indian companies, which was embodied in the futile Peace of Pondicherry, 1755. La Bourdonnais had actively laboured to disparage Dupleix, and the French Company had not seconded their governor's ambitious schemes, and refused to reimburse him for the vast sums he had spent out of his private fortune in carrying on the war. He died in poverty and neglect in 1763. See Hamont, *Dupleix d'après sa Correspondance inédite;* Owen, in *Eng. Hist. Rev.* (1886); Malleson, *French in India* (new ed. 1884); Rapson, *Struggle between England and France in India* (1887); Malleson, *Dupleix* (1890).

Duplicate Ratio. See PROPORTION.

Duplication of the Cube. See DOUBLING THE CUBE.

Düppel, or DYBBÖL, a village in the Prussian province of Sleswick-Holstein, 15 miles NE. of Flensburg. In 1848 its fortifications were stormed by the Germans; and again in 1864, by the Prussians, after a month's bombardment (April 18).

Dupuis, CHARLES FRANÇOIS, a distinguished French *savant*, was born in 1742, and already in 1766 was called to a chair of Rhetoric in Paris, where his acquaintance with Lalande introduced him to the study of mathematics and astronomy, and he was led to the thought of explaining mythology by means of astronomy. A work on this subject appeared in 1781. He was now appointed professor of Eloquence in the Collége de France, member of the Académie des Inscriptions, and during the Revolution, a member of the Convention, next of the Council of Five Hundred, and afterwards of the legislative body, of which he became president. He died in 1809. His great work, *Origine de tous les Cultes, ou Réligion Universelle* (1795, 10 vols.), was an extension of the memoir of 1781, and no doubt originated the famous commission afterwards appointed by Napoleon to explore Upper Egypt, which Dupuis had pointed out as the general source of southern mythology.

Dupuytren, GUILLAUME, BARON, a French surgeon, was born in 1777, and in 1812 was appointed professor of Clinical Surgery and surgeon-in-chief to the Hôtel-Dieu in Paris. He died in 1835. Keen in diagnosis, and firm of nerve, he invented many ingenious modes of operation and various surgical instruments.

Duquesne, ABRAHAM, MARQUIS, French naval officer, was born at Dieppe in 1610, and distinguished himself in 1637–43 in the war with Spain. During Louis XIV.'s minority he entered the Swedish service, and rose to the rank of vice-admiral. Returning to France, he reduced to submission Bordeaux, which had declared for the Fronde. He was successful in several engagements with De Ruyter and Van Tromp in 1672–73, and defeated the united fleets of Spain and Holland off Sicily in 1676, in an action in which De Ruyter fell. On the revocation of the Edict of Nantes, Duquesne was made the only Protestant excepted from the general decree of banishment. He died 2d February 1688. See Jal, *Duquesne et la Marine de son Temps* (1872).

Dura Den, between Cupar and St Andrews, in Fife, a small glen through which runs a tributary of the Eden, has become famous on account of the numerous and beautifully preserved fossil fish entombed in its yellow sandstone, which belongs to the upper beds of the Old Red Sandstone. See Dr Anderson's *Dura Den* (1859).

Dura Mater. See BRAIN, NERVOUS SYSTEM.

Duramen, or HEART-WOOD, in Botany, the inner and fully ripened wood of dicotyledonous trees. The division is often very marked between the *duramen* and the *Alburnum* (q.v.), or sap-wood, the former being more dense and compact, and also frequently of a darker colour, as most notably in ebony. As timber it is much more valuable and durable than the alburnum; hence this distinction is as well known to the carpenter or cabinetmaker as to the botanist. See TIMBER, WOOD.

Duran, EMILE AUGUSTE CAROLUS, painter, was born at Lille, 4th July 1837. In 1853 he began to study in Paris; in 1861 he went to Rome; and afterwards spent some time in Spain, where his style was powerfully influenced by Velasquez. For 'L'Assassiné' (1866) he gained his first medal; and in 1878 he exhibited his design—'Gloria Mariæ Medicis'—for a ceiling in the Luxembourg. Duran, however, is most widely known by portraiture, which is distinguished by great vigour, force of colouring, and power of direct realism. Among his portraits may be named those of Émile Girardin and Pasteur, and an equestrian one of Mdlle. Croizette. He is also a most successful teacher.

Durance, an unnavigable river of SE. France, rises in the department of the Hautes-Alpes, and joins the Rhone 3 miles below Avignon, after a course of 225 miles. An aqueduct from it, 51 miles long, supplies Marseilles with water, and irrigates 25,000 acres, otherwise parched.

Durand, MADAME. See GRÉVILLE (HENRY).

Durango (called also *Guadiana* and *Ciudad de Victoria*), a town of Mexico, on a dry plateau, 6700 feet above sea-level, 500 miles NW. of the city of Mexico. It is handsomely built, with a cathedral, a former Jesuit college, a theatre, and a mint, and has now tramways and telephones. Pop. 27,000. Area of state of Durango, 42,373 sq. m.; pop. (1882) 196,852.

Durazzo (Serb *Dratsch*, Albanian *Dúrresi*), a port of Turkish Albania, on the Adriatic, 50 miles S. of Scutari. It is a poor, decayed place, with 1200 inhabitants, and a ruined citadel; but the harbour, though sanding up, is the most important of Middle Albania.—Durazzo is the ancient *Epidamnos*, founded about 625 B.C. by Corcyræans and Corinthians. It became a great and populous city, but was much harassed by the party strifes, which ultimately led to the Peloponnesian

War (q.v.). Under the Romans it was called *Dyrrachium* (whence its modern name), and became the principal landing-place for those sailing from Brundusium in Italy to Greece; and the great military road to the Hellespont began here. The town is memorable for the battles of Cæsar and Pompey in 48 B.C.; but it attained its highest consequence about the end of the 4th century A.D., when it became the capital of the Byzantine province of New Epirus. After being possessed successively by the Ostrogoths, the Bulgarians, the Normans, and the Venetians, and destroyed by an earthquake in 1273, it was finally conquered by the Turks in 1501.

Durban, the seaport of the colony of Natal, is situated on the northern shore of a nearly land-locked tidal bay. The 30th degree of S. lat. passes about 6 miles to the south of the town, and the 31st degree of E. long. about 2 miles to the west. The population at the census taken in 1891 was 25,512, composed of Europeans (about 10,000) and natives and Indians. The climate, though hot in one or two summer months, is healthy and suitable for Europeans, the death-rate for 1887 being 17 per 1000. The town was laid out by the Dutch, who formed a republic in Natal before the British, under Sir Benjamin D'Urban, took the colony in 1842.

The public buildings include a capacious town-hall, museum, library, hotels, clubs, halls, theatre, &c. The streets, originally axle-deep in sand, are now hardened, and there are paved footpaths. The Town Gardens form a conspicuous open space in the middle of the town, and besides the Botanical Gardens, there are two public parks and a good racecourse. The residences of the inhabitants are chiefly situated on the Berea, a low range of hills overlooking the town. The town is well supplied with water from river water-works within 15 miles distance. The government railway to Pietermaritzburg and the interior starts from the landing-quay, and passes through the town. Four and a half miles of tramways are laid from the Point, as the port is called, along the main street and through the Berea. Heavy guns for the Bluff, a bold promontory at the southern entrance to the port, were made in 1888–89 at Lord Armstrong's works, Newcastle-on-Tyne. Durban has four volunteer corps—viz. mounted, infantry, artillery, and naval, with an aggregate strength of between 400 and 500 men and 8 guns. The port will be the entrepôt for coal from several interior parts of the colony. Large harbour works in course of construction during 1888–91 are designed to make the inner harbour (4700 acres) accessible at all times to vessels of the deepest draught. In the inner harbour the greatest depth, maintained by means of four dredgers, is 27 feet at low-water; at the outer end of the new breakwater the low-water depth is 32 feet. The gross tonnage of vessels which arrived at the port in 1888 was 362,237.

Durbar (Persian *darbár*, 'court,' 'audience'), a state reception of the Governor-general of India or one of the native princes. Specially memorable is the great durbar held by Lord Lytton at Delhi on 1st January 1877, when Queen Victoria was proclaimed Empress of India.

Düren (Roman *Marcodurum*), an ancient town of Rhenish Prussia, on the Roer, 18 miles E. of Aix-la-Chapelle. It has manufactures of cloth, iron and steel, paper, sugar, carpets, and beer. Pop. (1875) 14,542; (1885) 19,802; (1890) 21,731.

Dürer, ALBERT, the most celebrated artist of Germany, was born at Nuremberg, 21st May 1471. His father, a devout and excellent man, was a goldsmith, and he carefully trained his son, and instructed him in his own craft. But the youth showed greater inclination for painting, and in very early years had already attained considerable artistic skill, as is proved by such drawings as the portrait of himself at the age of thirteen, now in the Albertina Collection, Vienna. He was accordingly apprenticed to Michael Wolgemut, the best painter in the town at the time, and the chief illustrator of the famous Nuremberg Chronicle. After serving his time under this master, Dürer started on his travels in 1490; and there is reason to believe that he found his way to Italy and visited Venice. On his return his father arranged a marriage for him with Agnes Frey, the daughter of a Nuremberg merchant. It has been constantly asserted that the union was an unhappy one, but Thausing, Dürer's most accurate biographer, has shown reason for believing that the letter of Pirkheimer, written two years after the painter's death, upon which this statement is founded, should be received with great caution. Dürer now established himself in his native town; and, largely aided by such assistants as Hans Leonhard Schäufelein, Hans von Kulmbach, and Hans Baldung, he executed many paintings, among which the triptych in the Royal Gallery, Dresden, and the fine Paumgartner altar-piece in the Pinakothek, Munich, may be named. In 1498 he published his first great series of designs on wood, the illustrations of the Apocalypse, which, it seems to be now generally admitted, were, like the rest of Dürer's work of the kind, cut upon the block by a professional engraver. The copper-plates of this period include 'The Prodigal Son,' assigned to 1500; the 'Shield of the Death's Head' (1503); the 'Shield with the Lion and Cock,' assigned to the same year, and in technique one of his most accomplished engravings; and the 'Adam and Eve' (1504). In 1504 he completed his 'Adoration of the Kings,' begun in tempera and finished in oils, now in the Tribune, Florence; and the elaborate copper-plate of 'St Eustachius' probably dates from the same time.

In 1505 Dürer visited Venice, with the view of arresting the piracy of his works by Marc Antonio, who had copied, line for line upon copper, certain of his woodcuts of the 'Life of the Virgin,' which had been executed previous to this date, though the completed work was not issued till 1511. Here he produced the 'Feast of the Rose-garlands,' now in the monastery of Stradow, near Prague, of which he writes: 'I have also silenced the painters, who said I was a good engraver, but did not know how to manage colours. . . . There is not a better picture of the Virgin in the land.' On his return he painted his 'Adam and Eve' (1507), now in the Pitti, Florence; and his 'Assumption of the Virgin,' a work executed with unusual care and elaboration, as is indicated by the painter's correspondence, and proved by the very numerous studies for its various parts which still exist. The central portion of this altar-piece, executed entirely by his own hand, was destroyed by fire in 1674. It was followed in 1511 by the All Saints' picture, styled 'The Adoration of the Trinity,' in the Imperial Gallery, Vienna.

Dürer was much employed by the Emperor Maximilian I., of whom he executed several portraits, for whose prayer-book he designed a famous series of decorations, and in whose honour he drew the 'Triumphal Car' and the 'Triumphal Arch,' which were engraved on wood, the latter on ninety-two blocks, which when united form a surface 11 feet 3 inches by 10 feet wide—the largest known woodcut.

It was after the death of the emperor, and in order to recover sums due for his commissions, that the painter visited the Netherlands in 1520. His curious journal of the expedition has been preserved and published. At Antwerp he made the acquaintance of Erasmus, whose portrait he drew, and

afterwards engraved on copper, and he was present at the coronation of Charles V., who appointed him his court-painter; but among the swamps of Zealand he seems to have contracted a kind of low fever, and his health gradually failed, till he died at Nuremberg, 6th April 1528. During his later years the earnest and reverent-minded painter manifested great sympathy with the doctrines and progress of the Reformation; his journal in the Netherlands contains an impassioned outburst of grief, occasioned by the supposed death of Luther; and in 1526 he presented to the council of his native town a pair of companion panels, representing St John with St Peter, and St Paul with St Mark, inscribed with warning texts from Luther's translation of the Epistles.

Both upon technical and intellectual grounds Dürer ranks as the greatest of German artists; and his work is thoroughly national in character, fully expressive of all the homeliness and all the mysticism of the German nature. His paintings are distinguished by effective composition, careful manipulation, and forcible colouring; and that searching grasp of character and expression which renders his work in portraiture so valuable gives a sense of truth and reality to his subject-pictures also. His 'Four Apostles,' above referred to, and now at Munich, are interesting as exhibiting the final development of his pictorial style, being far broader in handling and larger in the disposition of the draperies than his earlier works. His masterly drawings and studies are very numerous, and are to be found in most public collections, those of the Albertina, in Vienna, and of the British Museum, London, being the richest. As an engraver on metal and a designer of woodcuts Dürer ranks even higher, and has certainly been more widely influential than as a painter. His work on copper and on wood is distinguished by the most unerring perception of the capabilities of his material, his metal-plates being executed with extreme finish and refinement, the burin being handled in a manner exceptionally free and painter-like; while his woodcuts are boldly drawn with a broad expressive line, such as could be easily followed by the engraver employed to cut the block. The most celebrated of his copper-plates, which number over 100, are those mentioned above; the 'Little Passion,' on copper (16 plates, 1508–13); 'St Jerome in his Study' (1514); and the 'Melancolia' (1514), and the 'Knight, Death, and the Devil' (1513)—two great imaginative designs, which are so filled with mysterious and poetic suggestiveness as to be susceptible of the most diverse interpretations. Dürer may also be regarded as the inventor of etching, as he produced several plates in which all the lines are bitten with acid, as well as others in which the process is used in preparation for work with the burin. His woodcuts are about 200 in number, including the 'Greater Passion,' 12 subjects; 'The Little Passion,' on wood, 37 subjects; 'The Apocalypse,' 16 subjects; and many single prints of religious, mythological, portrait, and heraldic designs. It has been asserted that Dürer executed several plastic works. The finest of these is the 'Birth of St John the Baptist,' a relief on soap-stone in the British Museum; but Thausing regards this and all similar works as spurious. Dürer was also author of various scientific writings, of which the *Instructions in Measurement* (1525), the *Treatise on Fortification* (1527), and the *Treatise on Human Proportion* (1528) are the most important. An English translation of his writings, abridged, was published in 1889 by W. M. Conway.

See Thausing's *Albert Dürer* (2d ed. 1884; trans. by Eaton, 1882), which superseded the Lives by W. B. Scott (1872) and Mrs. Heaton (1872); and the French work of Ephrussi (1882). Excellent reproductions of the complete series of his metal engravings have been published by Amand-Durand of Paris, and of his woodcuts of his 'Apocalypse' and 'Life of the Virgin,' by Van de Weijer of Utrecht. Thirty-three of the thirty-seven blocks of his 'Lesser Passion,' on wood, are preserved in the British Museum, and modern editions of these have been issued, from stereotypes, in 1844 and succeeding years.

Duress, in English law, is the plea of a man who has obliged himself to pay or perform, or who has committed a misdemeanour, under compulsion by restraint of liberty, or threat of loss of life and limb. In such cases he may plead to be held free of the consequences.

D'Urfey, THOMAS, dramatist and song-writer, was born at Exeter in 1653. Of Huguenot descent he was boisterous in his Protestantism all his life. Shackerley Marmion was his remote kinsman; a nearer one was Honoré d'Urfé (1568–1625), author of the famous romance of *Astrée*. He early became a busy playwright, his comedies especially being popular. Among these were *The Fond Husband, or the Plotting Sisters* (1676); *Madame Fickle, or the Witty False One* (1677); and *Sir Burnaby Whig, or No Wit like a Woman's* (1681). In 1683 he brought out his *New Collection of Songs and Poems*, which was followed by a long series of songs in volumes and sheets, which were finally in 1719 collected into an edition in five volumes, as *Wit and Mirth, or Pills to Purge Melancholy*, supplemented by a sixth volume in 1720 (repr. 1872). Meanwhile D'Urfey had been busy with a long series of plays, for the morals of which he suffered like the rest from the heavy hand of Jeremy Collier. He never married; and though he was not particularly profligate, his fortunes had declined as his comedies ceased to please. Charles II. had done him the honour to lean upon his shoulder, but does not seem to have put anything in his pocket; the good Queen Anne had paid him fifty guineas for his singing to her at supper. Tom D'Urfey, as he was called by everybody, was very popular with his contemporaries, and seems to have been a cheerful, kindly, and fairly worthy fellow, convivial but not dissipated in his habits, loving and dutiful to his mother, if the evidence of pious verses may be believed. Benefits in his behalf were promoted by Addison and Steele, and the former thus pleaded in his behalf: 'He has made the world merry, and I hope they will make him easy, as long as he stays among us. This I will take upon me to say, they cannot do a kindness to a more diverting companion, or a more cheerful, honest, good-natured man.' D'Urfey died 26th February 1723. See Mr Ebsworth's admirable article in volume xvi. (1888) of Leslie Stephen's *Dictionary of National Biography*.

Durga, the wife of Siva (q.v.).

Durham, a maritime county in the north-east of England, between Tyne and Tees. It has 32 miles of coast, generally low, but with some cliffs; area of land and water, 1012 sq. m., two-thirds being arable. The surface is hilly, and slopes to the east. In the west, which is waste but rich in minerals, are branches of the Pennine chain, rising in Kilhope Law, 2196 feet; Collier Law, 1678; and Pontop Pike, 1018. The two chief branches inclose the valley of the Wear, and send forth several parallel ranges, declining toward the coast, and inclosing many fertile tracts and sheltered valleys. The chief rivers are the Wear, Tyne, and Tees, navigable respectively for 12, 15, and 10 miles. The rocks are new red sandstone, magnesian limestone, millstone grit, carboniferous limestone, rich in lead; and coal-measures, forming the valuable Durham coalfield, 25 by 10 miles, with many

faults, and with about forty beds of coal, 3 to 10 feet thick. Basalt and greenstone trap dykes intersect the west part of Durham. The mineral products are coal, limestone, black marble, freestone, ironstone, firestone, slate, millstone, grindstone, iron pyrites, fluor-spar, zinc, and lead. The principal lead-mines are in Teesdale and Weardale. The annual value of the ore at the mines is over £80,000. Large furnaces for the production of iron are in operation in various parts of the county. Durham has the largest coal production of any county in England, the annual output being nearly 30,000,000 tons, and the number of persons employed above or below ground at the mines being over 100,000. The chief shipping ports are Stockton-on-Tees, South Shields, Sunderland, and Hartlepool. In the eastern districts it is intersected in all directions by railways. The soil is a clayey or dry loam. The chief crops are oats, wheat, barley, turnips, potatoes, and other green crops. The Teeswater or Holderness breed of cattle is famed for fattening, quantity of milk, and early maturity. The Durham horses are famed for draught and the saddle. Many sheep are pastured on the hills. There are manufactures of iron, coke, pottery, glass, alkalies and chemicals, and salt, and much shipbuilding at Jarrow, Sunderland, South Shields, Hartlepool, and Stockton. Coal is the chief export. Durham is one of the three counties palatine (see PALATINE) of England, the other two being Lancaster and Chester. It was the only county palatine in the hands of a subject, and belonged to the Bishop of Durham. By 6 and 7 Will. IV. c. 19, the palatine jurisdiction was separated from the bishopric, and vested in the crown. Till 1844 three wards adjoining Berwick formed a detached part of Durham; they were then incorporated with Northumberland. The county is divided into four wards. It contains 269 civil parishes, and is entirely in the diocese of Durham. Pop. (1801) 149,384; (1841) 307,963; (1861) 508,666; (1891) 1,016,449. The chief towns are Durham, the county town, Sunderland, Darlington, Gateshead, South Shields, Stockton, and Hartlepool. The county includes eight parliamentary divisions, each returning one member; and the following parliamentary boroughs: Sunderland, returning two members, and Darlington, Durham, Gateshead, Hartlepool, South Shields, and Stockton, each returning one. Durham has some ancient barrows, and has afforded many Roman antiquities, as altars, urns, and coins. There are extensive remains of Roman stations at Lanchester, Binchester, and Ebchester. Durham formed part of the Saxon kingdom of Northumbria (547–827). Subsequently it suffered severely from the incursions of the Scots. See R. Surtees, *History of the County of Durham* (4 vols. 1816–40); W. Fordyce, *History of the County of Durham* (2 vols. 1855–57); W. H. Smith, *Walks in Weardale* (1885).

Durham Cathedral.

Durham, a parliamentary and municipal borough, and ancient episcopal city, near the middle of Durham county, 12 miles S. of Newcastle, is built around a steep rocky hill 86 feet high, nearly encircled by the Wear. On the top of the hill are the cathedral and castle. Ancient walls partly inclose the hill, from which are fine views of the fertile wooded country around, and of the suburbs across the river. The chief manufactures are mustard, carpets, and iron. In the vicinity are coal-mines and coke-ovens. Pop. (1841) 14,151; (1891) 15,287. Formerly it sent two members to parliament, but in 1885 the number was reduced to one. Durham arose about the year 995, when Bishop Aldune brought hither St Cuthbert's bones from Ripon, and built a church to enshrine them. On the site of this church, Bishop William de Carilepho, about 1093, began the present cathedral, one of the noblest specimens of Norman architecture in the kingdom, alike from situation and from structure, that massive pile—'half church of God, half castle 'gainst the Scot.' To the main structure various additions continued to be made up till 1500; and the whole has on various occasions undergone extensive renovation. Its extreme length is 510 feet; length of the transept, 175 feet; height of the central tower, 214 feet; and height of the two western towers, 138 feet. The cathedral contains many old monuments. Here lie St Cuthbert (q.v.) and Bede's tomb. The castle, formerly the residence of the bishops of Durham, but now occupied by the university, was founded about 1072, by the Conqueror, in the Romanesque style, but it has received many alterations and additions. The dormitory of the monastery of Durham, now the new library of the cathedral, is one of the finest in England. The see extends over the county of Durham (Northumberland having been detached in 1882 to form the diocese of Newcastle); among the bishops of Durham have been Bek, Aungerville, Wolsey, Cosin, Butler, and Lightfoot. Two of the bridges over the Wear dated originally from the 12th century. Durham possesses seven parish churches, a town-hall, a miners' hall, large prison, grammar-school, diocesan training-colleges, and a school of art.

A college was founded in Oxford in 1290 by the prior and convent of Durham. It was abolished, however, at the dissolution of monastic houses in the reign of Henry VIII., and its endowments given to the dean and chapter of Durham. Under the Commonwealth, Cromwell instituted a college here, and endowed it with the sequestrated revenues of the dean and chapter, to whom, however,

these revenues again reverted at the Restoration, when Cromwell's college was suppressed. The present university of Durham was opened for students in 1833, under the provisions of an act of parliament, obtained by the dean and chapter during the previous year. A royal charter in 1837 empowered the university to bestow degrees. Licentiates in theology must be members of the Church of England; but otherwise subscription is not required from any member of the university. The Durham University comprises professorships in Divinity and Ecclesiastical History, Classical Literature, Hebrew, Mathematics and Astronomy, and Medicine, with lectureships in Hebrew, Classical Literature, and Mathematics, with several tutors and other teachers. It has two collegiate establishments—University College, and Bishop Hatfield's Hall. The Colleges of Medicine and of Physical Science at Newcastle-on-Tyne are affiliated with Durham University. See Murray's *Northern Cathedrals* (1869), and the Rev. J. L. Low's *Durham* (Dioc. Histories, 1881).

Durham, JAMES, a Covenanting minister, was born at Easter Powrie, in Forfar, in 1622, studied at St Andrews, fought as captain in the Civil War, and became a preacher in 1647. He was chaplain to Charles II. in 1650–51, and subsequently minister in Glasgow till his death, 25th June 1658. He left numerous sermons and several expository works, but is best known for his *Clavis Cantici, or an Exposition of the Song of Solomon* (1668).

Durham, JOHN GEORGE LAMBTON, EARL OF, an English statesman, was born, the descendant of an ancient county family, at Lambton Hall, Durham, on 12th April 1792. Of decided liberal sympathies, he was in 1813 returned for his native county, and though he did not speak on many questions, he took an active part in furthering all projects of a reforming tendency, even drawing up in 1821 a scheme for parliamentary reform much more advanced than that of 1832. In 1828 he was raised to the peerage, with the title of Baron Durham of the city of Durham. Under the administration of Lord Grey (1830) he held the office of Lord Privy Seal, and was one of the four persons who drew up the Reform Bill, and supported it in the House of Lords. He was not in cordial relations with his colleagues, and resigning his office on the plea of ill-health in 1833, was made an earl. For a time he was ambassador at St Petersburg. In 1838 he was appointed Governor-general of Canada, where, owing to the revolt of the French in Lower Canada, the constitution had been suspended. Lord Durham's measures were statesmanlike but dictatorial; and the House of Lords voted disapproval of some of his acts. Thereupon he took the extraordinary step of returning to England without either being recalled or obtaining the royal consent. Lord Durham's famous report on Canada (which, however, was mainly written by his secretary, Charles Buller, q.v.) anticipated many of the best features in the present Canadian constitution. He died at Cowes, Isle of Wight, 28th July 1840.

Durian, or DURION (*Durio zibethinus*), an Indian and Malayan fruit-tree of Malvaceous affinities, usually reckoned in the sub-order Bombaceæ. It is a lofty tree, with leaves resembling those of the cherry, and large bunches of pale-yellow flowers. The fruit is of the size of a man's head, roundish oblong, with a hard thick rind, covered with soft spines. The pulp is of a creamy consistence and delicious taste, but has a putrid smell which is at first very repulsive. Persons accustomed to it, however, universally regard the durian as one of the very finest fruits of the East. It contains ten or twelve seeds, as large as pigeons' eggs, which, when roasted, are not inferior to chestnuts. One tree yields about 200 durians in a year.

Dürkheim, a town of Rhenish Bavaria, 6 miles SW. of Mannheim, at the base of the Hardt Mountains, with mineral wells and salt-works. Pop. 6111.

Durlach, an old town of Baden, on the river Pfinz, at the base of the Thurmberg, 4 miles E. of Carlsruhe by rail. It manufactures linen, iron, sewing-machines, &c., and has extensive fruit and grain markets. Pop. 7655.

Durra (*Sorghum*), a genus of grasses, which is also called Durra Millet and Indian Millet, or Sorgho Grass. The genus is closely allied to sugar-cane (*Saccharum*) and Beard-grass (*Andropogon*). The species are generally annual, tall, broad-leaved grasses, having strong culms filled with a juicy and saccharine pith, and large panicles. Several of them are cultivated as corn-plants, chiefly in Asia and Africa, particularly the common durra (*S. vulgare—Holcus Sorghum* of the older botanists), also called Joar and Jowaree in India. It grows 4 to 8 feet high, with thickly crowded panicles. It is a coarse, strong grass; its grain is round, a little larger than mustard seed. It is a native of the East Indies, is extensively cultivated in Asia, and may perhaps be described as the principal corn-plant of Africa. It is also cultivated to a considerable extent in the south of Europe. It is sometimes cultivated in Germany, but the summer is not sufficiently long and warm to secure its perfection. The climate of Britain is still less suitable. Durra yields a very abundant produce, in this respect even rivalling maize, but the meal does not make good bread; it is excellent, however, instead of rice for puddings, and is prepared for food in various other ways. The culms and leaves, although coarse, are excellent food for horses and cattle, as is also the grain. In Armenia it is grown as fodder, and yields as many as seven or eight crops.—The seeds of the Shaloo or Sugar-grass (*S. saccharatum*) are more pleasant to the taste than those of the common durra. It is cultivated in the warm parts of Asia and in Africa, and has a diffuse and very spreading panicle. The sweet pith of the culm is eaten, and is also of value as a source of sugar, for which it is successfully cultivated in the United States (see SUGAR).—KAFIR CORN (*S. caffrorum*) is largely cultivated in South Africa, both by Kafirs and by the colonists; by the latter chiefly for feeding horses.—*S. halepense* is a troublesome weed in North Italy, like couch-grass. Its sweet rhizomes furnish a local substitute for sarsaparilla.

Dürrenstein, a village of Lower Austria, is situated in a highly picturesque locality, on the left bank of the Danube, 45 miles WNW. of Vienna. In its ruined castle, Richard Cœur-de-Lion was confined by Leopold of Austria for three months. Pop. 650.

Dursley, a town of Gloucestershire, amid picturesque scenery, near the Cotswold hills, 15 miles SW. of Gloucester by rail. Near it are quarries of Bath-stone. Pop. of parish, 2344.

Duruy, VICTOR, historian and educationist, was born in Paris, 11th September 1811. Destined for a designer in the Gobelins tapestry-works, he showed singular aptitude for learned studies, and, entering the École Normale in his nineteenth year, in 1833 became professor of History in the Collège Henri IV. From 1863 to 1869 he was Minister of Public Instruction, and as such carried out some important reforms, though his scheme for free and compulsory education was defeated by the clericals.

His numerous and important works, published between 1838 and 1879, include historical geographies of the Roman empire, of the middle ages, and of France, histories of France and Greece, and his *magnum opus*, the *Histoire des Romains jusqu'à la mort de Théodose* (Eng. trans. 6 vols. 1883–86). He became a Grand Officer of the Legion of Honour (1867), and a member of the Academy (1885). Died November 25, 1894.

Dussek (pronounced *Dushek*), JAN LADISLAW, composer and pianist, born 9th February 1761, at Czaslau in Bohemia, was trained at Iglau, Kuttenberg, and Prague, and afterwards was organist at Mechlin and Bergen-op-Zoom. At Amsterdam he met with much success, both as a teacher and performer, and here he produced his earliest works for the pianoforte; he afterwards resided at the Hague, and in Hamburg, Lithuania, Paris, Milan, and London (1788–1800), where he was very popular. In 1803–6 he lived as instructor and boon companion with Prince Louis Ferdinand of Prussia, whose death called forth the beautiful and pathetic 'Elégie Harmonique' (op. 61); in 1807 he entered the service of Prince Talleyrand, and thenceforward devoted most of his time to composition. He died at St Germain-en-Laye, 20th March 1812. To his contemporaries Dussek was the greatest of pianoforte specialists; there was a fascination in his style that raised him above even Clementi and Cramer. Of the seventy-seven numbered opus works, besides many without opus numbers, which he left behind, all, with few exceptions, were shortly forgotten.

Düsseldorf, the chief town of the populous district of Düsseldorf, in Rhenish Prussia, is situated on the right bank of the Rhine, at the influx of the Düssel, 24 miles NNW. of Cologne. It was formerly fortified, but its ramparts were converted into promenades in 1802, after the treaty of Lunéville. The streets, many of which are planted with rows of trees, are regular and spacious, while the eleven squares and the extensive garden-grounds in and near the town, are tastefully laid out and embellished with fountains and statues. Düsseldorf has recently considerably developed its trade and industries, but its chief importance is still as a centre of art. In the market-place rises a colossal equestrian statue of the Elector Johann Wilhelm, who founded a famous picture-gallery here in 1690, most of which, however, was removed to Munich in 1805. The Düsseldorf Academy was founded in 1767, reorganised in 1822, and attained great eminence during 1822–59, under the management of Cornelius and Schadow. Its reputation has again begun to revive. The present building, an imposing Renaissance edifice, with a façade 520 feet in length, was finished in 1879. The Art Hall (1881) contains a gallery of modern paintings. Among the other principal buildings are the old electoral palace (1710–1846; burned 1872); the present palace, the residence of the governor of the province; the government house, the observatory, town-hall (1567), theatre, gymnasium, and public library (50,000 vols.). Of the 25 churches the most remarkable are those of St Andrew, formerly the church of the Jesuits, a handsome and highly ornate structure completed in 1629, and St Lambert, dating from the 14th century. The Hofgarten is one of the finest public gardens in Germany. Adjoining it is the house and garden of the philosopher Jacobi, now the property of the famous 'Malkasten' club of artists. The iron (6000 hands) and cotton (2500 hands) industries of Düsseldorf are very important, and it has also manufactures of pianofortes, paper, soap, beer, chemicals, tobacco, chocolate, glass, &c., besides mills of all kinds, and photographic, lithographic, printing, and other institutions. Its rapidly growing commercial and industrial importance is fostered by its situation on the Rhine and at the junction of several railways. Düsseldorf is also an important educational centre. Pop. (1875) 80,750; (1890) 144,642, of whom 95,000 were Roman Catholics. Made a town by the Duke of Berg in 1288, Düsseldorf became the capital of the duchy in 1385; and in 1609 passed to the Palatinate. In 1806 it became the capital of the duchy of Berg, which was revived for a brief period by Napoleon, and in 1815 was united to Prussia. It was made a free port in 1829. The brothers Jacobi, Heine, Varnhagen von Ense, and the painters Cornelius and Peter von Hess, were born at Düsseldorf.

Dust is present in the atmosphere from various causes. The existence of dust in the air of a room or in a liquid is proved by the fact that we can trace the course of a beam of light through the air or the liquid by means of its partial reflection from suspended motes. The dust in the atmosphere is carried up in part from the earth's surface by currents of air, and in part by evaporation. A great part of it is due to volcanic action, and part also, the so-called 'cosmic dust,' has a meteoric origin (see METEORS). The blue colour of the sky is due to the reflection of light from particles of dust, possibly even from particles of air. Aitken has shown that no condensation of moisture (as in rain, mist, fog; see FOG) could occur without nuclei such as dust particles. He has also devised lately an apparatus for counting the number of dust particles in a given sample of air or gas.

Dust-brand. See SMUT.

Dusty-foot. See PIEPOWDER COURT.

Dutch is an English form corresponding to the German *Deutsch* (old *Diutisk*, 'belonging to the people'), which by them is used specifically for German, and in a wider sense is applied to all things belonging to the Teutonic (q.v.) stock (*Teutones* is from the same root), whether High German (*Hochdeutsch*) or Low German (*Niederdeutsch*), of which Plattdeutsch (q.v.) is a variety. Formerly *Dutch* and *Dutchland* were used in English for 'German' and 'Germany,' what is now called 'Dutch' being then 'Low Dutch;' but 'Dutch' has been long restricted in its reference to Holland and the things thereto pertaining. The people of Holland (who call themselves *Nederlandsch*) use their forms *Duitsch*, *Nederduitsch*, as the Germans do *Deutsch*, *Niederdeutsch*. For Dutch Language and Literature, see HOLLAND, Vol. V. p. 744.

Dutch Liquid is an oily substance obtained by mixing chlorine and olefiant gases, which combine together and yield Dutch liquid, with the formula $C_2H_4Cl_2$. It has a specific gravity of 1·271 (water = 1·000), boils at 185° (85° C), is not miscible with water, but readily dissolves in ether and alcohol. It produces Anæsthesia (q.v.), just as Chloroform (q.v.) does; but the great difficulty of preparing Dutch liquid in commercial quantities retards its employment as an anæsthetic.

Dutch Metal, sometimes called *Dutch gold* or *Dutch leaf*, is an alloy of copper and zinc. In other words, it is a kind of brass containing a large percentage of copper. It is made in the same manner as gold-leaf, and is said not to exceed $\frac{1}{2500}$ inch in thickness. Dutch leaf dissolves in strong nitric acid; true gold-leaf does not. The former is also easily tarnished. Ordinary Dutch metal is yellow, but a white kind is made, and both are used for coffin furniture.

Dutch Rushes. See HORSETAILS.

Dutens, LOUIS, a French writer, was born at Tours, 15th January 1730. A Protestant, he came to England, went as chaplain with the English

ambassador to the court of Turin as his secretary, and afterwards remained as *chargé-d'affaires*. He held a pension, in 1776 was presented to the rich living of Elsdon, in Northumberland, and was likewise made Historiographer Royal of Great Britain. He died 23d May 1812. He undertook the first comprehensive edition of Leibnitz's works (6 vols. Geneva, 1769), and wrote numerous books on the history of discoveries, English politics, theology, on numismatics and travels, as well as several volumes of poems.—His nephew, JOSEPH MICHEL DUTENS (1765–1848), wrote a *Philosophie de l'Économie Politique* (1835).

Duty. See CUSTOMS DUTIES, EXCISE, ETHICS.

Duval, CLAUDE, highwayman, was born at Domfront, Normandy, in 1643, and came to England at the Restoration, in the train of the Duke of Richmond. Taking soon to the road, he robbed many gentlemen of their purses, and ladies of their hearts, till, having been captured while drunk, he was hanged at Tyburn on 21st January 1670, and was buried in the mid aisle of Covent Garden church.

Dvořák (pronounced *Dvorzhak*), ANTONIN, the Bohemian composer, was born at Mühlhausen, near Kralup in the Prague district, on the 8th September 1841. He had more difficulties to overcome in his pursuit of education than the majority even of music's least favoured sons. His father was a butcher, and could ill afford to allow his son to indulge the tastes which a few lessons from a local musician had deeply implanted in the boy. At a great sacrifice, however, he sent his son in 1857 to Prague, which has since been the headquarters of his uneventful life. In 1873, after years of the dullest hack-work in café orchestras and as a church organist, he composed a hymn for chorus and organ which attracted attention. Attention begat ever-increasing interest, until two years afterwards the Austrian government conferred on him a *staats-stipendium* or annual allowance from the treasury. Brahms introduced his compositions to the musical public in Vienna; but the work which won for him the ear of all Europe was his *Stabat Mater*, which speedily became a favourite, especially in England, where it was first performed by the London Musical Society in 1883. This work rises above the strong influences of national feeling so generally found in Dvorák's writings into a more cosmopolitan atmosphere, and challenges comparison with the most universally accepted settings of the Latin hymn. Other compositions are songs, &c., very spontaneous and delicate (*Seven Gypsy Songs*, op. 55), and pianoforte compositions (*Dumka* or Elegy, *Furiante* or Bohemian Dances, *Slav Dances*), in all of which he has made very large use of national melodies and dance rhythms; also chamber music of great beauty (*E flat Quartette*, op. 51). His most ambitious work is orchestral (*Symphony in D*, op. 60) and choral. Of the latter, the *Spectre's Bride* (cantata written for the Birmingham Festival of 1885) is comparatively short, and full of that pulsing life which is characteristic of Dvorák's best manner. The *Stabat Mater* commands the admiration of all earnest musicians, and is probably his greatest work. *St Ludmila* (an oratorio written for the Leeds Festival, 1886) is very long and dreary. His efforts in the dramatic line are few and unfortunate. His opera *Der Bauer, ein Schelm*, had a short-lived existence; but his *Jacobin* (1889) was favourably received by good critics.

Dvorák is a prominent example of the eagerness with which a certain school turned to folk-song and national dance as a fountain of originality. So long accustomed to Teutonic inspiration, musical Europe gladly heard the new rhythms and strange harmonic effects of the Slav races. The characteristics of Dvorák's compositions are, first, the strong Czech element which pervades them, and displays itself in characteristic rhythmical effects and relations of tonalities, peculiar and indistinct to Western ears; secondly, the economical and often extremely clever use of small thematic material; and thirdly, the large amount of irrelevant 'padding,' which never rises to the level of Schubert's *Himmlische Länge*.

Dwale, an old name for deadly nightshade. See BELLADONNA.

Dwarf (A.S. *dweorg*, *dwerg*, or *dweorh*; cf. Icel. *dvergr*, Ger. *zwerg*) is a term applied to any organised being, but especially to the human species, whose height is much less than the average height of their race. The word is often restricted to those cases where there has been a uniform and general arrest of growth, except perhaps in the nervous system, which is often fully developed in dwarfs. See DEFORMITIES.

The ancients believed not only in dwarfs, but in nations of them. Aristotle declared that the report of trustworthy witnesses testified to the existence of a minute race of men, with minute horses, living in caves which are washed by the waters of the Nile; and Pliny gives details as to their habits and geographical position. There were also, according to later writers, pygmies (Gr. *pyx*, 'the fist') in Thule and beyond the Ganges. Greek fancy delighted to paint their Lilliputian dimensions: they cut down every corn-ear with axes; when Hercules came into their country, they climbed by help of ladders up to his goblet, to drink from it.

Of dwarf races of man, the most notable are the Bushmen (q.v.), 4 feet 7 inches high; the Akkas (q.v.) in Central Africa, about 4 feet 10 inches high, with whom Emin's men identified the hordes of forest dwarfs ('a venomous, cowardly, and thievish race, and very expert with their arrows') by whom Stanley's march in 1888 was so harassed; the Obongos on the Gaboon, and the still smaller Batwas, 4 feet 3 inches (see AFRICA); a tribe called M'Kabba, near Lake Ngami, reported as only 4 feet 1 inch; also the Andaman Islanders (under 5 feet), the Aetas in the Philippines, the Malayan Samangs, the Javan Kalangs. The Lapps, Ainos, Fuegians, and Veddahs are somewhat taller.

Dwarfs play a large part in the mythology of the ancient Germanic nations. They had their own kings, and dwelt in caves and rocky cavities in the interior of the earth, wherein are priceless treasures, metal, and wondrous works of art. It is they who forge for the gods their armour, who gave Odin his spear, and Thor his hammer Miölnir. Some of the attributes of the dwarfs are supposed to have been derived from an actual race of small stature—the Lapps, who occupied part of the Scandinavian peninsula before the immigration of the Gothic Scandinavian peoples (see SCANDINAVIAN MYTHOLOGY, and Grimm's *Deutsche Mythologie*). British tradition tells of a 'Tom Thumb' at King Arthur's court; and Gulliver's Lilliputians are amongst the most familiarly known of all dwarfs.

Dwarfs were not unfrequently retained as court favourites or toys down until the 18th century; more recently they have been popular as curiosities exhibited in shows. Of ancient dwarfs, Philetas of Cos, tutor of Ptolemy Philadelphus, was said to have worn weights in his pockets to keep him from being blown away, and a niece of Augustus had two dwarfs said to have been only 2 feet 4 inches. Gibson and his wife, dwarfs of Queen Henrietta Maria, had a united height of 7 feet 2 inches. Geoffrey Hudson (called Sir Geoffrey, and known to

as from *Peveril of the Peak*) was 3 feet 9 inches. 'Bébé,' dwarf of King Stanislaus of Poland, was only 23 inches in height, and died aged ninety in Paris in 1858. Count Borowlaski, a Pole of birth and accomplishments, was at thirty years of age but 3 feet 3 inches in height; he died in England in 1837. Charles Sherwood Stratton (1838–83), the American dwarf known as General Tom Thumb, was exhibited in England by Barnum in 1844. In 1863, when 31 inches in height, he married Lavinia Warren, aged twenty-one, and 32 inches in height. They, with their child and a dwarf called Commodore Nutt, visited England in 1864. The so-called 'Aztecs,' and Flynn, a New Yorker called General Mite, and only 21 inches high, are among dwarfs who have been exhibited in England. Jockeys are many of them practically dwarfs; and means are taken to keep down the stature of youths intended for this calling. Unlike giants, who are usually feeble in body and mind, ill-proportioned and short-lived, many of the notable dwarfs have been strong for their size, well-proportioned, active, lively, and intelligent. Some of them have spoken four or more languages. See E. J. Wood's *Giants and Dwarfs* (1868).

Dwarfed Trees, growing in flower-pots, are a characteristic ornament in Chinese and Japanese houses and gardens, and the production of them is an art which has been carried to great perfection. It depends on the prevention of an abundant flow of sap, so that whilst the tree is kept living and healthful, vegetation does not go on with its natural activity. The trees are planted in shallow and narrow flower-pots; care is taken that their roots never pass into the ground beneath; they are very sparingly supplied with water; their strongest and leading shoots are pinched off, and their branches are bent and twisted in various ways. A very extraordinary dwarfing is the result of these and other such processes; and the dwarfed trees not unfrequently abound in flowers and fruit.

Dwarka, a maritime town of Guzerat, India, on the west side of the peninsula of Kathiawar, in the dominion of Baroda, 235 miles SW. of Ahmedabad. On an eminence overhanging the seashore stands a great temple of Krishna, visited annually by 10,000 pilgrims. Pop. 5000.

Dwight, Dr Timothy, a well-known American theologian, was born at Northampton, in Massachusetts, May 14, 1752, grandson of Jonathan Edwards; he studied at Yale College, and was licensed to preach in 1777. During the War of Independence, he was for some time a chaplain in the Continental army. In 1783 he became minister of Greenfield Hill, in Connecticut, where he also conducted an academy for twelve years with distinguished success. The College of New Jersey conferred on him the degree of S.T.D. in 1787, and Harvard that of LL.D. in 1810; in 1795 he was elected president of Yale College and professor of Divinity. He died January 11, 1817. His principal work is his *Theology Explained and Defended in a series of 173 Sermons* (5 vols. Middletown, Conn. 1818), which has gone through a great number of editions both in America and in England. Among his other writings may be mentioned *The Conquest of Canaan* (1785), an ambitious epic poem, and *Travels in New England and New York* (4 vols. 1821), reckoned by Southey the most important of his works.—A grandson, a second Timothy Dwight, born in 1828, was in 1886 elected president of Yale University, and was a member of the American committee for the revision of the English version of the Bible.

Dwina, the name of two important rivers of Russia.—(1) The Northern Dwina has its origin in the confluence of the Suchona and the Jug, two streams rising in the south of the government of Vologda, and uniting in 60° 46′ N. lat., 46° 20′ E. long. The Dwina flows generally north-west through a flat country, to the Gulf of Archangel, which it enters by three principal mouths, of which only the easternmost is useful for navigation. The length of the Dwina is about 450 miles (with the Suchona, 760); its basin embraces over 140,000 sq. m. Its chief tributaries are, on the left, the Vaga and Emza, and on the right the Pinega and the Vytchegda, the last having a course of some 625 miles, 500 being navigable. The volume of water poured down by this main tributary increases the breadth of the Dwina from about one-third to nearly two-thirds of a mile; near Archangel it widens to over four miles. The river is free from ice from May to October, and is a valuable channel of inland trade. Its waters also are rich in fish.—(2) The Western Dwina (Ger. *Düna*) rises in the government of Tver, not far from the sources of the Volga and the Dnieper, and flows at first WSW. in a course almost parallel to the latter stream. From Vitebsk it flows WNW. to the Gulf of Riga, which it enters after a course of about 580 miles, navigable from the confluence of the Mezha downwards, although the numerous shallows and rapids greatly impede traffic. Its basin is estimated at 32,850 sq. m.; its average depth of 26 feet at Riga is increased to about 40, and its breadth of 1400–2400 feet is extended in some places to a mile during the heavy spring floods which overflow wide tracts of the low-lying lands on either bank. The Western Dwina is connected with the Dnieper, and so with the Black Sea by the Beresina Canal, and by other canal systems with the Caspian Sea, and with the Neva and Gulf of Finland, &c.

Dyaks, or Dayaks, is the Malay name for the race who constitute the bulk of the aboriginal population of Borneo, divided into innumerable tribes, differing pretty widely in language, customs, and degrees of savageness. Physically they closely resemble the Malays, to whom they are doubtless akin, but are somewhat taller; they are intelligent, hospitable, and unsuspicious, and greatly excel the Malays in truthfulness and honesty. Many of the dialects spoken by them are little known; but they seem all to fall into some five great geographical groups. The coast tribes have adopted many Malay words, and some have completely adopted the Malay speech. Even the most uncivilised tribes have many ingenious arts and industries, weave cloth, make excellent steel weapons, and erect most serviceable suspension bridges with bamboo poles and withes. Their chief weapon is the Blowpipe (q.v.), not the bow. The barbarous custom of systematic 'head-hunting' is dying out, though the heads of enemies are still cherished trophies of the warrior. The Sea-Dyaks were long famous as untamable pirates. See Borneo.

Dyce, Alexander, a great English critic, was born at Edinburgh, 30th June 1798. He spent part of his boyhood at Aberdeen, and had his education at the Edinburgh High School, and Exeter College, Oxford, where he graduated B.A. in 1819. He took orders, but soon abandoned the clerical calling to settle in London as a busy man of letters. His name will never be forgotten for the rare combination of learning, patience, and sagacity in his great editions of the dramatists, Peele (1828–39), Webster (1830; new ed. 1857), Greene (1831; in one vol. with Peele, 1858), Shirley (a completion of Gifford's ed. 1833), Middleton (1840), Beaumont and Fletcher (1843–46), Marlowe (1850; new ed. 1861), and Ford (a revised ed. of Gifford's, 1869). His edition of Shakespeare (9 vols. 1857; new ed. 1864–67) is not yet superseded. Besides these he edited between 1831 and 1835 the poems of Shake-

speare, Pope, Akenside, and Beattie, for Pickering's Aldine Edition of the Poets. Other works were his edition of Richard Bentley's works (1836–38), of Skelton's works (1843), and his *Recollections of the Table-talk of Samuel Rogers* (1856). He edited for the Camden, Percy, and Shakespeare societies, and was one of the severest assailants of Payne Collier's Shakespeare vagaries, an act of duty which ended an old friendship. Dyce died 15th May 1869, bequeathing his fine library to South Kensington Museum.

Dyce, WILLIAM, R.A., painter, was born at Aberdeen in 1806, and at 16 graduated M.A. of Marischal College. After acquiring the rudiments of his art-education he went in 1825 to Rome, where he developed a tendency towards early Italian or pre-Raphaelite art. In 1830 he settled in Edinburgh, where, besides painting portraits, he contributed largely to the exhibitions. In 1837 he was appointed master of the 'Trustees' Academy;' and eighteen months later he left for London, where he held various appointments in connection with the New School of Design at Somerset House. In 1844 he was appointed professor of Fine Arts in King's College, London. He was one of the artists selected to decorate the Palace of Westminster and the House of Lords, and at Osborne House several works in fresco were executed by him. Dyce was elected an A.R.A. in 1844, an R.A. in 1848. The following are some of the works he exhibited in the Royal Academy: 'King Joash shooting the Arrow of Deliverance,' a 'Madonna and Child' (1846), a 'Meeting of Jacob and Rachel' (1850), 'Christabel' (1855), 'The Good Shepherd' (1856), 'Neptune assigning to Britannia the Empire of the Sea'—a study for a fresco at Osborne (1857), 'St John leading Home his Adopted Mother,' 'The Man of Sorrows' (1860), and 'George Herbert at Bemerton' (1861). Dyce was a man of singularly wide culture, and an accomplished musician. In 1842–43 he published a sumptuous edition of the Prayer-book, with a dissertation on *Plain-chaunt*, and its use in the English service. He died at Streatham, 14th February 1864.

Dyck, SIR ANTHONY VAN. See VAN DYCK.

Dyeing is the art of imparting colours to textile and other materials, such as cotton, silk, wool, and leather. It has been practised among eastern nations from time immemorial; and in the Old Testament, we read of the purple-dyed vestments of the high-priests, of linen cloths dyed blue, purple, and scarlet, and of rams' skins dyed red. The famous Tyrian purple, obtained from one or two species of shell-fish, is believed to have been discovered by an inhabitant of Tyre fifteen hundred years B.C.; afterwards this purple became the badge of royalty, and cloth dyed with it commanded a princely price. Purple of various shades was dyed not only at Tyre, but at Tarsus, Alexandria, and other places on the shores of the Mediterranean, though other colours were of course employed. The Egyptians, Greeks, and Romans practised the art of dyeing. There is an ancient Roman dyer's workshop with its apparatus to be seen among the ruins of Pompeii. Gradually the art became more and more widespread as civilisation advanced. In earlier times, dyeing was much more extensively followed as a domestic art than it is at present, but in some outlying parts of Europe and even in the Highlands of Scotland, the colours imparted to home-made fabrics are still to some extent obtained from native vegetable dyes. Many of the ordinary dyestuffs and dyeing agents have been used in England for more than four centuries, and to these America added cochineal, as well as some important dyewoods and barks. Dyeing with colours obtained from natural products had reached a high state of perfection when Perkin, in 1856, introduced the first of the coal-tar colours. Since that date the progress of artificial colour making has been so rapid, and the application of the new dyes made so simple, that it now seems doubtful whether many of the older dyestuffs and processes can continue much longer in use. The experience acquired in dyeing with any colouring material must not be undervalued on account of its partial disuse; and some illustrations, though of less practical importance than they were lately, may here be given, in describing the general principles of dyeing.

Assuming that the textile material has been subjected to the cleansing and whitening operations described under BLEACHING; that the water is soft and clear, and the vessels free from rust and perfectly clean, the next point to consider is the nature of the fibre. Very often if this is of animal origin, such as silk or wool, a simple immersion in a bath containing the colour will dye the fabric; but colour so applied to a vegetable substance as cotton, linen, or jute, would be easily washed away. The fibre in the latter case requires some special preparation to make the dye adhere, and a mordant is employed for this purpose (see CALICO-PRINTING). Mordants are usually mineral salts applied to the yarn or cloth, so as to leave their bases in intimate contact with the fibre. A class of mineral colours may be first described, as their production depends on simple reactions similar to those occurring in the use of mordants. One of these colours, chrome yellow, has been already noticed under CALICO-PRINTING. They are the result of an interchange of the bases and acids of two soluble salts in the material of the fibre, one of the new salts being soluble and readily washed out, the other insoluble and the substance having the colour.

Prussian Blue (q.v.) may be taken as an instance of this mode of dyeing. A bath to dye 7 lb. of silk is made up as follows: 10 gallons water; 24 oz. nitrate of iron solution, specific gravity 1·6; 4 oz. stannous chloride. And another bath with 10 gallons water; 6 oz. yellow prussiate of potash; 3 oz. sulphuric acid. The first bath has a temperature of 130° F. The silk is turned through it till it is thoroughly penetrated with the liquor, then washed, and transferred to the second bath, which is also warm. The silk, without washing, is returned to the first bath, after which it is again washed and placed in the second bath. The first bath is now strengthened with 6 oz. of nitrate of iron and 2 oz. of stannous chloride, and the second bath with 3 oz. of sulphuric acid and 2 oz. of yellow prussiate of potash. Once more the silk is returned to the first bath, washed, and transferred to the second bath. After this steep, it is wrung out and left for six hours, when it is washed, raised, and dried in the air.

There are several things to be learned from this process. (1) The solutions must be dilute; (2) several operations are required to get an equal shade; (3) an acid solution is necessary to prevent iron oxide from depositing on the cloth, and this is made more certain by strengthening it in the last dipping; and (4) time is given for any action of the air before the final washing is given to the dyed silk. These or similar matters require attention in dyeing generally.

Buff is produced on cotton by a bath of nitrate of iron, followed by one of dilute and clear lime-water, washing and drying. In this case peroxide of iron is left in the fibre, and forms the colouring material; the nitrate of lime being readily soluble in water, washes out. This is an instance, however, in which the cloth has been mordanted as well as dyed, and if we wish to give it, say, a black or dark purple

colour, it only requires to be immersed in a bath of logwood.

Supposing that in place of nitrate of iron we had used a solution of alum or other soluble salt of alumina, as the sulphate (alum cake) or acetate (red liquor), we should have had the hydrate of alumina deposited in the fibre. As, however, this is simply white, the appearance of the cloth would not have altered; but if placed in a logwood bath, a pink or red colour would be the result, the tint and depth varying with the strength of the solutions. In such a case the cloth is dyed with an aluminous mordant.

The mordants most largely used are the salts of iron, alumina, and tin. Acetates and sulphates of both oxides of iron, as well as of alumina, and the two chlorides of tin and stannate of soda, form the greater portion of the materials employed. The method of using the acetates of iron and alumina as mordants has been given in CALICO-PRINTING. Suppose that cloth is impregnated with acetate of iron, which is a combination of the peroxide of iron with acetic acid. This oxide is a feeble base, and the acid is volatile. Consequently, when the cloth is placed in a hot chamber filled with moist air, the acetic acid is expelled, and the oxide of iron is left in the fibre, which is what the dyer requires. The application of the acetate of alumina as a mordant is explained in the same way.

In the case of salts with non-volatile acids (nitrate of iron or sulphate of alumina, for example), lime-water, caustic soda, carbonate of soda, or similar bodies are used to precipitate the mordants in the material to be dyed, as in the instances given above. But in some kinds of dyeing the assistance of an alkali is not necessary to decompose the salt, as merely boiling it with the fibre is sufficient to separate the base and liberate the acid, the cloth retaining the former, and the latter adding to the acidity of the bath. If fresh alumina were added to the bath to combine with the liberated acid, the process could go on indefinitely, but when a certain amount of free acid has accumulated, the fibre ceases to effect the decomposition of the salt. In practice this is not the method followed, but a potash salt of an organic acid is added to the bath, the potash of which neutralises the strong mineral acid; the weaker organic acid being set free, which has not the same power of preventing the absorption of alumina by the fibre. Tartar or argol (impure acid tartrate of potash) is much used along with alum for wool-mordanting, and also in silk-dyeing with tin mordants.

Several salts of tin are much used as mordants—the most important being stannous chloride or muriate of tin—also called 'tin salts' and 'tin crystals.' Stannic chloride or perchloride of tin is likewise used, and a solution of the metal in hydrochloric and nitric acids, called 'tin spirits' and 'oxymuriate of tin,' is in general use. The latter is a mixture of stannous and stannic salts, and requires very great care in its preparation. The salts of tin are decomposed readily by the fibre, and the tin spirits require to be used when freshly made, as deposits soon appear in the solutions. Stannate of soda is also much employed in dyeing. When the fibre is charged with it, the insoluble stannic acid is liberated with dilute sulphuric acid.

The mordants mentioned above are employed chiefly in cotton-dyeing with the vegetable dyes or the similar artificial alizarin colours. Wool and silk are not usually mordanted in the manner described, and the following observations apply to cotton and other vegetable fibre. The dye-baths or 'dye-becks' have been noticed in CALICO-PRINTING. Often, in dyeing, copper boilers are used with an ordinary fireplace for heating them. The dyestuffs are used either in powder or raspings among the water, or their extracts are employed. The dye solutions are generally warm or boiling, and the goods immersed in them require to be kept in constant motion, or nearly so, to insure uniformity of absorption.

Dyeing of Cotton.—The following is a brief outline of the processes in use for a few important colours:

Black is produced by steeping the goods in a decoction of sumac; then passing them through a solution of acetate of iron. After washing, they are next passed through a decoction of logwood.

Brown is usually obtained by passing the cloth through a decoction of cutch or Catechu (q.v.), and afterwards through a solution of bichromate of potash. Logwood, fustic, or any of the red colouring stuffs, can be afterwards added according to the shade of brown wanted.

Purples and lilacs are got from logwood and alizarin with mixtures of iron and alumina. With madder colours, reds and pinks are got by the use of alumina and tin.

Reds are also got from various dyewoods, as sappan-wood, peachwood, barwood, &c., with tin or alumina, the cloth being first soaked in an astringent, as sumac or gall-nuts. The coal-tar colours, safranine, &c., have almost entirely superseded these woods in the dyeing of reds.

Yellow is got from fustic, quercitron bark, Persian berries, &c., with tin or alumina mordants. Better shades of yellow are now, however, produced by auramine and other coal-tar dyes. Blue colours are not obtained from the natural dyeing materials with the usual mordants, and green is produced by dyeing a yellow such as fustic over cloth already rendered blue.

The production of Prussian blue on silk has been fully given, and the same method is applicable to cotton. For the dyeing of indigo blue, see CALICO-PRINTING.

Turkey-red is a very bright and permanent colour on cotton, obtained till recently from madder, but now almost entirely from alizarin, by a special process in the treatment. An oil mordant, as it is termed, is employed in combination with the fibre. Formerly a coarse olive-oil was made into an emulsion with a weak solution of crude pearl-ashes, through which the cloth was passed, then wrung out and hung up in a stove. The oil absorbs oxygen, and thickens into a varnish containing free fatty acids. The operation was repeated six or eight times. A Turkey-red oil is now sold which is chiefly the oleic acid of castor-oil in combination with ammonia or soda, and of this oil the cloth requires only one or two applications. The cloth is also mordanted with alumina as usual, and then passed into the dye-bath, which is gradually raised to boiling. The bath may be charged with ground madder, natural alizarin, or the artificial product, and generally sumac or some substance containing tannin is added. The goods are brightened by boiling in soap solution, and finally in a bath of tin spirits.

In dyeing cotton with coal-tar colours (with the exception of the azo group), the goods are first mordanted by passing them through a solution of tannic acid, and then through one of tartar emetic; or they are first passed through a decoction of sumac, and afterwards through a solution of stannate of soda. The goods are usually put into the dye-beck in a cold state, and gradually raised to a heat of about 120° F. as the dyeing proceeds. With the azo group of colours (see below) no previous mordanting is required, but a little sulphate of soda or common salt is added to the dye-beck to make the colour go on more evenly. These azo colours are dyed at a boiling heat. The reds of this group are not very satisfactory on cotton.

Aniline black is produced on cotton yarn directly by the oxidation of aniline with bichromate of potash and hydrochloric acid.

Dyeing of Wool.—This fibre absorbs both colours and mordants so much more readily than cotton, that for the most part the methods of dyeing it differ from those that have been described. Sulphuric acid has little action on wool as compared with cotton, consequently many operations in wool-dyeing are conducted in acid solutions at high temperatures, where cotton would be destroyed. An instance of producing a Prussian blue on worsteds may be given: 'Worsted, 100 lb. Make cold solutions of 9 lb. red prussiate of potash, 2½ lb. tartaric acid, 2½ lb. oxalic acid, and 2 lb. tin composition. Pour these together and add the mixture so produced to about 300 gallons of water at 100° F., and further add 12 lb. good oil of vitriol. Enter the goods, turn well, heat up slowly to the boiling-point, and boil for half an hour.'

Here it will be seen no salt with an iron base is present to form a Prussian blue, and consequently this constituent must be got from the decomposition of the red prussiate by the oil of vitriol, the wool absorbing the colour as it is formed. A blue produced in the way already given for silk would be comparatively cheap, but none of the mineral colours obtained by the mutual interchange of acids and bases in the fibre are successful with wool. Wool is dyed to a much larger extent than either cotton or silk with dark colours, and for these logwood and the astringent dyes catechu, nut-galls, sumac, &c., are chiefly used along with indigo, alizarin, and fustic for special shades. The wool is first, as a rule, boiled with bichromate of potash, sulphate of copper, and oil of vitriol, then with the dyes—for instance: 'Black. For 55 lb. wool. Boil with 17 oz. each chromate, bluestone, and oil of vitriol for 1½ hour. Dye in 22 lb. logwood and 4 lb. fustic, boiling 1 hour.' Sometimes the chromate is mixed with tartar for the first treatment of the wool, with or without sulphuric acid. Woaded blacks are the best for woollen cloths. By this method the wool or cloth is first dyed in the indigo vat a light or medium shade. It is then dyed a chrome black by a process the same or similar to that just given in which bichromate of potash and logwood are the chief ingredients used.

Generally when dyes on wool are required to stand milling (see under WOOL, Vol. X. p. 730), the goods are first mordanted by boiling them for an hour in a solution of bichromate of potash and tartar. Brown, olive, drab, and similar colours are dyed with madder or alizarin, camwood, fustic, and logwood, in proportions varying with the shade required.

Until quite recently, the most important of the materials for dyeing wool, next to indigo, was cochineal. It gives with tin and alumina mordants very brilliant pinks, crimsons, and scarlets. To produce scarlet the cloth is boiled in tin spirits—generally with addition of cream of tartar—until mordanted with stannic oxide, then washed and boiled in the ground cochineal till the solution gets colourless, that is, till all the dye is absorbed. A second boiling is given with cochineal mixed with a little more mordant and tartar. Benzidine reds are now replacing cochineal.

With coal-tar dyes almost every conceivable colour can be obtained on wool. In most cases it is only necessary to add a little sulphate of soda and sulphuric acid to the dye-beck, no previous mordanting being necessary. Tin spirits and tartar brighten a number of the colours.

In dyeing wool, alizarin blue solution is said to give beautiful deep blue shades, as fast as indigo to light and milling, and is regarded as a great success as a substitute for the natural dyeware; artificial indigo is as yet too expensive a competitor.

Silk, when dyed dark colours, may be used without the same bleaching operations for the removal of the gum, required for brighter tints. The dyes and mordants for these are much the same as for wool, but the baths are usually hot soap solutions containing the dyes. Cochineal gives a poppy red with a tin or alumina mordant, and annotto in alkaline solution an orange yellow with the latter. Archil and safflower give violets and pinks without a mordant, but they are fugitive.

Silk is dyed with the coal-tar colours by a simple immersion in a solution in water or, if necessary, in spirit. Usually the soap solution of the silk gum is taken, and the colour brightened by rinsing in acetic acid. For the oxyazo dyes sulphuric acid is added to the bath.

DYESTUFFS.—The principles of the art of dyeing being already stated under the head of DYEING, it is only necessary to notice here, in the first place, the more important of the older dyestuffs of commerce, and then to give some account of the remarkable group of artificial dyes known as the 'coal-tar colours.' The first of these was introduced in 1856, and the number of them now in use is considerable. Still many of the older colouring materials to a large extent hold their ground, and it is by no means certain that they will ever be entirely displaced by purely chemically prepared dyes. Natural dyestuffs are chiefly products of the vegetable and animal kingdoms.

Vegetable dyes are obtained from all parts of plants, such as the roots, the wood, the bark, the leaves, the flowers, and the seeds or fruits. That is to say, of certain plants one or other of these is the dye-yielding part, but sometimes the whole plant is employed. The number of plants which yield colouring materials such as could be applied in the tinctorial arts is very great, and if we include those employed by savage races, the number of these dyestuffs actually used is still large. Those, however, which are well known are not very numerous. A fuller account of a few of the more important of those noticed below is given under their separate heads.

Madder (q.v.), from the root of *Rubia tinctorum*, has been used for dyeing red and for producing, along with other dyes and with certain mordants, compound colours since ancient times. Until the discovery of a process of making artificial *Alizarin* (q.v.)—the chief colouring principle of madder—it was largely cultivated in the Levant. Madder, and not artificial alizarin, is still used for dyeing calico in Persia and some parts of India, but a comparatively small quantity is now brought to western Europe. There are other two species of Rubia yielding dyes somewhat resembling madder which are employed in India. These are *R. cordifolia* and *R. sikkimensis*, the dye from the former being called 'manjit' or Indian madder.

Garancine is a red dyestuff prepared by treating spent madder with sulphuric acid. It is of less importance now than formerly.

Safflower, from the flower-heads of *Carthamus tinctorius*, yields both a red and a yellow dye, but it is only the former that is useful. The red, or rather pink, is a beautiful, though not a permanent, colour applied to the dyeing of silk, and more sparingly to cotton. It is a costly material, and before the introduction of aniline colours, the cultivation of safflower was an important industry in India.

Brazil-wood (q.v.), obtained from one or more species of Cæsalpinia, according to some authorities from *C. braziliensis*, according to others from *C. echinata*. Peachwood and Lima-wood are probably mere varieties, and the colouring matter from all three is supposed to be identical. These red-woods,

as they are called, are chiefly used for cheap calico prints, and to some extent for dyeing silk.

Archil (q.v.) and *Cudbear* (q.v.) are dyes prepared from lichens. The colouring principle in each appears to be the same, and in fact there is no essential difference between the two stuffs. Archil is of a purple colour, and is most useful, along with other colouring matters, in the dyeing of wool various shades of brown and chocolate.

Panama Crimson.—This dye is used by the natives of the Isthmus of Panama for dyeing their straw-hats a fine crimson tint, which is said to withstand in a remarkable manner the action of sun and rain. It is obtained from a vine, but is scarcely known in commerce.

Chrysammic acid is a dye obtained by treating Aloes (q.v.) with nitric acid. From it a purple can be obtained on silk, black on wool, and pink on linen. It can be used with advantage along with aniline dyes.

Barwood and *Camwood* (q.v.), which are produced by the same tree, are employed in the ground state along with proper mordants for dyeing wool quiet reds and reddish browns; also for producing an imitation of Turkey-red on cotton. On wool the colours are permanent, but the dye on cotton is less so.

Quercitron.—From the bark of *Quercus tinctoria* a useful yellow dye is obtained. An extract of this bark called 'flavine' is used by woollen-dyers. Quercitron bark is most largely used as the yellow part in compound colours.

Fustic (q.v.).—There are two dyestuffs called by this name; the one is 'young fustic,' and the other 'old fustic.' The latter is the produce of *Morus tinctoria*, a large tree growing in Central America, and is the more important. The wood of this tree is ground, or an extract of it is made, and used like quercitron bark in the dyeing of compound colours on wool and cotton, for which it furnishes the yellow part.

Persian Berries, the fruit of *Rhamnus infectorius*, and perhaps other species. They are known also as Yellow Berries, French Berries, and Turkish Berries. The fruit is not much larger than a pea. The dye is employed for wool, but most largely in the printing of calico as the yellow part in such colours as green or orange. A decoction of the berries is made. The colour obtained is bright, but not very permanent.

Turmeric, the root of *Curcuma longa*, a plant largely cultivated in South Asia. It is rich in yellow colouring matter, which is, however, very fugitive. It is one of the few dyes which will fix itself on vegetable fibre without the help of mordants. Turmeric is largely used for colouring test-paper for chemical purposes, but its use as dye for textiles is falling off.

Annatto or *Arnotto* (q.v.), a preparation from the seeds of *Bixa orellana*. It produces a buff colour upon cotton, and a flesh colour upon silk, no mordants being required. The colours obtained from this dye are fugitive. The chief use of it is to improve the appearance of other dyed colours.

Indigo (q.v.) is obtained from two or three species of Indigofera, chiefly *I. tinctoria*. The indigo-plant is found wild over most parts of India, but generally near places where it has been cultivated. In that country the plant is extensively grown, there being two sowings in the year. It is cut just as the flowers begin to appear. The process of extracting the dye consists in steeping the plant for twelve hours, or rather more, in a vat with water, after which it is transferred to another vat where men agitate the liquid with sticks, thereby effecting the oxidation of the green colouring matter into blue particles of indigotin, which settle down as a sediment. This is next boiled for five hours and repeatedly passed through a strainer, by which the dye-particles are separated. After drying, the dye is pressed into slabs 3½ inches thick, from which the cubes of commerce are cut. For other plants from which indigo can be obtained, see INDIGO. This dye is one of the oldest known, and is still largely used for the dyeing of wool and cotton. See CALICO-PRINTING.

Woad.—This is believed to be the blue dye with which the ancient Britons stained or coloured their skins. It is obtained from the leaves of the cruciferous plant *Isatis tinctoria*, which has been long cultivated in Great Britain. In England woad is still used along with indigo in the dyeing of wool, but it is no longer employed in France or Germany.

Logwood (q.v.).—This well-known dyestuff consists of the heart-wood of *Hæmatoxylon campechianum*, a tree indigenous to Central America. Applied in small quantity to textile materials, the colour which logwood gives to them is a fugitive blue. At some places on the Continent it is used along with a mordant containing a large proportion of alum to dye wool a blue colour. It is employed to some extent as the blue part of compound colours in the dyeing of cotton, but the chief use of logwood is in the production of different shades of black on cotton and wool, for which suitable mordants are necessary. This dye stands best when applied in large quantities for dark colours.

The following vegetable dyes are of some importance in India, a few of them being also used in Europe: Sappan-wood (*Cæsalpinia Sappan*) yields a red colour; Sanders-wood (*Pterocarpus santalinus*), a pink; Catechu (q.v.) (an extract of *Acacia Catechu*), browns, drabs, and grays; the roots of *Morinda citrifolia*, a useful red; the twigs of *Strobilanthes flaccidifolius*, Assam indigo; the fruit-rind of the pomegranate (*Punica granatum*), a yellow; and the powder called 'kamala,' from the fruit of *Mallotus philippinensis* (otherwise called *Rottlera tinctoria*).

Several plants, either indigenous or naturalised, in Great Britain yield dyes. Among others, weld, the stalks of *Reseda luteola*, was used for dyeing yellow up to recent times. Dyer's Broom (*Genista tinctoria*) also yields a yellow colouring matter. From *Rhamnus catharticus* and *R. frangula* green and yellow dyes are obtained. The cultivation of the common yellow bedstraw (*Galium verum*) for red and yellow dyestuffs was at one time attempted.

The following are the chief dyes derived from animal substances:

Cochineal (q.v.), obtained from the insect *Coccus cacti*, is the most important red colouring matter for animal fibres. See above.

Kermes.—A colouring matter which, though not obtained from the same insect, is identical with cochineal. Several species of Coccus, of which the most common is *C. ilicis*, yield kermes. This dyestuff is chiefly employed for dyeing woollens and leather in the countries of which the insect is a native—viz. Spain, Turkey, Morocco, and the south of France.

Lac-dye.—In the washing of stick-lac (see LAC), the colouring matter secreted by the lac insect (*Coccus lacca*) is dissolved in the water, and recovered by boiling down the washings. The red dye is then made up in the form of small cakes. Lac-dye usually produces duller red colours than cochineal, but from a pure extract of it the same, or very similar, colours are obtained. It is still used as a dye in India, but very little now in Europe.

Murexide.—This beautiful and delicate purple dye, prepared by the action of dilute nitric acid upon uric acid and treatment of the product with

ammonia, was largely used in 1855 and 1856 for dyeing wool and silk, and for printing upon calico. The uric acid required for its production was got from guano. Murexide had only been tried for a year or two when its manufacture was rendered unprofitable by the introduction of aniline colours.

The only mineral dyes of much importance are *Prussian Blue* (q.v.) and *Chrome Yellow* (see CHROMIUM). The method of producing the former is given on page 136, and the latter under CALICO-PRINTING, where the purely pigment colours applied to cotton cloth, such as artificial ultramarine, are likewise noticed.

Coal-tar Colours.—The dyes now manufactured from products obtained in the distillation of coal-tar are extremely numerous, and new ones are daily added to the list. With the exception of anthracene, from which artificial alizarin is prepared, the raw materials chiefly used are the naphtha or benzene and carbolic acid; naphthalene, a crystalline solid body, has lately been coming much into use as well, more especially for dyes competing with cochineal. These substances, although not constituting a large percentage of the tar, are more than sufficient in amount for any supply that could be required, the quantity of tar from the gas-works in Great Britain alone being nearly half a million tons per annum. The total annual value of these colours produced in England, Germany, and France is about £4,000,000.

The rapid development of this industry is the result of the progress of organic chemistry, and these dyes can only be understood and classified from a chemical point of view. Leaving out artificial alizarin and indigo at present, these colours may be arranged in three divisions: (1) *Aniline Dyes.*—These are compound amines, bodies of the nature of bases. (2) *Phenol Dyes.*—These are derivatives of carbolic acid or phenol and similar chemical bodies, and have more or less acid properties. (3) *Azo Dyes.*—These are bodies containing azote or nitrogen connecting two groups, and may be neutral, but the groups may also be either of a basic or acid nature.

1. *Aniline Dyes.*—The preparation and properties of aniline have been described under that head. A base of the same series, toluidine, and another from naphthalene, are used along with it for certain colours. The method of preparation for all these bodies is nearly alike—viz. by the action of nascent hydrogen on the requisite nitro-compound and distillation of the product with soda. Iron filings and hydrochloric acid are generally taken to obtain the hydrogen.

When a mixture of aniline and toluidine is heated with arsenic acid for several hours to a temperature of about 380° F., a mass is left from which rosaniline is separated, the compounds of which chiefly form the aniline dyes. Stannic chloride can be used in place of arsenic acid, but the latter gives better results; careful attention is required in the separation of arsenic from the dyes. The residue after cooling is powdered and treated with boiling water, which dissolves arseniate and arsenite of rosaniline, and leaves a residue containing other colouring matters. When the solution has common salt mixed with it, double decomposition takes place, and the arsenical salts remain in solution, while rosaniline as hydrochloride is precipitated. This substance is not insoluble in water, but in water containing salt it is precipitated or 'salted out.'

The mixture of bases treated, called 'aniline oil,' combine with oxygen from the arsenic acid, which removes hydrogen in the form of water, the residues coalescing into the more complex molecule of the colouring matter. Another process—the one now chiefly used—for the preparation of rosaniline is heating aniline with nitrobenzine, protochloride of iron, and iron filings; in this case the oxygen is derived from the nitrobenzene. The residue is treated as in the previous process. The product is purified by crystallisation from water, and the hydrochloride of rosaniline so obtained is the colour magenta.

Rosaniline itself is colourless, and crystallises in needles or plates. It separates from magenta on adding soda to its solution, not being very soluble in water; it dissolves more readily in alcohol. It forms salts with acids, and these are the aniline red dyes. Magenta, or fuchsine, is chiefly hydrochloride, roseine the acetate, azaleine the nitrate, but pure simple salts are not usually sold. The salts have usually a green metallic lustre, and red in thin plates by transmitted light. The solutions have an intense crimson colour, and are not fluorescent.

Rosaniline is accompanied, as usually manufactured, by an almost similar substance—pararosaniline. The difference is that of homologues of the same series, and as pararosaniline is the lower, we shall use it in the following comparative formulæ, showing the replacements producing the various colours.

Methane (marsh-gas), CH_4, is the simplest of a series of hydrocarbons, and contains 1 atom of carbon and 4 of hydrogen. The hydrogen atoms may be replaced one after another by various elements or compound groups. In chloroform 3 are replaced by chlorine, giving the formula $CHCl_3$; and if this body, under certain conditions, acts on benzene, C_6H_6, we get hydrochloric acid and a hydrocarbon named tri-phenyl-methane.

$$CHCl_3 + 3C_6H_6 = C(C_6H_5)_3H + 3HCl.$$

The substitution products, or their compounds, derived from this hydrocarbon are the various aniline dyes.

By treating tri-phenyl-methane in the same manner as benzene is treated to get aniline, we get a tri-amido base termed paraleucaniline. By the addition of an atom of oxygen to this body we get pararosaniline, which by solution in acids, as already stated, forms the aniline reds. The following are the respective formulæ:

Tri-phenyl-methane.	Paraleucaniline.	Pararosaniline.
$C\begin{cases}C_6H_5\\C_6H_5\\C_6H_5\\H.\end{cases}$	$C\begin{cases}C_6H_4\cdot NH_2\\C_6H_4\cdot NH_2\\C_6H_4\cdot NH_2\\H.\end{cases}$	$C\begin{cases}C_6H_4\cdot NH_2\\C_6H_4\cdot NH_2\\C_6H_4\cdot NH_2\\OH.\end{cases}$

Aniline Blue.—When the hydrogen atoms in the amido groups (NH_2) become replaced in pararosaniline by phenyl, C_6H_5, methyl, CH_3, ethyl, C_2H_5, or similar groups, the aniline blue colours are produced. The ordinary spirit soluble blue has an atom in each of the amido groups replaced by phenyl, and is the hydrochloride of triphenylated pararosaniline, and has the following formula:

$$C\begin{cases}C_6H_4N - \begin{matrix}C_6H_5\\H\end{matrix}\\C_6H_4N - \begin{matrix}C_6H_5\\H\end{matrix}\\C_6H_4N - C_6H_5\cdot HCl.\end{cases}$$

This blue is obtained by heating rosaniline to a high temperature with a large excess of aniline along with some benzoic acid—the action of which is not understood. Ammonia is formed during the operation, and escapes along with the excess of aniline, which is distilled off. When the action ceases, the product is cooled, and excess of hydrochloric acid added, which forms an insoluble compound of the base, giving, when washed and dried, the spirit blue.

It will be seen by the formula that there are still two free atoms of hydrogen in the amido groups.

These can be substituted by methyl or ethyl, and blues of a purer shade obtained. All the varieties are only soluble in spirit, and to a small extent; they give very pure blue colours.

Soluble Blue.—The spirit blue, so called from being insoluble in water, is to a large extent converted into a compound soluble in water, termed 'soluble blue,' thereby giving it a much wider range in its application. The compound is a sulphonic acid salt, and is prepared in the usual manner by mixing with sulphuric acid, gently warming, and after a time pouring the mixture into cold water, in which the free acid is insoluble. After washing, it is cautiously dissolved in soda solution, and salted out. It is then dried gently, forming a brownish cake. It dissolves readily in water. This is monosulphonate of the dye, and called alkali blue.

Water Blue or *Cotton Blue* is a trisulphonate, and is prepared by longer heating at a temperature a little over 212° F. The excess of sulphuric acid used is separated from the solution by milk of lime, this sulphonic acid being soluble in water. It is converted into a soda or ammonia salt.

Methyl Violet.—If five of the amido-hydrogen atoms in rosaniline are substituted by methyl, this colour is produced. The methyl groups are substituted in the aniline, and the process of oxidation is then nearly the same as in the preparation of magenta. Pure di-methyl-aniline is treated with chloride of copper, and some common salt is used to moderate the action. After the mass is cold it is carefully treated with water, to form a strong solution of the salt, in which the colour is insoluble. After the salt is carefully drained off, the colour is dissolved in water and any copper removed by sulphuretted hydrogen. The salt or form in which this colour is sold is often a double chloride of the colour base with chloride of zinc, which is crystalline. The double zinc salts are frequently used for a similar purpose, as they crystallise readily, giving the product a definite form and appearance, and the oxide of zinc is readily soluble in acids and in caustic alkalies, and having no colour does not interfere with the dyes.

Benzyl-rosaniline Violet.—The methyl groups in the violet described can be replaced by heating the colour with the chloride of benzyl, a body prepared with tolnidine, the benzyl group, C_7H_7, producing a bluer colour.

Malachite Green.—This is a colour belonging to a class having only two amido groups in tri-phenyl-methane. The formula will best illustrate its structure. That of brilliant green is also given.

Malachite Green.

$$C\begin{cases} C_6H_5 \\ C_6H_4\cdot N(CH_3)_2 \\ C_6H_4\cdot N(CH_3)_2 \\ OH. \end{cases}$$

Brilliant Green.

$$C\begin{cases} C_6H_5 \\ C_6H_4\cdot N(C_2H_5)_2 \\ C_6H_4\cdot N(C_2H_5)_2 \\ OH. \end{cases}$$

In malachite green 4 hydrogen atoms are replaced in the amido groups by methyl, and in brilliant green by ethyl. These colours are chiefly sold as zinc double salts or oxalates. They generally have a rich metallic lustre, and are readily soluble in water.

Helvetia green and others are sulphonic acid derivatives of these colouring matters.

2. *Phenol Dyes.*—When the hydrogen atoms of benzene are replaced by hydroxyl, OH, bodies of an acid or semi-acid kind are formed, called phenols. These are mono-acid, di-acid, &c., according to the number of hydrogen atoms substituted. This is seen in the following formulæ:

Benzene.....C_6H_6;
Phenol, carbolic acid.....$C_6H_5(HO)$;
Resorcin, di-hydroxyl-benzene..$C_6H_4(HO)_2$;
Pyrogallic acid.....$C_6H_3(HO)_3$.

Naphthalene yields the most important bodies of this class, called naphthols. A general method for their preparation is to melt the sulphonic acid of the hydrocarbons with caustic soda, and add to the solution of the residue an excess of hydrochloric acid, which separates the phenol.

Some of the important yellow dyes are nitro compounds of these bodies. They are got by cautiously mixing the phenols with strong nitric acid, and generally finishing with the aid of heat. Practically better results are got by first forming the sulphonic acid.

Picric Acid is tri-nitro-phenol. Its formula is $C_6H_2(NO_2)_3OH$. It is sparingly soluble in water, to which it gives an intensely bitter taste, recognisable in fibres which have been dyed with it. It crystallises in thin yellow laminæ. The salts form fine crystals, and are more or less explosive.

Naphthol Yellow, Martius' Yellow.—This is di-nitro-naphthol, and was the first colour of value made from naphthalene. It is insoluble in water, but gives fine yellow or orange coloured salts, crystalline and soluble in water. They closely resemble the picrates. A sulphonic acid of this yellow is also used as a dye.

Rosolic Acid, Aurin.—If tri-phenyl-methane contained phenol instead of amine groups, as in rosaniline, it would represent these dyes. In fact, the rosolic acids and rosanilines are convertible into each other. These dyes are now of little importance in practice.

Phthaleins.—These form a very important class of dye-yielding materials, and are formed by the union of phenols with the anhydride of phthalic acid. Phthalic anhydride is obtained from naphthalene by first forming a chlorine addition product, and then oxidising with nitric acid. Crude phthalic acid so obtained is converted into water and the anhydride of phthalic acid (which is volatile) by heating.

Gallein was the first discovered of these colours, and was produced by heating pyrogallic acid with the anhydride. It is chiefly made into cerulein.

Cerulein is obtained from gallein by heating with sulphuric acid to 400° F. till the colour changes to brownish-green, then, on cooling, mixing with a large quantity of cold water. The treatment has removed an atom of water. The cerulein forms a blackish powder. It is insoluble in water, but dissolves in alkalies with a beautiful green colour.

Fluorescein, Eosin.—This is the resorcin phthalein, and is prepared by heating the materials to 400° F. till water ceases to be given off. The mass remaining is fluorescein. From the remarkable fluorescence of its compounds it derives its name, and an alkaline solution of it is taken as a striking example of this phenomenon. It is slightly soluble in water, with a yellow colour, and in the dry state is a reddish crystalline powder.

Fluorescein itself is scarcely used as a dye. But when part of its hydrogen is substituted by bromine, chlorine, or iodine, the beautiful dyes called *eosins* are formed. The tetrabrominated eosin, or rather its potash salt, has been most largely used. It forms red crystals with yellowish-green reflections. The solutions are rose-coloured with intense green fluorescence. One of the most beautiful colours of this group is the replacement by 2 chlorine and 4 iodine atoms, called phloxine. Methyl and ethyl ethers of this body are also dyestuffs.

3. *Azo Dyes.*—The first section of the coal-tar colours consisted of aniline and similar bodies coalesced into more complex basic forms. The second of phenols, with substitutions yielding acid compounds. The third section, now to be considered, in its simplest form is neutral, but by reactions with amines (bases) or phenols (acids)

can produce colouring bodies with the chemical properties of either of the other sections. This class is obtained by a reducing action on nitro compounds, leaving two residues in combination by the mutual affinity of the *nitrogen* atoms—hence the name, from azote (nitrogen). The construction will be understood from the following equation:

Nitrobenzene. Azobenzene.

$$2C_6H_5NO_2 + 4H_2 = 4H_2O + C_6H_5NNC_6H_5.$$

We have here, it will be seen, simple phenyl groups combined with two nitrogen atoms, and from the absence of amido or hydroxyl groups, the substance is neither basic nor acid. If in place of nitrobenzene a nitro derivative of a different hydrocarbon had been taken, a corresponding azo compound would have been produced. The principal development of the coal-tar colours of late years has been connected with this reaction. It can be seen that by manipulating the hydrocarbon groups with amido and hydroxyl groups as with the bodies in the other sections of the colours, any number of azo dyes may be obtained.

Most of these dyes from benzene and the lower members of its series are yellow or brown, but when hydrocarbons with more carbon atoms are used, such as cymol and naphthalene, reds and blues are produced; some of the scarlets having almost displaced the colours from cochineal.

Bismark Brown, Phenylene Brown, &c.—This is an example of a colour with amido derivatives, and is selected as being the first of the azo colours having a manufacturing success. It is prepared by the action of nitrous acid on the di-amine of phenylene. The reaction is shown in the equation:

$$2C_6H_4(NH_2)_2 + HNO_2 = 2H_2O + NH_2{\cdot}C_6H_4NNC_6H_32(NH_2).$$

These colours are very easily prepared; as a rule the colour precipitates when its components are brought together. Besides the dyeing of cotton and wool, this colour is much used for dyeing leather. It is used as the hydrochloride, a dark powder.

Fast Yellow is the potassium salt of a sulphonic acid. Its construction is seen by the formula:

$$KSO_3{\cdot}C_6H_4NNC_6H_4{\cdot}NH_2.$$

Oxyazo dyes are prepared with phenols, and have become the most important of the coal-tar colours. They are nearly all sulphonic acid compounds, and used in the form of soda salts of these acids. The yellow and orange colours are sold as Tropæolins; fast red, Roccellin; claret red, Bordeaux; scarlets, Biebrich, Crocëin, &c. An example may be given of the composition of one of these colours, first known as Meister's scarlet, now sold as scarlet G:

$$C_6H_3(CH_3)_2NNC_{10}H_4(OH)(HSO_3)_2.$$

This dye is the sulphonic acid itself, but usually an alkaline salt is employed in the dyeing process, as the acids are more or less insoluble. A compound of the acids with alkaline bisulphites has lately been used with some success.

The benzidine and allied colours recently introduced belong to the tetrazo group of the oxyazo dyes. These have the valuable property of dyeing cotton without a mordant. Almost any shade of blue, green, yellow, and red can be obtained from them. They stand scouring and milling, and are considered fast to light on wool; but some, at least, are not permanent on cotton. There exists a strong belief that the benzidine colours will be those most largely made from coal-tar products in the future since they are so simply applied. See, on preceding page, *Phenol Dyes*.

Anthracene Dyes.—These are only a small group, and are regarded rather as artificial productions of the natural colours of madder than coal-tar colours. Artificial alizarin is now, however, manufactured on a large scale, and has almost completely taken the place of the natural product. In England it was first made in 1870. In the manufacture of these dyes anthracene is first converted into anthraquinone by oxidation with solution containing chromic acid, and then into sulphonic acid, or rather sulphonic acids, for there are several formed. This requires fuming sulphuric acid, and a temperature of 320° F. The acids are converted into soda salts, and may be separated by crystallisation. Mono-acid produces blue, di-acids more of the red and orange colours.

The soda salts of the sulphonic acids are now mixed with a small proportion of chlorate of potash, and heated under pressure with caustic soda to 400° F. for twenty-four hours. Water is added in sufficient quantity to keep the soda liquid, and the mixture requires to be constantly stirred, or the materials would not come together. The mass obtained is ground and dissolved in water neutralised with hydrochloric acid, when the alizarin separates. It is filtered and pressed.

Alizarin as sold contains three colouring matters—alizarin, giving blue; anthrapurpurin, red; and flavopurpurin, orange shades. They may all be produced separately from the different sulphonic acids. Their properties as dyes are similar.

Artificial Indigo.—There are two processes for preparing this material from coal-tar derivatives, and both are complicated; see under INDIGO.

See Benedikt on *Coal-tar Colours* (1886), and Perkin on the same subject in the *Journal of Chemical Industry* (1885); Crookes on *Dyeing and Tissue-printing* (1882); O'Neill on *Calico-printing, Dyeing, &c.* (1878); and various articles in the *Textile Manufacturer Journal*.

Dyer, GEORGE, antiquary and scholar, was born in London, March 15, 1755; and educated first at Christ's Hospital, and afterwards at Emmanuel College, Cambridge, which he entered in 1774. He took his degree of B.A. in 1778. During the next fourteen years he was variously engaged, chiefly at Cambridge, as tutor and usher, but he finally settled in London in 1792. Here he devoted himself principally to literature, and produced, among many works of less note, the *History of the University and Colleges of Cambridge* (1814), and *Privileges of the University of Cambridge* (1824). He also contributed largely to the *New Monthly* and *Gentleman's Magazine*, made indexes, and corrected for the press. He contributed the original matter to Valpy's classics, 141 volumes (1809–31), but became blind when his work was done. The incident of his walking into the New River and being nearly drowned is chronicled by Charles Lamb in his essay 'Amicus Redivivus.' He died in Clifford's Inn, 2d March 1841. Dyer was a man of remarkable straightforwardness and honesty of character, qualities which are everywhere discernible in his works. He was destitute of humour, slovenly in dress and in his home surroundings. 'For integrity and single-heartedness,' Lamb ranked him 'among the best patterns of his species.' He was also a poet, although now forgotten, and never famous.

Dyer, JOHN, an English poet, was born about 1700, near Llandilo, in Carmarthenshire, and educated at Westminster. On the death of his father, a solicitor, he abandoned law, and took to art, rambling over South Wales and the English country near. In 1727 he published his poem of *Grongar Hill*, remarkable for simplicity, warmth of feeling, and exquisite descriptions of natural scenery, which it was much more a merit for a man to see then than now. He next travelled in Italy, returned in bad health to publish a second poem, the *Ruins of Rome* (1740), took orders, and became vicar of Catthorpe in Leicestershire in

1741, which he exchanged later for the Lincolnshire livings of Belchford, Coningsby, and Kirkby-on-Bain. He died in 1758. The year before his death he published *The Fleece*, an unpretentious didactic poem, which had the honour to be praised by Wordsworth in a sonnet.

Dyer, THOMAS HENRY, an industrious archæologist and historian, born in London, May 4, 1804. In early life he was engaged in the West India trade, but he ultimately devoted himself to literature, and qualified himself as an authority on classical antiquities by extensive travel on the Continent and prolonged study of the topography and antiquities of Rome, Pompeii, and Athens. In 1865 he was made LL.D. by the university of St Andrews. His works are a *Life of Calvin* (1850), *History of Modern Europe* (4 vols. 1861–64), *History of the City of Rome* (1865), *History of the Kings of Rome* (1867), *Ruins of Pompeii* (1866; 2d ed., substantially a new work, entitled *Pompeii: its History, Buildings, and Antiquities*, 1868), and *Ancient Athens* (1873), besides numerous articles in the *Classical Museum* and Dr Smith's *Dictionaries of Biography and Geography*. He died at Bath, 30th January 1888.

Dyer's Broom. See BROOM.

Dying Declaration. See DECLARATION.

Dyke, or DIKE, an artificial mound along the bank of a river or seashore, erected for the purpose of preventing inundation; but *dyke* is also used in the sense of *ditch*, another form of the same word. Dykes or embankments, in some form or another, are in use in most low-lying countries, as in the English Fen Country and along the lower Mississippi (q.v.). But the classical land of dykes is Holland, where as early as 10 B.C. the Roman commander Drusus made embankments. Besides the river-dykes, and those which help to keep the *polders* (see POLDER) drained, the kingdom of the Netherlands possesses, where the shores are not defended by sand-dunes, no less than 1550 miles of sea-dykes, erected and maintained at enormous cost. One, the West-Kappel dyke, is 12,648 feet long, and 23 feet high, with a seaward slope of 300 feet; it is protected by piles and stone-work, and has a road and a railway on its top. Great destruction has been brought about by the bursting of dykes in Holland; sometimes the Dutch dykes have been deliberately broken down for military purposes, as when in 1574 the Prince of Orange raised the siege of Leyden by breaking down the dykes, flooding the country, and drowning many of the besieging Spaniards. Recent illustrations of the fearful damage caused by the bursting of dykes are those which destroyed Szegedin, in Hungary, in 1879, and the flooding of a vast area in China by the inundation of the Hoang-ho in 1887. For various kinds of embankments, see AQUEDUCT, CANAL, RAILWAYS, LEVÉE, WATER, HAARLEM, BEDFORD LEVEL.

Dykes and Veins. Igneous rocks which rise in even-sided, more or less vertical, wall-like sheets are called dykes, from the common Scotch word for a wall. The term vein is applied to the more irregular, winding, branching, and generally smaller intrusions. Dykes and veins are of common occurrence in the cones of existing volcanoes, where they appear to have been injected chiefly from below. Occasionally, however, the rents occupied by dykes would seem to have been filled from above by an overflowing stream of lava. The crystalline rocks of which dykes are composed are of various kinds. In Scotland, where dykes are abundantly developed, the rock is chiefly some variety of basalt-rock. These basalt-dykes vary in thickness from a foot or less up to 100 feet and more; and in length, from apparently only a few yards up to many miles. Sometimes they cut across rocks which have yielded more readily than themselves to the denuding agents, and hence they form prominent features in a landscape, stretching like great wall-like ramparts across low-lying undulating tracts; when, on the other hand, they traverse strata which are less readily eroded than themselves, they frequently form deep trench-like hollows. Sometimes they have come up along lines of faults; but more frequently they appear simply to occupy great rents which are not accompanied by any vertical displacement of strata. They generally run in approximately straight or gently undulating lines; but occasionally they follow a more zigzag course. The rock of a dyke is usually jointed at right angles to its direction, and now and again this jointing gives rise to fine prismatic columns. In the centre of the dyke the rock is more markedly crystalline than towards the sides, where it is often compact, and its point of junction with the walls of the rent in which it lies are not infrequently coated with a skin of volcanic glass. Vesicular cavities frequently appear in the centre of a dyke, and finer pores are often distributed through the rock near the sides. As a rule, the strata are not much affected at their junction with a dyke—the alteration seldom extending beyond a foot or two. When the dyke, however, is very thick, say 100 feet or so, the adjoining rocks are often considerably baked—limestones being rendered crystalline, while coals are converted into a kind of coke, shales are porcelainised, and sandstones changed into quartzite. Sometimes, too, the strata are much smashed and jumbled, and their fragments inclosed in the marginal areas of the intrusive rock.

In regions where fissure-eruptions have taken place, the dykes are often branching and irregularly ramifying—the rocks being traversed by a perfect network of dykes and veins, anastomosing with and crossing each other at all angles. Good examples occur in the western islands of Scotland, the Faröe Islands, and Iceland. Veins are frequently very numerous in the neighbourhood of great masses of granite, from which, indeed, they proceed. It is remarkable that the rock of such veins is frequently finer grained than the granite from which it comes, and often passes into quartz-porphyry or Felsite (q.v.). Granite itself is also very commonly traversed by peculiar dykes and veins, some of which are more coarsely crystalline, while others are finer grained, than the granite itself. These veins are so closely welded into the granite, their crystals indenting the surrounding rock, that it is obvious they were formed at a time when the granite was only partially consolidated. It seems probable that they were injected before the granite had quite solidified. They are known as 'contemporaneous' or 'segregation' veins; but their precise mode of formation is still very obscure. Occasionally dykes of fragmental matter occur, as in the Sidlaw Hills, the hills of Ayrshire, and the Cheviots in Scotland. They have been observed also in the Canary Islands. Such dykes vary in width from a foot or two up to many yards. They seem only to occur in association with other volcanic rocks, and generally to indicate the proximity of some volcanic vent. The fragmental materials are angular, and form a breccia or agglomerate of volcanic rocks alone, or of these and various derivative rocks, hence they are termed *agglomerate dykes*. See IGNEOUS ROCKS.

Dykes, JOHN BACCHUS, composer, was born at Hull, 10th March 1823, graduated at Cambridge, was ordained in 1847, and was appointed precentor of Durham cathedral in 1849. In 1861 he received the degree of Mus. Doc. from the university of Durham, and in 1862 was presented to the vicarage

of St Oswald's in that city. An earnest High Churchman, he became involved in a controversy with Dr Baring, his diocesan. He died 22d January 1876. Dr Dykes was a joint-editor of *Hymns Ancient and Modern*, and composed, besides many services and anthems, a number of hymn-tunes, most of which are to be found in all English collections. Among these are 'Lead, Kindly Light,' 'Nearer, my God, to Thee,' and 'Jesus, Lover of my Soul.'

Dymoke, the name of a Lincolnshire family who for nineteen generations held the office of Champion (q.v.) of England.

Dynamics is the science which treats of *matter* and *motion*. The term *Mechanics* (q.v.) has been, and still is, much employed to denote this science, but its use in this way is not justifiable. *Kinematics*, the science of *motion*—i.e. of *space* and *time*, does not take account of *what* moves, nor of what *cause* produces the motion. In dynamics, the nature of the moving body and the cause of its motion are both considered. The whole science is based upon Newton's Laws of Motion (q.v.), which are as follows: (1) Every body continues in its state of rest or of uniform motion in a straight line, except in so far as it is compelled by force to change that state; (2) change of momentum is proportional to force, and takes place in the straight line in which the force acts; (3) to every action there is always an equal and contrary reaction. Definitions of the principal terms used in the science are given below.

The *mass* of a body—i.e. the quantity of matter which it contains, is proportional to its volume and density conjointly, the *density* being the quantity of matter contained in unit volume. If V be the velocity of a moving body, the mass of which is M, the quantity MV is termed its *momentum*: and similarly, if A be the acceleration of velocity, MA is called the *acceleration of momentum*. The quantity $\frac{1}{2}MV^2$ (which represents the work done on a body of mass M, originally at rest, in order to produce in it the speed V) is called the *kinetic energy* of the body.

Force is defined as any cause which alters a body's state of rest or of uniform motion in a straight line. A force is measured (in accordance with Newton's second law) by the momentum which it produces in unit time—i.e. by the quantity MA. It is completely specified when its place of application, its direction, and its magnitude are given. Hence (and since every force produces its own change of momentum in a body quite independently of the action of other forces) forces are compounded and resolved in the same way as accelerations and velocities (see VELOCITY). A force does *work* when it moves a body in the direction in which it acts, and the work done is measured by the product of the force into the distance through which it moves the body; or, as has been already remarked, by the kinetic energy produced. A pair of equal and oppositely directed forces acting so as to rotate a body about an axis is termed a *couple*, and the product of either of the forces into the distance between their lines of action is called the *moment* of the couple.

In many cases of motion the moving body, though of finite dimensions, may be treated as if it were a mere material particle. Thus there is the dynamics of a particle. This subject is further subdivided into *statics* and *kinetics* of a particle according as the particle is or is not in equilibrium under the forces. The condition for equilibrium is that the sum of the resolved parts of the forces in *any* direction is zero; but, because of the tri-dimensional character of space, it is sufficient to show that the sums of the resolved parts in any three non-coplanar directions are zero. When motion occurs, three cases arise according as the motion of the particle (1) is limited to a given curve, (2) is limited to a given surface, or (3) is unlimited. Simple examples are those of particles (1) falling under the action of gravity, or sliding under gravity on a smooth or rough surface; (2) projected at any inclination under gravity, or revolving around an attracting centre (in both these cases the surface to which the motion is confined is a plane). In all these cases, in accordance with the second law of motion, the resultant of the forces acting on the particle is equal to the acceleration of momentum; and whenever two or more particles mutually influence each other, the third law is required, in addition, to completely determine the motion. When two smooth spheres impinge upon one another, and remain in contact, their common speed is that of their Centre of Inertia (q.v.) before impact. If they separate again, the centre of inertia retains its previous motion, while the relative speed of separation is always a definite fraction (less than unity) of the relative speed of approach. Thus the motions are determinate.

A moving body, though it cannot always be considered to be a mere particle, may often be regarded as rigid. We have thus the statics and kinetics of a rigid solid. The three necessary conditions for equilibrium of a particle are here insufficient, as the body may rotate. The other conditions are that the sums of the moments of the forces about any three non-coplanar axes shall vanish. When the rigid body moves under the action of forces, it is sufficient to know the motion of the centre of mass (which is a case of kinetics of a particle), and the *moments of inertia* of the body about three non-coplanar axes through the centre of mass. The moment of inertia about any axis is the sum of the products of the mass of each particle of the body into the square of its least distance from the axis. When a body rotates about an axis, it is always possible to find a distance such that, if the whole mass of the body were condensed at that distance from the axis, its moment of inertia would be the same as that of the actual body. This distance is called the *radius of gyration*. The quantity MAR^2, where R is this radius, A is the angular acceleration, and M is the mass, is the rate of increase of moment of momentum; and, by the second law, this is equal to the moment of the resultant couple about the axis of rotation.

The case of equilibrium of a flexible cord or chain is readily treated by means of the consideration that the difference of the horizontal parts of the tension at each end of any link is zero, while the difference of the vertical parts is equal to the weight of the link; and at least one case of motion of a flexible cord can be treated by an elementary statical method (see WAVE). The subject of dynamics of an elastic solid is of great complexity. For a slight discussion of the more elementary parts, see ELASTICITY and RIGIDITY.

Dynamite (Gr. *dynamis*, 'strength') is produced by the admixture of nitro-glycerine with a siliceous infusorial earth known under the German name as *kieselguhr*. Nitro-glycerine, which can be prepared in small quantities by dropping glycerine into a mixture of strong nitric and sulphuric acids, the temperature being kept as low as possible, was discovered by Sobrero in 1846, but it was not till nearly twenty years later that the experiments of Alfred Nobel, who combined it with the absorbent inert earth just mentioned, placed the new substance on a basis of practical and commercial importance.

How important were the results of Alfred Nobel's investigations, and how extended an application in

industrial undertakings this class of explosive has obtained, may be judged from the fact that whereas about 1870 the total world's output of dynamite was computed not to exceed 11 tons, in 1889 the annual production of nitro-glycerine compounds was reckoned to be no less than 12,000 tons. For the properties of nitro-glycerine, see that article.

Kieselguhr is the mineral remains of a species of algæ (see DIATOMS); the stem consisted chiefly of silica, and when the organic portions of the moss decayed, the tubular siliceous stem remained, retaining its shape. Beds of kieselguhr, underlying peat, are found in many countries; the principal formations in Europe being in Great Britain (especially Aberdeenshire—that of Skye not being sufficiently absorbent), Germany, and Norway.

The raw kieselguhr, after calcination in a specially designed kiln to remove water and organic substance, is ground and sifted, and finally contains about 98 per cent. of pure silica with traces of lime and iron. In the early days of dynamite many substances were employed for admixture with nitro-glycerine, such as charcoal, sawdust, brick-dust, paper, rags, &c., before kieselguhr was finally adopted.

Dynamite, which has a reddish-brown colour, consists of 1 part of kieselguhr to 3 parts of nitro-glycerine, and has a specific gravity varying from 1·59 to 1·65. Dynamite burns with a yellowish flame, and in small quantities without danger; but explodes with great violence when fired by a detonating fuse. The freezing-point is about 40° F., but this is liable to fluctuate. Like nitro-glycerine, dynamite is more difficult to explode when frozen. The time of explosion of a dynamite cartridge has been calculated to occupy only the 24,000th part of a second; a fact which explains the violent nature of its action. Dynamite is much employed in breaking up boulders and the heavier metal-castings, also in agricultural operations for removing the roots of trees. Under water it loses only 6 per cent. of its power, and is consequently greatly in requisition for subaqueous operations. Loose tamping, such as sand or water, is found to be amply sufficient, and in many instances boreholes can be dispensed with altogether, the dynamite being simply laid on the surface of the bodies to be blasted, and covered with sand or clay. For quarrying purposes, dynamite possesses too great shattering power, and gunpowder, though about double the quantity and some three times the number of boreholes are found necessary, is more generally employed.

The principal dynamite-works in Great Britain are those founded by the Nobels at Ardeer, near Stevenston, Ayrshire, in 1873. The manufacture is carried on under the supervision of H.M. inspectors of explosives, who pay periodical visits, and test the raw materials, a system which, if adding to the cost of production, forms an authoritative guarantee of the article produced. The various processes are carried on in isolated wooden buildings, about 20 yards from each other, and surrounded by massive banks of earth. Nitric and sulphuric acids having been mixed, the temperature being maintained as low as possible by cold water and compressed air, the acids are run into a large leaden tank and further cooled, when glycerine is injected by means of compressed air. This process, being one of considerable danger, has to be closely watched; but on 8th May 1884 an explosion cost ten women's lives. The nitro-glycerine now formed is drawn off and washed in an alkaline solution to remove any acidity, and is then incorporated with the kieselguhr in the proportion of 1 to 3. Cartridges, about 1 inch to ⅛ inch diameter by 3½ inches long, are then made up by female labour, wrapped in vegetable parchment, and packed in boxes covered with water-proof oil-paper, with instructions and cautions printed on them in different languages. Government regulations, both as to the storage and transport of dynamite, are stringent and restrictive.

For the pneumatic dynamite gun, patented by Mefford in 1883 and improved by Zalinski, see CANNON. It is rather an apparatus for discharging torpedoes than a gun. The so-called 'dynamite cruiser' *Vesuvius* of the United States navy was built in 1888-89 to carry three pneumatic guns. In 1888, too, a United States naval lieutenant invented a dynamite shell which can be discharged from any ordinary breech-loading gun, fired with gunpowder. The shell is lined with asbestos cloth, and partitioned so as to contain a number of pellets of dynamite, each wrapped in paraffined paper. Dynamite has unhappily been turned effectively to merely destructive uses. At Bremerhaven (q.v.) a dynamite infernal machine exploded prematurely in 1875. In 1883–85, plotters belonging to extreme sections of Irish malcontents in America arranged a series of dynamite explosions intended to strike terror through the length and breadth of Great Britain. Those outrages include attempts to blow up the Glasgow gas-works, the Parliament House at Quebec; and, in London, the Local Government Offices, four railway stations, Scotland Yard (the police headquarters), and, on the same day, the House of Commons, Westminster Hall, and the Tower. They caused great destruction of property, and injured many people; but happily only two lives were lost—the lives of two of the dynamiters themselves, who were blown to atoms in trying from a boat to blow up London Bridge. Between January 1882 and November 1885, twenty-five of their confederates were brought to justice, and sentenced, most of them to life imprisonment.

Dynamo-electric Machines are machines for generating electric currents by means of the relative movement of conductors and magnets. Faraday discovered in 1831 that an electric current is induced in a conductor when it is moved across the pole of a magnet, so that it cuts the lines of magnetic force, or (more generally) whenever the number of these lines which passes through the circuit of the conductor is in any way varied. If, for example, a coil of wire, the ends of which are connected so that the whole forms a closed circuit, be suddenly withdrawn from the pole of a magnet, a transient electric current is induced in it, while the lines of magnetic force which proceed from the pole are ceasing to be present within the coil. If the coil be replaced, a current will again be induced, but in the contrary direction. Similarly, a transient current is induced if the coil be held at rest while the magnet is drawn away; or, again, if the coil be turned round so that the direction of the lines of force through it becomes reversed, in which case the effect will be twice as great as before. Any movement which causes an alteration to take place in the amount of magnetic induction through the coil produces a transient current, the electromotive force of which is proportional to the rate at which this alteration takes place. The whole amount of electricity produced is the same whether the movement be fast or slow. When the movement is slow, the current lasts longer in proportion as its strength is less. To produce the movement requires an exertion of mechanical work, which finds its equivalent in the energy of the induced current.

Faraday's discovery was immediately followed by the invention of numerous forms of magneto-electric machines, as they were then called, in most of which a steel horseshoe magnet was made to

rotate over a pair of coils wound on a fixed armature, or the armature and coils were made to rotate while the magnet was held fixed. Fig. 1 is an example of one of these early forms, in which the armature, BB, with the bobbins, C, D, which consist of coils wound upon iron cores fixed to the armature, revolves in front of the magnet poles, N, S. In every half-revolution the lines of magnetic force through the bobbins have their direction reversed, and a series of transient currents are consequently produced in the coils. These pass to the external part of the circuit through the spring brushes, H, K, which make contact with a revolving collector, consisting of insulated metallic rings on the axle, to which the ends, *m*, *n*, of the coils are attached. If *m* were always in contact with H, and *n* with K, it is obvious that each successive transient current would take the direction opposite to its predecessor —the direction of the current would alternate at every half-revolution. On the other hand, it is easy, by splitting the rings, to arrange the collector so that H is in contact with *m* for half a revolution, and then with *n* for the other half, while K is in contact first with *n*, and then with *m*, with the effect that the successive currents all have the same direction in the external portion of the circuit. The collector is then called a commutator. A common form of commutator is shown in fig. 2.

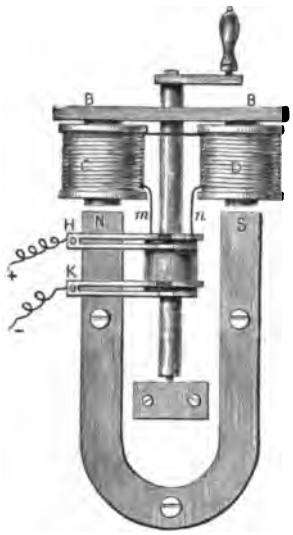


Fig. 1.

Fig. 2.

An ideally simple form of dynamo is represented diagrammatically in fig. 3, which represents a conductor consisting of a single loop of wire revolving in the magnetic field between the poles of a magnet, NS, so that at every half-revolution the lines of force have their direction of passing through the loop reversed, and a series of transient currents is consequently induced in the loop. Here, again, a commutator is required if the currents are to have one continuous direction in the external portion of the circuit. In the position sketched (by full lines), the side, *a*, of the rectangular loop is cutting the lines of force in one direction, and the side, *b*, is cutting them in the other, and both these movements are contributing to produce electromotive force in one direction round the loop; the other two sides (i.e. the front and the back) of the loop do not cut lines of force, and therefore do not contribute to the production of electromotive force. As the loop approaches the vertical position (shown by dotted lines), the component motion of the sides across the lines of magnetic force becomes reduced, and the electromotive force diminishes, till, at the vertical position, it disappears entirely, for there the sides of the loop are moving (at the instant) along the lines of force. After that they begin to cut the lines of force again, but in the reverse direction, and an electromotive force opposite to the last begins to act, which reaches its maximum when the coil is again horizontal. The same variations are repeated as the coil turns through the remaining half of its revolution. The strength of the current follows similar fluctuations, being determined by the electromotive force and by the resistance of the circuit, including the resistance of the revolving loop itself.

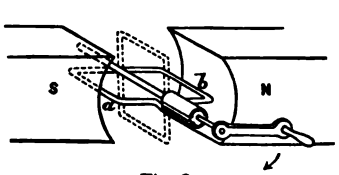


Fig. 3.

The effect of the revolving conductor in producing electromotive force may be increased (1) by increasing the speed of rotation; (2) by forming the loop with more than one turn of wire so as to make a coil, the whole effect is then the sum of the effects due to the individual turns; (3) by strengthening the magnetic field. One very important method of doing this is to furnish the revolving coil with an iron core, the effect of which is to increase the magnetic induction through the loop, across the space from pole to pole, by providing an easier path for the lines of magnetic force to cross this gap. In early dynamos the armature (as the revolving-piece is called) frequently consisted of a coil of many turns wound on an iron core, in the manner illustrated by fig. 4, which shows in section the simple shuttle-wound armature introduced by Siemens in 1856. The ends of the coil were brought to a commutator like that of fig. 2, and the effect was to produce currents which were uniform in direction. They were, however, very far from uniform in strength, varying from zero to a maximum twice in every revolution of the shaft.

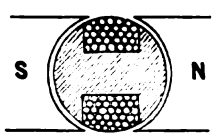


Fig. 4.

In the early dynamos permanent steel magnets were used to produce the field in which the armature moved, but it was soon recognised that electromagnets might be employed instead, and in 1863 Mr Wilde introduced a machine with large electromagnets, which were excited by a small auxiliary armature revolving between the poles of a permanent magnet. Before this it had been proposed in machines with permanent magnets to supplement the magnetism when the machine was in action, by having coils wound upon the magnets, and by allowing the current produced in the machine itself to pass through these coils. It was not till 1867, however, that it became known that steel magnets were wholly unnecessary, and that dynamos with electro-magnets might be made entirely self-exciting. Even when the cores of the electro-magnets are of soft iron, there is enough residual magnetism to initiate a feeble current; this develops more magnetism, which in its turn develops more current, and so the process goes on until full magnetisation is reached. The principle of self-excitation was enunciated independently, and almost simultaneously, by Wheatstone, Werner Siemens, and S. A. Varley; it is now made use of in all except the smallest machines. The term 'dynamo-electric' was at first applied to distinguish those machines which were self-exciting from 'magneto-electric' machines, which had permanent magnets to give the field; but this distinction is no longer maintained, and the name 'dynamo' is now used in the wider sense defined above.

An extremely important step in the development of the dynamo was taken in 1870 by Gramme, who

introduced a form of armature which, for the first time, gave a current not merely continuous in direction, but also sensibly uniform in strength. The Gramme ring armature is shown diagrammatically in fig. 5. It consists of a ring-shaped iron core, revolving in the magnetic field, and having a series of coils, A, B, C, &c., wound upon it. These are joined to one another in a continuous series, and also to the insulated segments of a commutator, *a*, *b*, *c*, which revolves with the ring, and from which the current is taken by brushes, H, K. Consider now the action of the field in producing electromotive force in any one of the coils, such as A. Near the place in which it is sketched, the coil A is moving in a direction parallel, or nearly parallel, to the lines of force, and, therefore, is having little or no electromotive force induced in it. But by the time the ring has made half a revolution, the same coil will have the lines of force within it reversed. Between these two positions, therefore, there must have been a generation of electromotive force, and this will in fact be going on most actively half-way between the two places. The coil C is at present the most active contributor of electromotive force, but B and D, the coils lying in front of and behind it, are also contributing a share, and the whole electromotive force between A and E, so far as that side of the ring is concerned, will be the sum of the several effects due to all the coils from A to E. A little consideration will show that the same action is going on on the other side of the ring, so that if the brushes be applied at *a* and *c* they will take off to the external portion of the circuit a current, half of which is contributed by one side, and half by the other side of the ring, the two sides acting like two groups of battery cells arranged in parallel and of equal resistance and equal electromotive force. The whole electromotive force in the armature is the same as that produced by the coils on one side alone, but the internal resistance is halved by the division of the current between the two sides. In actual Gramme armatures, the number of coils on the ring is very much greater than the number shown in the sketch, and each brush is made wide enough where it presses on the commutator to touch two of the segments at once. Hence the current is never interrupted, and the fluctuations in its strength, which occur as one segment passes out of contact and another comes in, may be made almost indefinitely small. As each coil passes, it is for the instant short-circuited through the brush, and this would give rise to a waste of energy in the coil and to sparking at the brushes, were it not that the brushes are set to bear on the commutator at the points where the development of electromotive force in the corresponding pair of coils is a minimum. These neutral points, as they are called, are not exactly midway between S and N, but are in advance of that position in consequence of the magnetic field within the ring being distorted through the action of the currents in the armature coils. Hence the brushes require to have what is called 'lead,' and this lead has in general to be adjusted whenever the output of the machine is considerably varied, more lead being needed if it happen that the armature current is increased while the field magnets remain of constant, or nearly constant, strength. The adjustment of the brushes is a matter of much practical importance in the management of a dynamo, for the sparking to which faulty adjustment gives rise speedily wears away the commutator bars as well as the brushes themselves.

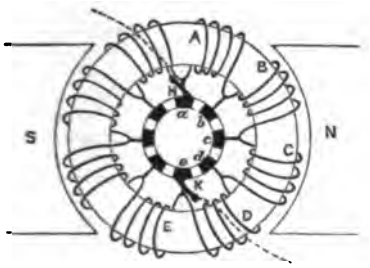


Fig. 5.

A small practical Gramme dynamo of an early form is shown in fig. 6. In this example two field-magnets conspire to produce a north pole at N, and other two to produce a south pole at S. The

Fig. 6.

commutator is a series of copper bars mounted on an insulating hub fixed to the shaft, and separated from one another by thin stripes of mica or other insulating material; these bars have radial projections, which are soldered to the junctions of successive armature coils. Each brush consists of a flat bundle of copper wires pressed lightly against the commutator by a spring. The core of the armature is a ring made up of many turns of soft iron wire, on which insulated copper wire is wound to form the coils. It is essential that the core of the armature should not be solid, for in that case currents would be developed in the substance of the moving iron itself to such an extent as very seriously to impair the efficiency of the machine. Hence the core of dynamo armatures is always subdivided, by being made up either of wire, or more usually of thin plates more or less carefully insulated from one another. Fig. 7 shows the

Fig. 7.

armature of a small Gramme dynamo, removed from its place between the pole-pieces.

Two years after the introduction of the ring armature by Gramme, it was shown by Von Hefner Alteneck that the Siemens armature (fig. 4) might be modified so that it also should give continuous

currents of practically constant strength. In the original Siemens armature there was but one coil, all wound parallel to one plane, and the current fluctuated from nothing to a maximum in every half-revolution. In the modified form the coil is divided into many parts, which are wound over the same core, but in a series of different planes, the plane of each successive coil being a little inclined to the plane of the coil before it. The coils are all joined in series, and their junctions are connected to the bars of a commutator just as in the Gramme ring. The Siemens-Alteneck or drum armature may, in fact, be compared to a Gramme armature, in which the coils, instead of being wound on successive portions of a ring, are all wound on one piece of core, preserving, however, the angular position they would have in the ring. Their action depends on their angular motion, and is therefore the same in both cases. As the drum revolves, that coil which is passing the neutral plane (viz. the plane perpendicular to the lines of force) is for the moment inoperative, and the brushes are set to touch those bars of the commutator that are connected with it. The other coils are more or less operative, the most active contributor of electromotive force being that one which is for the moment perpendicular to the neutral plane. The electrical effects in drum and in ring armatures are the same. Nearly all continuous current dynamos have one or the other; most makers prefer the ring type, mainly from considerations of convenience in construction; but the drum type holds its place in some of the best modern machines.

An important element in the classification of dynamos is the manner in which magnetism is induced in the field-magnets. These may of course be excited from an independent source of electricity; but when the machine is self-exciting, there are three important alternative methods. In the early machines the coils on the field-magnets were connected in series with the external part of the circuit, and consequently the whole current produced by the machine passed through both. This arrangement is distinguished as *series winding*, and is shown diagrammatically in fig. 8. It was first pointed out by Wheatstone, in 1867, that the magnet coils, instead of being put in series with the external conductor, might be arranged as a shunt to it, thereby forming an alternative path through which a portion only of the current would

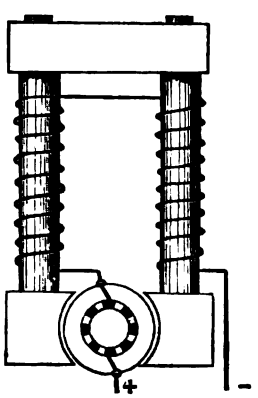


Fig. 8.

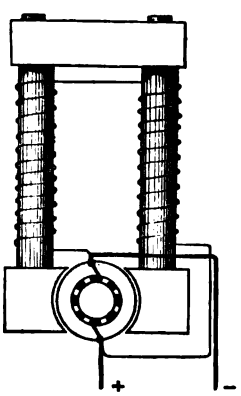


Fig. 9.

pass. In this arrangement, which is called *shunt winding* (fig. 9), the magnet coils consist of many turns of comparatively fine wire, so that they may not divert an excessive quantity of current from the external circuit. Finally, in *compound winding* (fig. 10) the two previous methods are combined. The field-magnets are wound with two coils; one of these (which is short and thick) is connected in series with the external circuit, and the other (which is long and fine) is connected as a shunt to it. This plan appears to have been first used by Varley in 1876, and afterwards by Brush, who pointed out that it, along with simple shunt winding, has the advantage of maintaining the magnetic field even when the external circuit is interrupted. It has, however, when properly applied, another and more important merit, as will appear below.

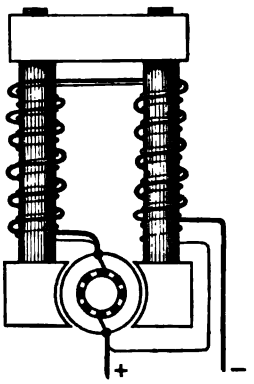


Fig. 10.

In a series-wound dynamo the magnets do not become excited if the external circuit is open, and become only feebly excited when the external resistance is high. Let the external resistance be reduced, while the armature is forced to turn at the same speed. The current will now increase, producing a stronger magnetic field; the electromotive force is therefore greater than before. A curve drawn to show the relation between the current and the difference of potential between the terminals of the machine (which is a little short of the full electromotive force, in consequence of the resistance of that part of the circuit which is within the machine itself) will in its early portion rise fast as the current increases, in consequence of the rapid augmentation of the magnetic field. Such a curve is called the characteristic curve of the machine, and is shown at AA in fig. 11. If we continue to increase the current by further reducing the external resistance, the magnets tend to become saturated, and finally even have their magnetism somewhat weakened on account of the influence of the currents in the armature coils. Further, the loss of potential, through internal resistance, becomes more considerable. The difference of potential between the terminals accordingly passes a maximum, and becomes considerably reduced when the current is much augmented, as appears in fig. 11. The characteristic curve for a shunt-wound dynamo is shown at BB in the same figure. Here the strength of the magnetic field is nearly constant, but decreases a little when the machine is giving much current, partly because the current in the shunt circuit is then somewhat reduced, and partly because the current in the armature coils tends to oppose the magnetisation. Hence the potential falls off as the

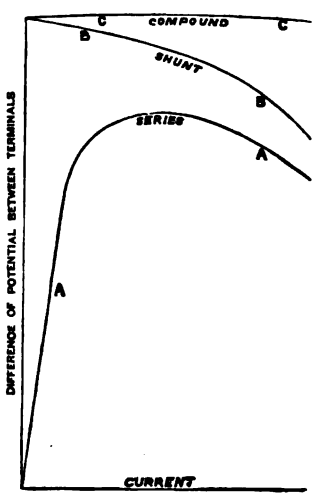


Fig. 11.

current increases. This fall will, however, be slight if the resistance of the armature is very low and if the field-magnets are very strong, and under these conditions a shunt-wound dynamo will give a nearly constant difference of potential whether much or little current be taken from it, provided, of course, that the speed remain unchanged. To make the difference of potential more exactly constant, it is necessary that the magnetic field should become stronger when the machine is giving much current, and compound winding achieves this. A compound-wound dynamo may be regarded as a shunt machine in which the action of the shunt winding is supplemented by that of a series coil on the magnets. When the machine is running on open circuit, the shunt coil alone is operative; as the current taken from the machine is increased, the series coil produces a larger and larger supplementary effect on the magnets, and by choosing a proper number of series windings, their effect may be made to neutralise with great exactness the droop in the characteristic curve which would occur if the shunt coil were the only source of magnetism. Compound machines wound for constant potential give a nearly straight horizontal line for their characteristic; CC in fig. 11 is an actual example. By making the series coil more influential, so that the potential at the terminals rises slightly as the current increases, the machine may be compound-wound to give constant potential at the ends of long leading-wires by which the current is conducted to a distance.

Series-wound dynamos are largely employed for electric lighting by arc lamps. Compound-wound machines are especially suitable for incandescent lighting, where the lamps are connected in parallel, and where it is important that the potential shall not vary when more or fewer lamps are in action. Shunt-wound machines are also largely used for incandescent lighting, the potential being adjusted to a constant value by varying the speed of the machine, or by throwing resistance into or out of the magnet shunt circuit. Shunt machines are the most suitable for charging storage batteries and for electro-plating, because of their not being liable to have their polarity reversed by a back current from the battery or bath.

Fig. 12 illustrates the Edison-Hopkinson dynamo, which may be cited as an excellent instance of modern construction. Here a drum armature is used, not a ring; and in this instance the armature coils, instead of being of wire as they are in smaller machines, are formed of copper bars insulated with mica, each pair of opposite bars being joined to form a loop, the ends of which are connected to opposite segments of the commutator, as well as to the loops which come next in order. The field-magnets are shunt-wound, and are set vertically with the pole-pieces at the bottom. Machines of this class are made of sufficient size to give a current of 660 ampères, with a potential of 105 volts; the output of electrical energy is therefore at the rate of 69,300 watts, or over 92 horse-power. There are five brushes on either side of the commutator, giving a large area of contact, and these are separately removable to allow of their being trimmed or cleaned while the machine is running.

In most dynamos the field-magnets are designed to form as simple a magnetic circuit as possible, with two poles which stand at opposite ends of one diameter of the commutator. In some cases four or more poles are used, spaced at equal intervals round the armature, which then takes more or less the form of a disc, in which the similarly affected coils may be connected together, so that a single pair of brushes still serves to take off the current. In some cases the coils are connected to commutators of special design, which have the effect that each coil is entirely cut out of circuit for a time, during that part of its movement in which there is little or no electromotive force induced in it. The Brush dynamo, which took a prominent place in the early industrial development of electric lighting, and the Thomson-Houston dynamo, are instances in point.

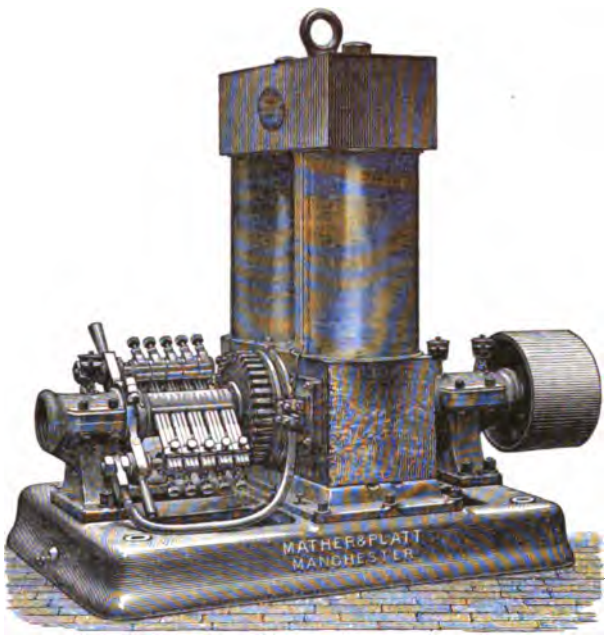


Fig. 12.

In *alternate current dynamos* the armature consists usually of a group of coils, joined in parallel or series, attached to a disc which revolves in the space between a corresponding group of pairs of magnet-poles, so that rapidly alternating transient currents are induced as the coils pass the successive poles, and these currents pass to the external circuit through a simple collector which is not a commutator. In some cases the armature is stationary, and the field-magnets revolve. The field is usually excited by an auxiliary dynamo of the continuous current type. It is impossible in the space at our disposal to describe the great variety of forms which alternate current machines have taken in the hands of Siemens, Gordon, Ferranti, Westinghouse, Mordey, and others. Dynamos of this class are now acquiring a special importance from their use in connection with transformers in Electric Lighting (q.v.), and are being made for this purpose of very great size and power. In alternate current dynamos, the relation between the strength of the current and electromotive force induced in the moving coils depends not merely on the resistance of the circuit, but also on its coefficient of self-induction, which has the effect of making the maximum of strength in each transient current lag behind the maximum of electromotive force. It has been shown experimentally and theoretically, by Adams and Hopkinson, that in consequence of self-induction two similar alternate current machines driven

independently, but started at the same speed, and connected in parallel, will control one another, so that the phases of the currents will continue to agree.

Dynamos, of whatever type, may be regarded as machines for converting energy from a mechanical into an electrical form, and from this point of view a matter of prime importance is what is called the efficiency of the machine, which is the ratio of the electrical power the dynamo gives off, available for use outside the machine, to the power used to drive the machine. The electrical energy given off falls short of the mechanical energy absorbed, in consequence of (1) mechanical friction; (2) the generation of eddy currents, to be prevented as much as possible by laminating the iron core of the armature; (3) magnetic friction or 'hysteresis,' by which every reversal of magnetism in the iron causes dissipation of energy, apart from the production of eddy currents; (4) the energy consumed in maintaining the magnetic field; and (5) the heating of the armature in consequence of the resistance of its own coils. The aggregate effect of these sources of loss is that in a good machine about 90 per cent. of the driving power is available as electric energy in the external circuit. Dr Hopkinson has shown by careful measurements that machines of the type illustrated in fig. 12 may attain an efficiency of over 93 per cent.

The Dynamo as a Motor.—Just as a conductor when made to move across the lines of magnetic force has a current generated in it, so when a current is made to pass along a conductor placed in a magnetic field, the conductor tends to move across the field in the direction which would reduce the current by inducing an opposing electromotive force. Even before Faraday's discovery of the induction of current in a conductor by its movement in a magnetic field, he had shown (in 1821) that the reverse process was possible, and soon afterwards various forms of magneto-electric engines were devised by Barlow and Sturgeon, and later by Ritchie, Henry, Dal Negro, Joule, and others, which employed electric currents to do mechanical work on a small scale. In 1838 Jacobi constructed an electric motor of sufficient power to propel a small boat, using a group of electro-magnets, which revolved on a disc between opposite groups of other electro-magnets, which were fixed. Some time before the application of the ring-armature to dynamos by Gramme, it had been used in a motor by Pacinotti, and the principle had been explicitly stated that any electric motor might be used to produce currents, but it was not until Gramme's time that the full significance of this principle was generally recognised. The action of the dynamo is in fact reversible; the same machine which converts mechanical into electrical energy will serve the opposite function equally well. Power may therefore be conveyed to any distance by using a dynamo to produce currents, conducting these to the distant spot, and utilising them there to produce mechanical effect by means of another dynamo acting as a motor. The second dynamo may be a counterpart of the first; in some cases, however, it may be desirable, for the sake of lightness or for other special reasons, to adopt a different construction in the motor. In general, however, the most efficient generator is also the most efficient motor. The experiments of Hopkinson, in a case where some 50 horse-power was being transmitted in this way, show that the double conversion of energy from the mechanical to the electrical, and back again to the mechanical form, may be accomplished with a total loss of no more than 13 per cent.; the efficiency of the motor and that of the generator being each above 93 per cent.

Alternate current dynamos form fairly efficient motors when driven by alternate currents; they require, however, to be started in synchronism with the impulses received from the generating machine, but once started they tend to remain in synchronism. Special forms of motor for alternate currents have been designed by several inventors, but these have scarcely as yet passed the experimental stage.

Literature.—Among many important contributions to the theory of dynamos, perhaps the most noteworthy are papers by J. Hopkinson (*Proc. Inst. Mech. Eng.* 1879–80), in which were explained the construction and uses of curves, such as those of fig. 11 (afterwards called characteristic curves by Deprez); by J. and E. Hopkinson (*Phil. Trans.* 1886), in which it was shown how the strength of the field and the performance generally of a dynamo might be predicted by calculation of the induction in the magnetic circuit of the machine; by Joubert (*Jour. de Physique*, 1883), on alternate current machines; and by Ayrton and Perry (*Jour. Soc. of Telegraph Engineers*, 1883), on the regulation of motors. For descriptive articles, reference should be made to the *Electrician*, the *Electrical Review*, and *Engineering* from 1878. The whole subject is comprehensively and systematically treated in Professor S. P. Thompson's *Manual of Dynamo-electric Machinery* (3d ed. 1888).

Dynamom'eter, originally an instrument for measuring force, such as the pull exerted by a horse in drawing a cart; but the name is now usually given to instruments for measuring power. A friction brake, for example, applied to a drum on the shaft of a steam-engine, may be arranged so that it measures the rate at which the engine is doing work on the brake: the device then forms an *absorption dynamometer*. There are also various *transmission dynamometers* which measure the power conveyed by a belt or by a shaft without absorbing it.

Dyrrachium. See DURAZZO.

Dysart, an old-fashioned seaport of Fife, on the Firth of Forth, 2½ miles NE. of Kirkcaldy, much of whose extended municipal burgh lies within Dysart's parliamentary boundary. It owes its name (Lat. *desertum*, 'a solitude') to St Serf's cave near Dysart House, Lord Rosslyn's seat; was a thriving place prior to the Union; and now has some textile manufactures. James V. made it a royal burgh, and with Kirkcaldy, Burntisland, and Kinghorn it returns one member to parliament. Pop. of royal burgh (1851) 1610; (1881) 2645; (1891) 3022; parliamentary, 12,849.

Dyscrasia (Gr. *dys*, 'difficult,' and *krasis*, 'a mixture'), a pathological term much used in Germany by certain authorities, to indicate an altered condition of the blood and fluids of the system, leading to constitutional diseases, as dropsy, cancer, delirium tremens, lead-poisoning, &c. See CACHEXIA, and DIATHESIS.

Dysentery (Gr. *dys*, 'difficult,' and *enteron*, 'the intestine'), a form of disease accompanied by discharges from the bowels, and differing from Diarrhœa (q.v.) chiefly in being attended by marked fever and pain, as also by the presence of blood and inflammatory products in the discharges. Dysentery is, in fact, a disease of the mucous membrane of the colon or great Intestine (q.v.), and when severe it is followed by the destruction of that mucous membrane to a great extent, the intestine becoming much contracted at intervals, especially in its lower part, and the evacuations being therefore apt to be retained, especially the solid portions. The most distinctive symptoms are excessive pain in evacuating the bowels, and frequent ineffectual attempts at evacuation (*tenesmus*), tenderness on pressure in the left side of the abdomen, discharges of blood mixed with mucus, and comparatively little fæcal matter; these symptoms being accompanied or followed by intense fever, passing early into depression of strength.

After the acute symptoms have passed off, the disease sometimes continues in a chronic form for a long period, greatly enfeebling the patient. Dysentery is a disease of extreme danger in many cases, and should always be placed early under medical treatment. The best domestic plan, when medical advice cannot be at once procured, is to give a moderate dose of castor-oil, guarded by twenty or thirty drops of laudanum, and then twenty-grain doses of powdered ipecacuan, repeated every six or eight hours, with opium sufficient to subdue the pain and tenesmus, and diminish the tendency to vomiting which the ipecacuan is apt to produce (one grain every two, four, or six hours). If the pain and irritation of the bowels are extreme, the opium had better be given by a small injection (see CLYSTER) with starch, after the lower bowel has been well cleansed by a larger warm-water injection; and it will be well to repeat the simple warm-water injection at intervals throughout the treatment. Dysentery, in its most severe and epidemic forms, is commonly a disease of the tropical zone, and frequently, though not always, occurs in low and swampy regions, where malarial fevers are also prevalent. Some authorities, indeed, regard dysentery as itself a malarial disease; but this is not certain. Isolated cases, occurring in localities not subject to the disease, are seldom severe or dangerous. It is often found in connection with abscess of the liver.

Dysodil, a yellow or grayish laminated bituminous mineral, often found with lignite. It burns vividly, and diffuses an odour of asafœtida.

Dyspepsia (Gr. *dys*, 'difficult,' and *pepsis*, 'digestion'), a scientific term for Indigestion (q.v.).

Dysphonia. See THROAT (AFFECTIONS OF THE).

Dyspnœa (Gr. *dys*, 'difficult,' and *pnoē* or *pnoia*, 'breathing'). See ASTHMA, RESPIRATION.

Dysuria (Gr. *dys*, 'difficult,' and *ouron*, 'urine'), a difficulty of passing urine. It may depend on a variety of causes, as regards which see URINE.

Dytiscus (Gr. *dytes*, 'a diver'), a genus of water-beetles, including a common large British species, *D. marginalis*. See WATER-BEETLES.

Dyveké ('the little dove'), called by the Latin chroniclers *Columbula*, the famous mistress of Christian II. of Denmark. Born at Amsterdam in 1488, she was but nineteen when she first met her lover at Bergen, where her mother had settled as an innkeeper. She followed him to Denmark, where her mother acquired such political influence as to become hated by the nobles. Dyveke, who herself took no interest in affairs, died suddenly in 1517, almost certainly from poison. Christian avenged his favourite's death by executing a young noble, Torben Oxe, whom he suspected at least of having himself aspired to her favour. The unhappy fate of Dyveke has been the subject of dramas in Danish or in German by Samsöe (1796), H. Marggraff (1839), and Riekhoff (1843); and of romances by L. Schlefer, Tromlitz, Carsten Hauch, and Ida Frick. See Münch's *Biographisch-historische Studien* (1836).

Dyvour (from the Fr. *devoir*, 'to owe;' 'a debtor'), in the old legal language of Scotland, was a bankrupt who under various acts from 1606 to 1696 was until discharged compelled to wear a hideous and conspicuous costume. Thus an act of 1688 prescribes as the dyvour's habit 'a bonnet, partly of a brown and partly of a yellow colour, with uppermost hose, or stockings, on his legs, half brown and half yellow coloured, conform to a pattern delivered to the magistrates of Edinburgh.' The barbarous usage had fallen into desuetude long ere the dyvour's habit was abolished by law in 1836.

Dziggetai (*Equus hemionus*), a species of wild ass, more horse-like than the others. It is probably the hemionus ('half-ass') of Herodotus and Pliny. It inhabits the elevated steppes of Tartary, extending into the south of Siberia and to the borders of India. The Dziggetai lives in small herds, sometimes of several males and several females, sometimes of a single male with about twenty females and foals. The Mongols and Tungûs hunt it eagerly on account of its flesh, but its fleetness, watchfulness, and power of endurance often secure its safety. It has been partly domesticated, but does not seem to breed in captivity. It is also known by the names of Kiang, Khur, and Goor. See ASS.

Dzungaria. See ZUNGARIA.

E

is the fifth letter in our own and the cognate alphabets. The original symbol 𓂝 in the Egyptian hieroglyphs had the value of the aspirate *h*. It is usually called the Mæander, but is supposed to represent the ground-plan of a house (see the table in Vol. I. page 187). The Phœnicians called it *he*, a name which probably meant a 'window.' When the Phœnician alphabet was taken over by the Greeks, the symbol lost its aspiration, and was used to represent the vowel *e*, and was called *e-psilon* or 'bare *e*,' to distinguish it from *eta*. In Latin it had the two sounds which are heard in the French *eté*. In English it has four sounds. The normal sound is heard in *get*, *bed*, *met*. The name-sound *ee* is usually expressed by doubling the letter, as in *see*, *feet*, *heel*, but it is expressed by a single *e* in *evil*, and in some monosyllabic words, such as *he*, *me*, *we*, *be*. It has the sound of *i* in the word *England*, and of *u* in the last syllable of *eleven* and *better*, and also when followed by *r*, as in the words *fern*, *pert*. When followed by *y*, as in *grey*, *prey*, it has the sound of the Italian *e*, which is our *a* in *fate*. Custom will not allow any English word to end in *v*, and hence a mute *e* has been appended to such words as *give*, *live*. But this subscript *e* is most commonly used to lengthen the previous vowel, as in *not*, *note*; *bit*, *bite*; *met*, *mete*. The use of a subscript *e* was originally a mere fashion in spelling, introduced from France in the 15th century, but in the 16th century it became generally used, as now, to lengthen the preceding vowel. This, though anomalous, is a very convenient device, since without introducing any new symbol, it practically doubles the number of vowel-signs which we possess.

E, in Music, is the third note or sound of the natural diatonic scale, and is a third above the tonic C. See MUSIC, SCALE; for the keys of E major and E minor, see KEY.

Eadgar, Eadmund. See EDGAR, EDMUND, &c.

Eadie, JOHN, a learned Scotch divine, was born at Alva, in Stirlingshire, 9th May 1810. He studied at the university of Glasgow, and was licensed in 1835 as a preacher of the United Secession Church, in which, soon after, he became minister of a Glasgow congregation—a post he retained after its union with the Relief Church (1847) as the United Presbyterian Church. From 1843 to the close of his life he also lectured on the exegesis of Scripture in the theological college of his church. He received the degree of LL.D. from Glasgow in 1844, and of D.D. from St Andrews in 1850, was moderator of the synod of his church in 1857, and was one of the original members of the New Testament Revision Company. He died 3d June 1876. Eadie maintained throughout life an incessant literary activity. If not an exegete of the highest order, he possessed wide learning and great power of exposition. Few books are more generally useful and more intelligible to the non-theological reader than his *Biblical Cyclopædia* (1848), and his *Ecclesiastical Encyclopædia* (1861). Sound contributions to New Testament exegesis were his commentaries on St Paul's epistles to the Ephesians (1854), Colossians (1856), Philippians (1857), Galatians (1869), and Thessalonians (posthumously, 1877). His latest work was *The English Bible* (2 vols. 1876), a learned and yet popular history of the English translations of the Scripture. See his Life by Dr James Brown (1878).

Eadmer, a learned monk of Canterbury about the end of the 11th century, the devoted friend of Archbishop Anselm, to whom he had been sent by Pope Urban. There also he remained in the same favour with St Anselm's successor, Archbishop Ralph, until 1120, when at the request of King Alexander I. he went to Scotland to become Bishop of St Andrews. There was already a controversy between Canterbury and York for jurisdiction over the see of St Andrews; while that see asserted its independence of either. Eadmer claimed to be consecrated by the Archbishop of Canterbury, but the Scottish king naturally refused to recognise this right, and accordingly the monk returned to Canterbury, whence eighteen months later he sent his renunciation of all claims to the bishopric. He died, it is supposed, in 1124. He tells us that from his childhood he was a diligent observer of contemporary events, especially in church affairs; and this habit has given more than usual interest to his writings, which show no little literary dexterity in their clearness and selection merely of such historical details as are really significant. The most valuable are his *Historia Novorum*, first printed by Selden in 1623, and his *Vita Anselmi*, first published at Antwerp in 1551. Both were printed in the Benedictine edition of Anselm's works (Paris, 1721), and have been edited (1884) in the 'Rolls' series by Martin Rule. His lives of St Dunstan, and St Bregwin of Canterbury, and of St Oswald of York, were printed by Wharton in the second part of his *Anglia Sacra* (1691).

Eads, JAMES BUCHANAN, engineer, born in Lawrenceburg, Indiana, 23d May 1820, early designed some useful boats for raising sunken steamers, and in 1861, when called to advise the national government, constructed within a hundred days eight ironclad steamers for use on the Mississippi and its tributaries. He afterwards built a number of other ironclads and mortar-boats, which were of considerable service to the North. His steel arch bridge (1867–74) across the Mississippi at St Louis, with its central arch embracing a clear span of 520 feet, ranks deservedly among the notable bridges of the world; his works for improving the south pass of the Mississippi delta were successfully completed in 1875–79; and his great plan for deepening the river as far as the mouth of the Ohio, by means of jetties, has been demonstrated to be entirely practicable. A later suggestion, for the construction of a ship-railway across the Isthmus of Tehuantepec, attracted much attention. In 1884 he received the Albert Medal (q.v.) of the Society of Arts, being the first American citizen to whom this honour had

been awarded. He died at Nassau, New Providence, 8th March 1887.

Eagle, a name given to many birds of prey in the family Falconidæ and the order Accipitres. The Golden Eagle, the White-headed Eagle, and the Sea-eagles are characteristic examples. The falcon family includes over 300 predacious birds, feeding for the most part on living animals, hunting by day, and living usually on exposed rocky places. They are cosmopolitan in distribution. The bill is powerful, but rather short, high at the root, and slightly curved; the partition between the nostrils is complete; the upper margin of the eye-socket projects; the head and neck are feathered; the soles of the feet bear large callosities. It is a matter of much difficulty to separate the eagles definitely from the related falcons, buzzards, kites, and hawks.

(1) The genus Aquila includes the Golden Eagle, the Imperial Eagle, and other species. The bill is large and high, with the upper part much bent, and with notched margins; the powerful wings reach to the end of the tail, and are rounded off; the tail is of medium size, broad, and straight; the leg-feathers extend down to the toes. Representatives of this noble genus are found in all parts of the world except the neotropical and Australian regions. The powers of vision and flight are well known; the power of 'renewing youth' is mythical.

The Golden Eagle (*A. chrysaëtus*) is a large and magnificent bird. The predominant colour is dark, tawny brown, but the back of the head and neck are more tawny and look golden in the sunlight. The young birds have tails of a brighter colour. The adult female measures about 3 feet in length; the male is rather less both in length of body and

The Golden Eagle (*Aquila chrysaëtus*), Adult Male.
From E. T. Booth's *Birds of the British Islands* (Porter, London, 1881).

wing. The golden eagles have their homes in remote rocky regions, but often wander far in search of booty. They prey upon numerous mammals and birds, but are rarely willing to run any great risks in so doing. Rabbits, hares, lambs, and even young deer; ducks, plovers, ptarmigan, and the like, are seized and torn up, or carried home to the eyry. They have been known to drive roe deer over the rocks, and even to attack a pony, but at the same time they do not disdain carrion. The nest, usually upon a rocky ledge, is large and roughly made. There are most commonly two eggs. Though a strong and majestic bird, it cannot be credited with much bravery. The occasional cry is loud and shrill, but with some hoarseness. The golden eagles have been almost exterminated in Britain, and are only very occasionally seen, except in Sutherlandshire, where they are strictly preserved and are not unfrequent. The species is widely distributed in Europe, Asia, and North America. Allied species are the Imperial Eagle (*A. imperialis*) in south-eastern Europe, western Asia, and North Africa; and the Screaming Eagle (*A. nævia*), with similar distribution, but commoner in the north of Europe than either of the above species.

(2) *Other Genera.*—The Crested Eagles (Spizaëtus and Morphnus), the former in tropical parts of both hemispheres, the latter in South and Central America, are in some species distinguished by tufts of feathers on the back of the head. The Harrier-eagle (Circaëtus) is an Old-World genus represented in Europe, North Africa, and western Asia. The European species (*C. gallicus*) is known as Jean-le-Blanc. The White-tailed or Sea-eagles (Haliaëtus) are absent only in South America. One species (*H. albicilla*) is, like the golden eagle, a British species, becoming as usual increasingly rare (see ERNE). The Fishing Eagle or Fish-hawk (*Pandion haliaëtus*) is an almost cosmopolitan bird, with markedly piscivorous diet. It nests on high trees, and is remarkable among eagles for the backward grasping adaptation of the outermost toe. The Bateleur Eagle (Helotarsus) is represented by two species in South and Central Africa. The best-known species (*H. ecaudatus*) is remarkable for its short tail, as the specific title suggests. With the exception of the first (Spizaëtus), all the above genera are distinguished from Aquila in being bare-legged, the feathers being restricted to the upper part of the limb. The Harpy-eagle of South America (*Thrasaëtus harpyia*) seems to be a buzzard. There are several eagles in Australia, such as *Aquila audax*.

While undoubtedly doing much damage to useful birds and quadrupeds, the eagles must be allowed some share in the credit of keeping down the 'vermin.' In one case at least, the prey consists in part of serpents. See ERNE; and, for the golden eagle, Macgillivray's *British Birds*.

In Mythology, the eagle usually represents the sun; its beak, its talons, or the whole bird itself, the lightning and the sunbeam. The great mythical eagle of India, the Garuda, is the bearer of the god Vishnu, victorious by his brightness over all demons. In the Scandinavian mythology, the eagle is a gloomy figure assumed by demons of darkness, or by Odin himself, concealed in gloomy night or in wind-swept cloud. The storm-giant Hräswelgr sits in the form of an eagle at the extremity of heaven, and blows blasts of wind over all peoples; and on the great tree Yggdrasil sits an eagle observing everything that happens. When Zeus was preparing for his struggle with the Titans, the eagle brought him a thunderbolt, whereupon the god took the bird for his emblem. He holds the bolts of Zeus in his talons, inspires heroes with courage, and also carries out the tyrannous behests of Zeus, as in tearing at the heart of Prometheus, and carrying off Ganymede from the earth. As an emblem of the immortal gods he becomes also a symbol of abstract immortality and of the human soul ascending after death. From the analogy of the heavenly authority of Zeus, the eagle also became the symbol of earthly power. Ptolemy Soter made it the emblem of the Egyptian kingdom. In the Roman story, an eagle was the herald to Tarquinius of his royal power, and it was one of the most important insignia of the republic, was also assumed by the emperors, and adopted into medieval heraldry after the time of Charlemagne. In the apotheosis of the Roman emperors,

an eagle ascending from a funeral pyre symbolised their reception among the gods. Even in Christian symbolism the eagle has preserved to the present day its significance as the symbol of St John the Evangelist in the lecterns of churches.

As a standard of war the eagle seems first to have been used by the Persians, but the most famous eagles of antiquity were those that so often carried the Romans on to victory. These were made of silver or bronze and with outstretched wings, and were carried before the legions upon long poles, just as the great Napoleon's armies after 1804 carried gilded eagles with outstretched wings in place of banners.

The German imperial eagle was originally one-headed, and was first adopted by Charlemagne as a symbol of his empire after his coronation at Rome in 800. We find it already on the imperial banner in the time of the Emperor Otto II. When it came to be armorially depicted, its blazon was or, an eagle displayed sable, beaked and membered gules. The eagle is occasionally figured as two-headed towards the end of the 13th century, and is so represented on coins of Ludwig the Bavarian in 1325. It has been matter of speculation whether the double head symbolises the eastern and western divisions of the Roman empire or the union of the imperial and the kingly dignity. The eagle continued to be the arms of the Holy Roman Empire to its close. It was first crowned in the 15th century; somewhat later the sword, sceptre, and orb came to be borne in its claws; and on the breast of the eagle were the personal arms of the emperor. In the arms of the present German empire (fig. 1), an eagle (with one head) displayed sable, beaked and membered gules, sustains on its breast a shield containing the arms of Prussia—viz. argent, an eagle displayed sable, crowned, armed, and membered or,

Fig. 1.—German Eagle.

Fig. 2.—Austrian Eagle.

and charged on the breast with the arms of Hohenzollern—viz. quarterly argent and sable, with which is entwined the collar of the order of the Black Eagle. On the head of the imperial eagle rests the imperial crown, from which fall down on both sides golden fillets embellished with arabesques. The Prussian eagle is the original imperial eagle granted as a special mark of honour to the Teutonic knights by the Emperor Frederick II., and retained by them after the double-headed eagle had become the imperial emblem. Austria has preserved the double-headed eagle (fig. 2) of the earlier German empire. Russia assumed in 1472 the double-headed eagle under Ivan III. to signify that the czar sprung from the Greek emperors, who had borne it as a symbol since the partition of the Roman empire. The Russian arms (fig. 3) differ from the Austrian in the eagle's holding only a sceptre in its dexter claw, and being charged with a shield gules, bearing a figure of St George and the dragon. The shield is encircled with the collar of the Russian order of St Andrew, and the wings of the eagle are charged with groups of small shields representing the provinces of the empire. A white crowned eagle in a red field was the shield of the kingdom of Poland; and the United States of America have adopted a dark-brown eagle with outspread wings, having in one of its talons a bundle of arrows, in the other an olive-branch, bearing on its breast a shield whose upper part is blue and under part silver, and crossed by six red vertical bars (fig. 4). In its beak it holds a band with the inscription *E pluribus unum*, surmounted by thirteen stars, the original number of states. In France, the eagle was assumed as his imperial symbol by Napoleon I. (fig. 5), was set aside at his fall,

Fig. 3.—Russian Eagle.

Fig. 4.—The Seal of the United States.

Fig. 5.—French Eagle.

restored by Napoleon III. in 1852, and once more abolished by the republic in 1870. The arms of the French empire may be blazoned azure, an eagle rising and respecting to the sinister, grasping in both his claws a thunderbolt all or.

Eagle, a gold coin of the United States of America, of the value of ten dollars, or over forty-one shillings sterling. The double-eagle is a gold twenty-dollar piece. See DOLLAR.

Eagle, BLACK and RED, Prussian orders. See ORDERS.

Eagle-hawk, a name applied to several eagles of comparatively small size, belonging to the genera Spizaëtus and Morphnus. They are natives of warm climates, and are often very beautiful in form and colour. Some species are adorned with well-developed crests extending backwards from the

Eagle-hawk (*Morphnus guianensis*).

crown of the head. Hence they are sometimes called *Crested Eagles*. The crest is well seen in a species of Morphnus from Guiana. See EAGLE.

Eaglehawk, a mining town of Victoria, Australia, 4½ miles from Sandhurst, and 106 NW. of Melbourne, with both of which it is connected by rail. Much gold has been found here in the quartz lodes with which this hilly district abounds. Pop. 1891) 7645.

Eagle-owl (*Bubo*), a genus of large owls. The familiar disc of feathers round the ear is incomplete above, there is a large free tuft on each side, and the feathers on the legs extend down to the toes. The members of the genus are widely distributed, occurring in most parts of the world except Australia. The largest eagle-owl (*B. maximus*) has a wide range in Europe and Asia. It is a large and powerful bird, said sometimes to cope with the golden eagle, and to prey upon young deer; in length it may measure over two feet; the colour is rusty yellow, varied with brown and black; its voracity is excessive, and has made it an Ishmaelite among birds.

Eagle-owl (*Bubo maximus*).

The loud weird cry has given origin to the German name *Uhu*, and has been the basis of many evil omens and superstitious terrors. Its favourite haunts are desolate and wooded rocky regions. The eagle-owl of America (*B. virginianus*), the Virginian Horned Owl, is somewhat smaller, but very bold and powerful. It carries off with ease almost any inhabitant of the poultry-yard. It is found in almost all parts of America. See OWL.

Eagre. See BORE.

Ealing, a town and parish in Middlesex, 5¾ miles W. of Paddington by rail. It is the birthplace of Huxley. The population of the parish, which includes also Brentford (q.v.), rose from 9828 in 1851 to 15,769 in 1881 and 23,978 in 1891.

Ear. The apparatus of hearing, as it exists in man and the mammalia, is composed of three parts —the external ear, the middle ear or tympanum, and the internal ear or labyrinth.

The *external ear* consists of two portions, the *auricle* or *pinna* (the part popularly recognised as the ear), and the *auditory canal* or *external meatus*.

In man, the auricle, on its outer or more exposed surface, presents various eminences and depressions, resulting from the form of its cartilaginous framework. These have received special anatomical names, to which it is unnecessary to advert further than to mention that the deep capacious central space to which several grooves converge is termed the *concha*, and that the lowest and pendulous portion of the ear is termed the *lobe*. The cartilage forming the basis of the external ear consists of one principal piece, in which there are several fissures, which are filled up by fibrous membrane. Several muscles are described as passing from one part of the auricle to another, but they are so little developed in man that they do not require notice; there are additionally three muscles—the *attollens aurem* (or *superior auris*), the *attrahens aurem* (or *anterior auris*), and the *retrahens aurem* (or *posterior auris*), which pass from adjacent parts of the scalp to the ear, and which, though more developed than the previous group, are of little or no real importance in man (at least in his civilised state), but are of considerable use in many mammals. Their actions are sufficiently indicated by their names.

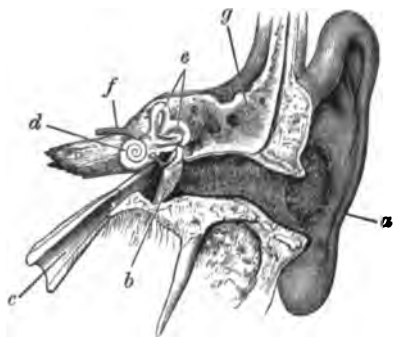


Fig. 1.—Sectional view of the external, middle, and internal Ear, showing the interior of the Auditory Canal, Tympanic Cavity, and Eustachian Tube:
a, the auditory canal; *b*, the tympanum; *c*, the Eustachian tube, leading to the pharynx; *d*, the cochlea; and *e*, the semicircular canals and vestibule, seen on their exterior by the removal of the surrounding bony tissue; *f*, auditory nerve; *g*, temporal bone.

The auditory canal passes from the concha inwards, and a little forwards, for rather more than an inch. It is narrower at the middle than at either extremity; and on this account there is often considerable difficulty in extracting foreign bodies that have been inserted into it. The membrane of the tympanum which terminates it is placed obliquely, in consequence of the lower surface of the meatus being longer than the upper. The canal is partly cartilaginous and partly osseous; the osseous portion consisting in the fœtus of a ring of bone, across which the membrane is stretched, and in many animals remaining persistently as a separate bone. The orifice of the meatus is concealed by a pointed process, which projects from the facial direction over it like a valve, and which is called the *tragus*, probably from being sometimes covered with bristly hair like that of a goat (*tragos*); and it is further defended by an abundance of ceruminous glands, which furnish an adhesive, yellow, and bitter secretion, the cerumen or wax, which entangles small insects, particles of dust, and other small foreign bodies, and prevents their further passage into the meatus.

The *middle ear*, or *cavity of the tympanum*, is a space filled with air which is received from the Pharynx (q.v.) through the Eustachian tube (see fig. 1, *b*, *c*), and traversed by a chain of very small movable bones (fig. 2), which connect the membrane of the tympanum with the internal ear. It lies, as its name implies, between the external meatus and the labyrinth or internal ear, and opens posteriorly into the cells contained in the mastoid portion of the temporal bone, and anteriorly into the Eustachian tube. The cavity is of an irregular shape, and is lined by a very delicate ciliated epithelium, which is a prolongation of that of the pharynx through the Eustachian tube.

Its external wall is in great part formed by the membrane of the tympanum, which is nearly oval, and placed in a direction slanting inwards, so as to form an angle of about 45 degrees with the floor of the auditory canal (see fig. 1). The handle of the

malleus (or hammer), the first of the chain of ossicles (see fig. 2), is firmly attached to the inner side of this membrane in a vertical direction as far downwards as the centre, and by drawing it inwards, renders its external surface concave.

Its internal wall has two openings communicating with the internal ear, each of which is closed by a delicate membrane. These openings are termed, from their respective shapes, the *fenestra ovalis*, and the *fenestra rotunda;* the former leads to the vestibule, and is connected by its membrane with the base of the stapes (or stirrup-bone), the last of the chain of ossicles; while the latter opens into the cochlea.

The ossicles of the tympanum are three—viz. the *malleus*, the *incus* (or anvil), and the *stapes*. We have already explained how the malleus is connected with the membrane of the tympanum by means of its handle. Through this connection, the tension of that membrane may be modified by the agency of a muscle which is attached to this ossicle. This muscle is the *tensor tympani*, which arises from the under surface of the petrous portion of the temporal bone, and is inserted into the handle of the malleus immediately below the commencement of the *processus gracilis*. The mode in which the malleus articulates with the incus is sufficiently explained by the figure. The *incus* much more closely resembles a molar tooth with two fangs than the anvil from which it derives its name. Of the two processes which it gives off (see fig. 2), the short one, *sc*, runs backwards, and is attached to the posterior wall of the tympanum near the entrance to the mastoid cells; while the long one, *lc*, inclines downwards, and terminates in the lenticular or orbicular process, *a*, to which the head of the stapes is attached. The *stapes* is almost sufficiently described by the figure. It has a head, neck, two branches, and a base, which, as has been already mentioned, fits into the *fenestra ovalis*. A minute muscle, the *stapedius*, takes its origin from a hollow conical eminence termed the *pyramid*, which lies behind the *fenestra ovalis*, and is inserted into the neck of the stapes; its function is probably to act as an antagonist to the *tensor tympani*.

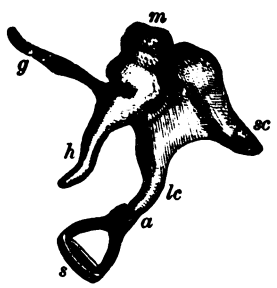


Fig. 2.—Ossicles of the left Ear, as seen from the outside and below:

m, head of the malleus; *g*, the slender process, or *processus gracilis;* *h*, the manubrium or handle; *sc*, the short crus, and *lc*, the long crus of the incus; *a*, the position of the lenticular process, through the medium of which it articulates with the head of the stapes; *s*, the base of the stapes. Magnified three diameters.

The Eustachian tube, into which the tympanic cavity opens anteriorly, is about an inch and a half in length, and passes downwards, forwards, and inwards to its opening in the pharynx. It is partly osseous, but chiefly cartilaginous. Its chief use is to allow the free passage of air in and out of the tympanum.

The *internal ear* or *labyrinth* is the essential part of the organ of hearing, being the portion to which the ultimate filaments of the auditory nerve (see BRAIN, NERVOUS SYSTEM) are distributed. It is composed of three parts—viz. the *vestibule*, the *semicircular canals*, and the *cochlea*, which form a series of cavities presenting a very complicated arrangement, and lying imbedded in the hardest part of the petrous portion of the temporal bone. They communicate externally with the tympanum by the two openings already described—the *fenestra ovalis*, and the *fenestra rotunda;* and internally with the internal auditory canal, which conveys the auditory nerve from the cranial cavity to the internal ear. The very dense bone immediately bounding these cavities is termed the *osseous labyrinth*, to distinguish it from the *membranous labyrinth*, which lies within a portion of it.

The *vestibule* is a common central cavity into which the semicircular canals and the cochlea open (see fig. 3, V). It is about a fifth of an inch in height and in length from before backwards, its transverse diameter (from side to side) being somewhat less. On its posterior wall are five orifices

Fig. 3.—Interior of the Osseous Labyrinth:

V, vestibule; *av*, aqueduct of the vestibule; *r*, maculæ cribrosæ; S, semicircular canals; *s*, superior; *p*, posterior; *i*, inferior; *a*, *a*, *a*, the ampullar extremity of each; C, the cochlea; *sv*, osseous zone of the lamina spiralis, above which is the scala vestibuli, communicating with the vestibule; *st*, scala tympani, below the spiral lamina. Magnified 3½ diameters.

for the semicircular canals, one of the orifices being common to two of the canals. Anteriorly, the cochlea enters it by a single opening, partially divided by an osseous partition—the *lamina spiralis ossea*. On its outer wall is the *fenestra ovalis*, and on its inner are the *maculæ cribrosæ*, containing several minute orifices for the entrance of filaments of the auditory nerve.

The *semicircular canals* are three in number, and open into the vestibule by means of five orifices, the two vertical canals having at their non-ampullate extremities a common orifice. They vary in length, and notwithstanding their name, each is considerably more than a semicircle, the superior vertical canal being the longest. The average diameter is about a twentieth of an inch, one extremity of each canal exhibiting a dilatation or *ampulla*. Each canal lies in a different plane, very nearly at right angles to the planes of the other two, hence their names of the *superior vertical*, the *inferior vertical*, and the *horizontal* canals.

The *cochlea*, which derives its name from its resemblance to a common snail-shell, forms the anterior portion of the labyrinth. It consists of an osseous and gradually tapering canal, about an inch and a half in length, which makes two turns and a half spirally around a central axis, termed the *modiolus*, which is perforated at its base for the entrance of the filaments of the cochlear portion of the auditory nerve. This spiral canal gradually diminishes towards the apex of the cochlea. At its base it presents an opening into the vestibule, partially divided into two. In

the recent state, one of these openings (*scala tympani*) does not communicate with the vestibule, but is closed by the membrane of the *fenestra rotunda*. Its interior is subdivided into two passages (*scalæ*) by an osseous lamina. This is the *lamina spiralis*, which incompletely divides the cochlea into an upper passage, the *scala vestibuli*, and a lower one, the *scala tympani*—i.e. the division is incomplete so far as the skeleton goes, but is completed during life by soft parts afterwards to be described. At the apex these two passages communicate by an opening to which the term *helicotrema* has been applied.

We now return to the *membranous labyrinth*. The membranous and osseous labyrinths have the same shape, but the former is considerably smaller than the latter, a fluid, termed the *perilymph*, intervening in some quantity between them. At certain points recent investigations have shown that the membranous is firmly adherent to the inner surface of the osseous labyrinth. The vestibular portion consists of two sacs, an upper and larger one, of an oval shape, termed the *utriculus*, and a lower and smaller one, of a globular shape, called the *sacculus*. The membranous semicircular canals resemble in form and arrangement the osseous canals which inclose them, but are only one-third of the diameter of the latter.

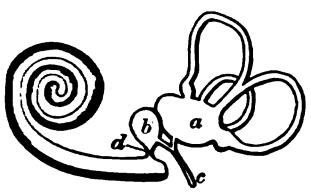


Fig. 4.—Scheme of Mammalian Labyrinth:

a, utricle; *b*, saccule; *c*, aquæductus vestibuli, dividing into two branches, going to saccule and utricle respectively; *d*, canalis or ductus reuniens.

It will be remembered that the osseous structure of the cochlea is that of a tube almost but not quite divided into two by the lamina spiralis ossea. The division is completed by the lamina spiralis membranacea (or basilar membrane). From near the junction of the osseous with the membranous lamina springs the membrane of Reissner, which, stretching across to the wall of the osseous cochlea, shuts off a third space known as the *ductus cochleæ*. The cochlear duct terminates blindly at both ends, but near its lower extremity is connected with the saccule through a delicate membranous channel known as the *ductus reuniens*. Upon the basilar membrane is situated the organ of Corti, which consists of the following parts (to name only those of most importance) from within outwards: (1) a single row of so-called inner hair-cells; (2) the two rods of Corti (known as inner and outer); (3) four or five rows of outer hair-cells. These are again protected by the curtain-like *membrana tectatoria*.

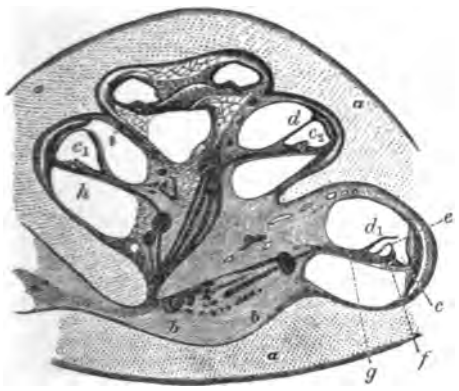


Fig. 5.—Section through the Cochlea of a Human Embryo:

a, *a*, *a*, cartilage, which afterwards ossifies; *b*, *b*, tissue, which afterwards becomes the modiolus; c–c_2, duct of the cochlea; *d*, d_1, membrane of Reissner; *e*, membrana tectatoria, rather elevated from its proper position; *f*, position afterwards occupied by organ of Corti; *g*, lamina spiralis; *h*, scala tympani; *i*, scala vestibuli.

The auditory nerve leaves the medulla oblongata together with the facial, and passing into the internal auditory meatus, divides into two branches, which pass respectively to the vestibule and the cochlea. The former ends in a peculiarly modified epithelium with projecting processes situated in the ampullæ of the semicircular canals and on certain spots within the saccule and utricle, known as the *maculæ acusticæ*. In the latter situation are also found small crystalline bodies, called otoliths, which are suspended around the maculæ: by exactly what means this suspension is effected is at present unknown. The cochlear branch of the auditory nerve probably terminates in the inner and outer hair-cells of the organ of Corti (see fig. 6). The saccule and utricle communicate with each other and with the interior of the skull through the *aquæductus vestibuli*, while the *aquæductus cochleæ* connects the perilymph of the scala tympani with the arachnoid space.

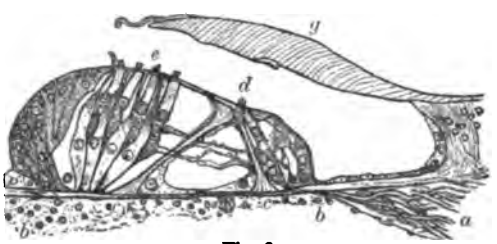


Fig. 6.

a, lamina spiralis ossea, with nerve bundles from cochlear nerve; *b*, *b*, lamina spiralis membranacea; *c*, inner rod or pillar of Corti; c_1, outer rod or pillar of Corti; *d*, inner hair-cell; *e*, outer hair-cells; *f*, nerve fibres; *g*, membrana tectatoria.

PHYSIOLOGY.—(1) *Of the External Ear.*—A true auricle only exists in the mammalia, and in this class it varies from little more than an irregularly shaped cartilaginous disc with little or no motion, as in man and the quadrumana, to an elongated funnel-shaped ear-trumpet movable in all directions by numerous large muscles, as in the horse, the ass, and the bat. The mode in which we see it employed by those animals in which it is highly developed sufficiently indicates that its main function is to collect and concentrate the sounds which fall upon it. But the experimental investigations of Savart, with an apparatus constructed to resemble the tympanic membrane and the external auditory apparatus, show that these parts are also adapted to enter into vibrations in unison with those of the air; and he suggested that the human auricle, by the various directions of different parts of its surface, could always present to the air a certain number of parts whose direction is at right angles with that of the molecular movement of the air, and therefore is the most favourable position for having the vibrations communicated.

(2) *Of the Tympanum and its Contents.*—Savart's experiments show that the membrane of the tympanum is thrown into vibration by the air, and that it always executes vibrations equal in number to those of the sonorous body which excites the oscillations in the air. He further ascertained that

the malleus participates in the oscillations of the tympanic membrane, and that these vibrations are propagated to the incus and stapes, and thus to the membrane of the *fenestra ovalis*. The malleus has further the office of regulating, through the *tensor tympani* muscle, the tension of the tympanic membrane; and to allow of the motion necessary for this purpose, we find movable joints between it and the incus, and again between the latter bone and the stapes. The contraction of the stapedius muscle similarly modifies the tension of the membrane of the *fenestra ovalis;* and as compression or the reverse exercised on this membrane extends to the perilymph, and is propagated through it to the *fenestra rotunda*, the tension of the membrane of the latter opening is also influenced by the muscle in question. The incus is much more limited in its motions than either of the other bones, and its use seems to be to complete the chain of ossicles in such a manner as to prevent any sudden or violent tension of the membranes, such as we can easily conceive might occur if the conductor between the membranes were a single bone. The presence of air in the tympanic cavity serves a double purpose: in the first place, it preserves a uniform temperature on the outer surfaces of the fenestral membranes, and thus supports a fixed elasticity in them, which would not be the case if they were freely exposed to ordinary atmospheric changes; and secondly, the action of the chain of ossicles as conductors of sound is materially increased by their being completely surrounded by air, as is obvious from the first principles of acoustics; further, were it not for the presence of air within the tympanum, the drum membrane would be arched inwards, and the resulting displacement and change of tension would produce deafness.

(3) *Of the Labyrinth.*—Sonorous vibrations may be conducted to the labyrinth through the bones of the skull; but during the ordinary act of hearing, the movements of the tympanic membrane are propagated through the chain of ossicles and the labyrinth, and thus perceived by the auditory nerve. A considerable amount of mystery surrounds the functions of the saccule and utricle; indeed, on this subject so little is at present accurately known that no good purpose would be served by discussing it further. The view, until recently accepted, that these parts were concerned in the perception of sounds as distinguished from tones (i.e. notes), has been rendered doubtful by recent researches.

The semicircular canals have been of late years made objects of study by many physiologists. It has now been conclusively demonstrated that they are intimately associated with the maintenance of the body in the erect position. Injury of a semicircular canal tends to produce rotatory movements of the body and eyes, and it has therefore been suggested that the functions of these organs may be connected with the reflex act of listening, as exemplified in the lower animals by pricking the ears and rotation of the head. From experiments on animals, and observations on the human subject in disease, it has now been proved that a lesion of the semicircular canals is followed by giddiness or vertigo, which manifests itself either in involuntary falling, rotation, or in a subjective condition, during the continuance of which surrounding objects seem to revolve round the patient. It is generally believed by physiologists that the cochlea has the special function of analysing sounds. It has been found that the basilar membrane is not equally broad throughout, but that it increases gradually from base to apex. It therefore presents a series of strings of different lengths, and the short ones are assumed to vibrate in the perception of high notes, while the long ones are stimulated to motion by low tones. The lower part of the cochlea is therefore chiefly concerned in the perception of sounds of high pitch, while the upper parts respond to those of low pitch. Some observers, however, do not accept this view—e.g. Voltolini and Rutherford, but believe that sounds are analysed in the auditory centre, which, according to the investigations of Munk and Ferrier, is located in the temporal lobe. For the hearing of birds, reptiles, &c., see BIRD, REPTILES, &c.

THE DISEASES OF THE EAR.—It is manifestly impossible to attempt any account of the various individual ear diseases in an article like the present. Since aural surgery has become an exact science, the medical profession have come to realise that such phrases as a 'cure for deafness,' or a 'treatment for earache,' are not only inexact but absurd. Deafness—varying in degree from a slight impairment of hearing up to total inability to perceive sounds—may be due to a great variety of causes, and any of these causes may produce not only deafness, but noises in the head. Thus the auditory canal may be blocked by wax, the products of skin eruptions affecting its lining membrane, tumours, masses of fungus, the results of inflammation, &c. The tympanic membrane may be displaced or thickened, the ossicles may be impeded in their movements by the presence of exudation, or by fibrous adhesions or swelling of the mucous membrane within the tympanum. Then again these parts may be injured either by disease or by violence. The auditory nerve may be affected in any part of its course from the auditory centre to the labyrinth, and thus deafness may result. We have only indicated some of the pathological causes of impaired hearing, but enough has been said to show that before deafness can be prescribed for with any hope of success, an examination of the ear must be made by a competent medical man.

Turning now to earache, let us consider some of its causes. Sometimes it is due to the presence of boils in the auditory canal, or the whole lining membrane of the passage, including the outer layer of the membrana tympani, may become inflamed. Perhaps the most common cause of earache is inflammation of the drum-cavity. Such inflammation often stops before the inflammatory products have taken on a purulent character. This mild form is very common in children, and often sows the seeds of deafness in after-life if appropriate treatment be not applied. Occasionally earache is altogether due to the presence of a diseased tooth, which need not necessarily be tender or painful. By far the most dangerous form, however, is that which arises in connection with a so-called 'running ear.' The general meaning of this symptom in such cases is an accumulation of decomposing matter and sometimes diseased bone in close proximity to the brain, and a fatal result is by no means uncommon. Vertigo, or giddiness, is a very frequent symptom of ear disease, and can often be relieved or cured by attention to this organ.

A feeling of fullness in the head, and disinclination for mental effort, is far from uncommon. Rarer or less important symptoms of aural affections are (1) anomalies of taste, owing to involvement of the chorda tympani nerve on its way through the drum-cavity; (2) paroxysmal cough and sneezing; (3) neuralgia of the head; and (4) epilepsy; the last named being fortunately extremely uncommon. We should not be justified in omitting to mention that nasal diseases, especially in children, are often the causes of deafness. This is all the more important, because such cases when taken early can almost always be cured.

From what has been said, it will be obvious that any remarks we could, without unduly extending

this article, make with regard to treatment would be useless. We feel it, however, to be our duty to warn those who suffer from ear disease from consulting unqualified quacks. This resort to empirics is all the more uncalled for as there are now numbers of respectable highly-qualified practitioners who devote attention to aural maladies.

There are, however, a few points of general interest and of great importance which may be touched upon.

It is a common delusion that it is a dangerous thing to cure a discharge from the ear. Now this is by no means true; indeed it may be at once stated that life is never safe so long as a chronic putrid discharge issues from the ear. In all such cases it is not only safe but necessary to syringe the meatus with a warm disinfecting solution, such as boracic lotion, or water to which some Condy's fluid has been added. The ear should then be dried by carefully introducing a wick of absorbent cotton-wool. The origin of the superstition anent the danger of stopping a discharge is easily explained. If the putrid matter be present, it is better that it should find its way out. Now, if in such a case some physical obstacle prevents its exit, a fatal result is apt to supervene. It had thus been noticed that in many cases the 'running from the ear' stopped before dangerous symptoms set in, and hence the delusion. Another point as to which much misapprehension exists, is the danger caused by the presence of a foreign body in the ear. It has been observed by a noted specialist that 'the point of a dagger in the meatus is less likely to do harm than unskilled efforts to remove it.' No endeavour should ever be made to remove a foreign body which is not seen, and all probing in the dark is to be absolutely avoided. Most extraneous objects can be removed simply by means of warm water and a syringe used by a skilled hand. If the object be a pea, bean, or any other body which is likely to swell from absorbing moisture, it is better not even to attempt syringing, and to wait until skilled advice can be obtained.

Should an insect get into the ear, it can almost invariably be syringed out with warm water, or if a syringe be not at hand, the ear may be filled with warm oil or even water.

Deafness occasionally runs in families, and the symptom is then usually due to chronic thickening of the tympanic structures. Persons in whom this hereditary tendency exists should, on the first indication of ear trouble, seek advice.

It need hardly be said that picking the ears ought to be avoided. This habit may lead to the 'ear pick' being driven through the drum membrane. Should the ear be made to bleed, and should there be any doubt as to whether the drum membrane be wounded, scrupulous care should be taken to prevent the entrance of fluid. If the tympanic membrane be accidentally perforated, syringing, or instilling ear drops is almost certain to be followed by inflammation. After fifty the hearing tends to fall off a little, but except possibly in extreme old age, marked deafness for conversation is always abnormal. It is a curious fact that elderly people who require a watch to be put quite close to the ear, can often hear conversation well. This is explained by the fact that after middle life the auditory nerve is less sensitive, and the power of readily perceiving high-pitched tones is then less acute.

According to the writer's experience, almost complete deafness in one ear, while the other is perfect, does not necessarily endanger the sound organ. Others, however, take the opposite view. It must be remembered that in most cases, impairment of hearing is bilateral, and this is always the case when deaf persons have to be addressed in an elevated voice.

The instruction and training of children who have been born deaf is dealt with in the article DEAF AND DUMB.

EAR-TRUMPETS, &c.—The number of ear-trumpets now advertised makes any detailed account of them impossible. The application of one of three principles exists in most, if not all, to wit: (1) a tube with a suitable ear-piece at one extremity, and a more or less conical mouthpiece at the other; (2) a bell-shaped sound-collector, with an ear-piece for insertion into the auditory canal; (3) appliances for tilting the auricle forwards. There can be no doubt that a person who desires to purchase an ear-trumpet will best gain his end by carefully testing a large number of instruments, and choosing that which suits him best.

As a rule small invisible instruments are useless. Politzer has constructed a small tube made of vulcanite and flesh-tinted, the object of which is to prolong the tragus backwards; in a very few cases this is found to be an exception to the above rule. The same authority has attempted, by a special appliance, to conduct the vibrations of the auricle directly to the tympanic membrane. The Audiphone (q.v.) and dentiphone are only useful in a few cases; in both the object is to convey sonorous vibrations through the teeth and the auditory nerve. The so-called fonifero is a rod for connecting the larynx of the speaker with the teeth of the auditor. In some cases—those in which the drum membrane is destroyed—the introduction of an artificial drum is useful. This fact has been taken advantage of by unscrupulous quacks, who sell for several pounds an appliance not differing in its essentials from 'Toynbee's artificial tympanum,' which can be had for a shilling or two.

Ear-cockles. See WHEAT.

Earl, a title of nobility now the third in the peerage of the United Kingdom. Among the northern races of Europe a *jarl* or *eorl* was one of the noble class, as opposed to the *ceorl*, who was the mere freeman (see also THANE). Of the noble class, a certain number, under the name of *ealdormen*, were made governors and judges over particular districts, and were sometimes designed in Latin phraseology *comites*, sometimes *duces*. William the Conqueror rewarded his chief followers by granting them the lands and also the offices of the Saxon nobles. The office of ealdorman, so long as Norman-French continued to be spoken in England, was, as on the Continent, called *count*, and its holder was considered the *comes* of the sovereign (see COUNT); and though the designation earl was afterwards reintroduced, the French term continued to give a name to the district (county) over which the earl presided, and the title of countess to his wife. After, as before the Conquest, each earl, besides having supreme authority under the crown in his own county, had a fixed revenue from it, consisting of the third penny of the pleas. When Geoffroy de Mandeville was made Earl of Essex, the Empress Maud, besides giving him and his heirs the third penny of the shrievalty of the pleas as an earl ought to have within his county, made him and his heirs in direct terms 'hereditabiliter' earls of Essex. In other cases, however, down to the reign of King John, an earl was so constituted by a grant of the third penny of the pleas, of which the earldom was assumed to be a pertinent, the words being added, '*unde comes est*,' or '*ut sit inde comes*;' and the newly-created earl was invested with his dignity by girding on the sword, a ceremony which was a survival from Saxon times.

William the Conqueror, by making earldoms hereditary, probably took the first step to convert a title of office into one of dignity. Deputies, *vice-*

comites, or sheriffs had necessarily to be appointed when the earl was a minor, or otherwise incapacitated from discharging his duties, and by degrees the office itself passed to the deputy. In the reign of King John a fixed sum, payable from the profits of the county, began to take the place of the third penny, and the words '*unde comes est*' were supplanted by the words '*sub nomine comitis*,' showing that the official power had ceased, and the dignity only survived. In the reign of Edward III. earldoms began to be created by charter or patent, certain lordships or lands being generally erected into a *comitatus* to descend with the newly-created dignity. But the girding on of the sword as a solemnity of investiture still continued, to which the imposition of a cap of dignity or golden circlet was added in the reign of Edward VI. In 1615 these ceremonies were declared unnecessary, and in the reign of Queen Anne it became the practice to insert a clause in patents expressly dispensing with them.

Until late in the reign of Edward III. earldoms were limited by the charters constituting them to heirs-general, and an heir-female often succeeded, her husband generally obtaining the title of earl; but in the case of more co-heirs than one, the lands were divided, and the dignity, which could not subsist without them, reverted to the crown. So inseparable at that period were the lands from the dignity, that there seem to be one or two instances where the title was taken away on the ground of poverty. But in fact the will of the crown at times diverted the succession from its regular channel, and occasionally the rights of the heir were suspended for a time and then recognised.

Towards the end of the 14th century it became the rule for patents of earldom to be limited to the heirs-male of the body of the grantee, the title on their failure merging in the crown; and there are a few occasional instances of the dignity being conferred for life. The title of countess, more than any other degree in the peerage, has from time to time been conferred for life on females. The idea of earls being territorial officers has been so entirely departed from that the designation bestowed on them is occasionally (as in the case of Earls Grey, Nelson, Spencer, Russell, and Cairns) their own surname with the prefix earl.

In Scotland the earl was the successor of the Celtic *mormaer* or great steward, who was first a tributary king, and afterwards a hereditary judicial officer placed over a certain territory. In the reigns of Alexander I. and David I. the mormaers gradually assumed the title of earls or comites, while vice-comites or sheriffs were appointed, who, if they did not at once supersede them, at least exercised a concurrent jurisdiction with them. Seven earls are enumerated by their names, not titles, in the foundation charter of the abbey of Scone in 1114; and during the 12th century there existed a body called the Seven Earls, with whose sanction the king acted. With the introduction of feudalism, the earls passed into the position of feudal lords, holding the lands with which their connection had at first been judicial as an earldom of the crown. The creation of additional earldoms formed a part of the feudalising process; and though the earldoms continued to be spoken of as seven, those enumerated were not always the same. The coronation of Alexander II. (1214) is the latest date at which the earls are specified as seven in number; and their functions as advisers of the sovereign were afterwards merged in those of the 'communitas.'

Earldoms continued territorial much longer in Scotland than in England. From the beginning of the feudal period down nearly to the 17th century, the title was usually conferred by the erection of certain lands into an earldom, the charter but rarely making specific mention of the dignity of earl. In 1578 the practice first became general of introducing the title of earl into the charter; and from that date till 1600 half the charters of earldom in the Register of the Great Seal (they are eighteen in all) make special mention of it. Patents of the dignity of earl after the English fashion were first introduced in 1600, the earliest being that of the Earl of Winton. The older earldoms, like lands and other heritable subjects, passed to heirs of line; and in the case of co-heirs the lands were divided, the dignity with the principal messuage passing to the eldest. The husband of a countess was often, though not always, designed by the courtesy title of earl.

In 1889 there were in the peerage of the United Kingdom one hundred and twenty earls, with one countess in her own right; there were forty-four earls in the peerage of Scotland; and sixty-four earls in the peerage of Ireland. For the coronet of an earl, see CORONET. His mantle is scarlet with three doublings of ermine. He is styled the 'Right Honourable,' and in formal documents the sovereign usually designs any peer of the degree of an earl as 'Our trusty and well-beloved Cousin,' an appellation which originated in the reign of Henry IV., who was either by descent or alliance related to every earl in the kingdom. An earl's eldest son takes as a Courtesy Title (q.v.) one of his father's inferior titles. The younger sons take 'The Honourable,' with Christian name and surname added, and the daughters 'Lady,' with Christian name and surname. See ADDRESS (FORMS OF).

Earle, WILLIAM, major-general, was born in Liverpool in 1833, entered the army in 1851, and served through the Crimea; he held several staff appointments abroad, and was military secretary to the governor-general of India in 1872–76. Promoted major-general in 1880, he commanded the garrison of Alexandria in 1882–84, and led a column of the Gordon rescue expedition, which was detached to punish the tribes who had murdered Colonel Stewart and Mr Power. The murderers' village was burned, and on February 10, 1885, the intrenched positions occupied by a strong force of Arabs at Kirbekan were successfully carried; but, while leading on his men, Earle was shot in the forehead and instantly killed. His body was brought back to England, where a fine statue has been erected in his native town.

Earl Marshal. See MARSHAL.

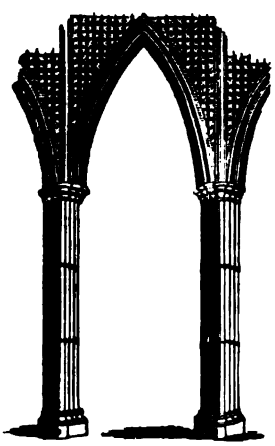
Earlom, RICHARD, mezzotint engraver, born in London in 1743, was a pupil of Cipriani, and early began his art under the patronage of Boydell. He engraved over sixty plates, which were very popular, and are still highly esteemed by collectors. He died in 1822. Among his works was a fine series of prints from the originals of Claude Lorraine's *Liber Veritatis*.

Earlston, or ERCILDOUNE, a village of Berwickshire, 4 miles NNE. of Melrose, with a railway station and manufactures of ginghams, woollens, &c. Between it and Leader Water is a fragment of the 'Rhymer's Tower,' the traditional abode of Thomas the Rhymer (q.v.); whilst one mile south is Cowdenknowes, with its 'bonny broom.' Pop. 1010.

Early, JUBAL ANDERSON, Confederate general, was born in Virginia in 1816, graduated at West Point, and served in the Florida and Mexican wars. During most of the years 1838–61, however, he practised law in his native state. On the outbreak of the civil war he entered the Confederate service as a colonel, and commanded a brigade at Bull Run, and a division at Fredericksburg and Gettysburg. In 1864, after some successes, he was

defeated by Sheridan in several battles; and, Custer having also routed him at Waynesboro in March 1865, he was relieved of his command a few days later. He subsequently returned to the practice of law. Died March 2, 1894.

Early English, the term generally applied to the form of Gothic in which the pointed arch was first employed in Britain. The Early English succeeded the Norman towards the end of the 12th century, and merged into the Decorated (q.v.) at the end of the 13th. Its characteristics are beautiful and peculiar. Retaining much of the strength and solidity of the earlier style, it exhibited the graceful forms without the redundancy of ornament which latterly degenerated into a fault in the Decorated. Generally, it may be said to bear to the Decorated something like the relation which an expanding rosebud bears to a full-blown rose. The pointed arch was introduced in the 12th century in the north of France, when it was found convenient in enabling the cross vaulting of oblong spaces to be carried out, so that the ridges of the groins might all be kept at the same height. The wall ribs being pointed, led to the windows within them being made of the same form, and thus the pointed arch came to be gradually adopted in all the wall openings. The windows are long and narrow, and are often acutely pointed, when they are called lancet windows. When gathered into a group, they are frequently surmounted by a large arch, which springs from the extreme mouldings of the window on each side. The space between this arch and the tops of the windows is often pierced with circles, or with trefoils or quatrefoils, which by degrees led to the development of tracery. Each window, however, is generally destitute of any tracery in itself. 'The mouldings,' says Parker, 'in general consist of alternate rounds and deeply-cut hollows, with a small admixture of fillets, producing a strong effect of light and shadow.'—*Glossary of Architecture.* From the same work we borrow the accompanying illustration of two very beautiful piers, surmounted by a lancet-shaped arch, and decorated in the manner peculiar to the style. They are from Westminster Abbey. Circular windows are much used, and trifoliated archways over doors are also to be found, as at Salisbury Cathedral. By far the most characteristic decoration of the style is the Tooth-ornament (q.v.), which is often used in great profusion. Where foliage is used, it is conventionally treated and cut with great boldness, so as to throw deep shadows, and produce a very fine effect. The under-cutting is often so deep as to leave nothing to connect the leaves with the mouldings but the stalks, and occasionally the edge or point of a leaf. The caps of the columns are often composed of mouldings only, and are circular in plan, both of which features distinguish Early English from the Early Pointed style of France. The buttresses are more prominent than in the Norman style, and pinnacles and flying buttresses are introduced. The term Early English is said to have been introduced by Mr Millers in 1805. It corresponds to *Ogivale primitive* of French writers, and is very often known as the First Pointed or lancet-arched amongst ourselves. See GOTHIC ARCHITECTURE.



Early English Piers and Arch.

Earn, a river and loch in the south of Perthshire, in the finely-wooded, beautiful valley of Strathearn. Loch Earn lies to the north of Ben Voirlich; its eastern extremity is 24 miles west of Perth. Lying 306 feet above sea-level, it is 6½ miles long from east to west, from a half mile to nearly a mile broad, and 600 feet deep; it is surrounded by bold and rugged hills. The river Earn flows east from the loch 46 miles through the strath, past Comrie, Crieff, and Bridge of Earn, into the estuary of the Tay, 7 miles south-east of Perth. Its waters contain salmon, trout, perch, and pike.—The Bridge of Earn, a much frequented village, stands on the right bank of the river, 4 miles SSE. of Perth, and near the saline springs of Pitcaithly.

Earnest (in Scotland, ARLES) is a sum of money given in token that the parties to a bargain are in earnest (though 'earnest' in this sense is etymologically distinct), and mean their agreement to be binding. The contracts in which earnest is most frequently given are sale and service. Earnest is not the same as part payment; it is something given 'to bind the bargain;' whereas it is plain that there can be no part payment until the bargain is concluded. It is also necessary to distinguish between 'dead earnest'—i.e. some small gift or payment made by way of evidence of the bargain, and the payment of a sum to be deducted from the price if the bargain is completed, to be forfeited by the purchaser if he fails to complete. For the English law on this subject, see Benjamin on *Sale;* for the Scotch law, Erskine's *Institutes.* The term 'earnest' is sometimes used to include the symbolical acts of hand-shaking, thumb-licking, &c., by which, in various countries, consent to a bargain is or has been signified.

Ear-ring, a ring suspended from the ear, which is bored for the purpose, a mode of adorning the person which has always been practised by Orientals, by both sexes among the Persians, Babylonians, Lydians, Libyans, and Carthaginians. They were always worn by the Greek women, from Hera in the *Iliad* down to the Venus de Medici, whose ears are pierced for the reception of ear-rings. Pliny tells us that there was no part of dress on which greater expense was lavished amongst the Romans. Many Egyptian ear-rings of very beautiful design have been preserved, and these antique designs have often been imitated in modern times. During the reigns of Elizabeth and James I., ear-rings were worn in England by men, a custom which is still continued by many sailors. Otherwise, at the present day in England and the United States they are worn only by women. The ears are bored usually at about seven years of age. The boring is still popularly believed to be a valuable remedy in cases of sore eyes, by producing counter-irritation. This idea, however, is without satisfactory evidence in its support, and certainly there are much more efficient and beneficial methods of producing the desired effect.

Ear-shell. See HALIOTIS.

Earth is the name applied to the third planet in order from the sun. This planet is of unique importance as the dwelling-place of man, and is the only portion of the universe of which we have direct knowledge. Like other members of the solar system, the earth revolves in an elliptical orbit round the sun in a definite plane termed the plane of the Ecliptic (q.v.). The mean distance of the earth from the sun has been calculated from the Transit of Venus observations in 1874 and 1882 as 92,800,000 miles. The minimum distance,

attained in December, is 91,250,000, and the maximum in June, 94,500,000, the difference, or 3,250,000 miles, is the eccentricity of the earth's orbit or the extent of its departure from a circle. The earth is accompanied by one satellite, the moon, at a mean distance of 238,800 miles.

Figure of the Earth.—It was anciently believed that the earth was a flat disc of land (see PTOLEMAIC SYSTEM), surrounded by a great world-river (Oceanus), but the theory of a flat earth has been abandoned by all but a few fanatics. The earth's figure may be popularly said to be that of a ball; many irregularities in form make it impossible to speak of it strictly as a sphere or even a spheroid. In consequence of the dip of the horizon, the field of view—the boundary line of which is a circle in all parts of the earth—becomes wider as the height of the observer increases. On a wide, smooth surface also, such as the sea or a great plain, the upper part of a distant receding object remains in sight when the lower part has disappeared. These facts, being verified experimentally in innumerable places scattered over the earth's surface, can only be explained on the assumption that the earth is like a ball. On travelling northwards or southwards from any place, the position of the stars, their daily path in the heavens, and the time of rising and setting are altered; and new stars, altogether invisible before, come into view as the traveller proceeds. This also can be explained only by the rotundity of the earth. The most convincing proof to the popular mind is, however, that the earth has been circumnavigated by vessels steering always in the same general direction.

If the earth were a sphere or perfect ball, the arc of the surface subtending an angle of 1° at the earth's centre would be equal in every part of the circumference. The angle in degrees subtended by any arc of a meridian can readily be found astronomically (see LATITUDE), and the length of this arc in ordinary lineal units such as feet or yards can be accurately measured (see GEODESY). This has been done in several places, and the result (see DEGREE) shows that towards the north and the south the degree becomes longer than it is near the equator. It results that the earth is flattened somewhat at the poles and projects in the equatorial region. Delicate experiments at sea-level by means of the spring-balance or the pendulum show that the force of Gravitation (q.v.) is greater in high than in low latitudes. A standard mass weighed in a spring-balance is heavier in Greenland than in Brazil, even after making the necessary correction for the result of centrifugal force (see CENTRE). Since the mass of the two attracting bodies remains the same, their centres must be nearer at the station where the weight is greater—i.e. the polar regions must be flattened so as to lie nearer the earth's centre than is the equator. The extent of the flattening is such that the polar diameter is approximately $\frac{1}{289}$ shorter than the mean equatorial diameter, a deviation from the form of a sphere far too slight to be detected by sight or touch in any model which is small enough to be seen at one view. Accurate measurements of degrees of longitude in tropical regions indicate that the equator is not a circle, as it would be if the earth's figure were that of an oblate spheroid, but an ellipse of very slight eccentricity (estimated by some calculators as $\frac{1}{10000}$, by others with more probability as $\frac{1}{4000}$), the longer diameter running from about the meridian of Ireland to that of New Zealand.

The earth's surface is ridged and wrinkled with innumerable irregularities, so that the simile of an orange with its slightly corrugated rind, its flattened poles, and slightly irregular equator gives a very fair idea of the form, which is termed in geometry a *geoid*. All measurements of the earth's surface are hampered by the uncertainty of level; 'sea-level' being far from uniform in all places (see CONTINENT).

Dimensions.—Supposing the earth to be an oblate spheroid or ellipsoid of revolution, its polar or shortest diameter has been determined as 7899·6 miles, sufficiently near the value of 500 million inches to be conveniently remembered. The longer, or equatorial mean diameter is 7926·6 miles, a difference of 27 miles or $\frac{1}{293}$ of the mean diameter. The vertical distance between the greatest natural height and hollow (Mount Everest, and a point in Tuscarora Deep, east of the Kurile Islands) amounts to 11 miles, or $\frac{1}{715}$ of the mean diameter.

The meridional circumference of the earth is 24,856 miles, and the Metre (q.v.) was intended to be $\frac{1}{40000000}$ of this distance, though really made somewhat shorter. The circumference at the equator is 24,899 miles, and this is the longest distance which can possibly be travelled in a direct line over the surface. The total area of the earth's surface calculated from these dimensions is 197 million square miles, and the corresponding volume 260,000 million cubic miles.

Mass of the Earth.—The problem of measuring the mass or amount of matter in the earth is one of peculiar interest. The usual mode of measuring mass is by means of weight or the attraction of the earth on bodies, and this method is of course inapplicable in determining the mass of the earth itself. The method that is employed is to compare the attraction of gravity between two known masses, and between one of these masses and the whole earth. The simplest method of doing so is by observing the deviation from the vertical of a plumb-line near an isolated mountain. The volume of the mountain has first to be found by accurate survey, and its density calculated from the geological structure and the density of its component rocks. Observations have been successively made with great precautions on Chimborazo, on Schiehallion (q.v.), and on Arthur's Seat, and the results are fairly concordant. Sir George Airy in 1854 made a series of experiments in the Harton coal-pit at South Shields, taking advantage of another principle. The rate of vibration of a pendulum at the surface depends on the attraction of the earth as a whole; but at the bottom of a shaft the same pendulum will vibrate at a different rate for two reasons: (1) faster, because it is nearer the centre; (2) slower, as the attracting mass is less. The spheroidal skin of the earth's crust equal in thickness to the depth of the shaft ceases to exert any influence, and the force of gravity due to this spheroidal shell is the difference between the force measured by the vibration of the pendulum at the surface and that at the bottom of the mine. If then the mean density (and hence the mass) of this spheroidal skin can be ascertained, the problem would be solved; but this it is impossible to do in a satisfactory way, and so the experiment is vitiated, and the results compare badly with other methods. Professor Tait has pointed out that an excellent opportunity of making an experiment of a similar kind is afforded on the shores of estuaries where there is a high rise of tide—e.g. the Bay of Fundy. It would be easy to estimate the gravitational influence exerted by the alternate piling up and clearing away of a readily calculated mass of water.

The most satisfactory method of finding the mass of the earth is that suggested originally by Michel, but carried out carefully by Cavendish, and hence known as the 'Cavendish Experiment.' It consists of measuring very accurately the minute attraction exerted by two large spheres of metal on

two much smaller metal balls fixed to the extremities of a light lever which is suspended by a wire. The slight attraction of the large spheres is measured by the Torsion Balance (q.v.), of which the smaller balls form part, and the distance of the attracting bodies is known. Hence, making the proper allowance for distance in each case, the attraction of the large spheres on the small balls is to the attraction of the earth on the small balls—i.e. the *weight* of the small balls—as the mass of the large spheres is to the mass of the earth. The attraction measured is so minute that the most elaborate precautions are necessary to get a definite result. Cavendish used leaden spheres a foot in diameter, which were swung round so as to exert their attraction alternately on opposite sides of the torsion balance. The apparatus was much simplified by Cornu, who alternately filled with mercury and emptied hollow iron spheres suitably placed with regard to the small balls. A still further refinement has recently been introduced in this experiment by using an ordinary Balance (q.v.) of great delicacy, with double scale pans, the lower pan of each pair being suspended by a fine wire from the centre of the upper. On the right-hand side this fine wire is surrounded by a massive perforated cast-iron cylinder built up in sections. On standard masses being placed in the upper pans, the one on the right-hand side is *heavier* by the attraction of the iron; then when the masses are changed to the lower pans the right-hand mass is *lighter* by the attraction of the iron, so that the difference of weight represents twice the attraction. The iron cylinder is then taken to pieces, and built up round the left-hand wire, and the process repeated several times.

Mean Density of the Earth.—The result of all these experiments shows the mass of the earth to be approximately 6,000,000,000,000,000,000 tons. The mean density calculated from this mass, and the known volume of the earth, is a more manageable figure, and may be given as an example of the degree of accordance in the various measurements. The following table shows the values arrived at by the various experimenters:

Cavendish	5·48
Reich	5·49
Baily	5·67
Baily (recalculated by Cornu)	5·55
Cornu	5·50
Maskelyne on Schiehallion	4·86
Carlini on Mont Cenis	4·95
James on Arthur's Seat	5·32
Airy in Harton Pit	6·56

The average of the concordant results may be taken as 5·5, the density of pure water at 4° C. being 1. The density of surface rocks is only about 2·5, but lavas of deep origin have densities ranging up to 3 or even higher, and it follows that the density becomes greater towards the centre. The whole earth is bound together mainly by the force of gravity, cohesion being of much less importance, and the pressure at great depths is so enormous, that at the centre it is calculated to amount to 15,000 tons per square inch. At this pressure the density of the ordinary rocks would be far greater than the mean density of the earth will warrant, so that instead of being obliged to suppose that all the heaviest metals have accumulated at the centre in order to account for the high mean density, we have to seek in the elevated temperature of the interior a reason for the mean density being so small as it is. The density of the crust of the earth is irregularly distributed. It must be greater under the Pacific Ocean, in order to balance the projecting mass of Africa and Europe on the opposite side of the world, otherwise, the globe would be lop-sided. In many places observations with the pendulum or plumb-line show discrepancies that cannot be accounted for by the configuration of the neighbouring surface, and must be due to irregularities in the density of the crust. The dimensions given above refer to the earth as a perfectly smooth figure, the solid geoid or lithosphere being surrounded by a fluid shell, the hydrosphere, 2 miles thick, which is included in the estimate, but this is enwrapped by the Atmosphere (q.v.), which is of undefined extent, and is left out of account in calculating the size or the mass of the earth.

Constitution of the Earth.—The elements present in the earth are, as far as can be ascertained, the same as those in the sun and other members of the solar system. Of the seventy elements which are recognised by chemists, very few occur in a free state, in those parts of the crust accessible to us, except the oxygen and nitrogen of the atmosphere. The hydrosphere ($\frac{1}{1000}$ of the mass of the earth) is composed of about 97 per cent. of pure water, a compound of hydrogen and oxygen. The lithosphere is made up mainly of silicates—i.e. compounds of silicon, oxygen, and a few metals. The following table shows, according to Prestwich, the approximate composition of the crust of the earth, expressed in two different ways:

As Elements.		As Oxides.	
1. Oxygen	50·0	1. Silica	58·0
2. Silicon	25·0	2. Alumina	19·0
3. Aluminium	10·0	3. Lime	6·3
4. Calcium	4·5	4. Magnesia	5·3
5. Magnesium	3·5	5. Soda	2·5
6. Sodium	2·0	6. Potash	2·4
7. Potassium	1·6	7. Carbonic acid	7·5
8. Carbon	2·4	8. Iron oxides	
9. Iron		9. Sulphuric acid	
10. Sulphur		10. (Chlorides)	
11. Chlorine		11. Other oxides	3·5
12. Other elements	1·0		
	100·0		100·0

The character of the rocks composing the lithosphere varies with depth. Beneath the outer part of the crust composed of sedimentary or metamorphic rocks, there seems to occur a zone of acidic lavas—i.e. rocks in which the proportion of silica is greater than is required to saturate the bases. At greater depths, basic lavas of greater density occur, in which there is a deficiency of silica. The thickness of the crust, and the constitution of the earth beneath it, can only be guessed at from superficial indications, or by deductions from its movements. The change of temperature with depth has been carefully studied (see TEMPERATURE), especially by the Committee on Underground Temperatures of the British Association, who have collected great masses of data, and shown that as a rule beneath the stratum of invariable temperature (which lies at a variable depth, and is the limit of solar influence), the temperature increases at the rate of about 1° F. in every 55 or 60 feet. There are indications of this rate diminishing at great depths. The deepest depressions of the oceans extend about 5½ miles below sea-level, and it might be expected that the heat of the earth's crust would raise the temperature of the water there, and keep up, if not a boiling sea, at least energetic oceanic circulation. This is found not to be the case, as the cold water from the polar regions has long since cooled down the bed of the open oceans to a temperature nowhere higher than about 40° F. When a tunnel is bored horizontally through a mountain, the temperature in the interior is found to be higher than corresponds to its distance from the centre of the earth, but quite in accordance with the depth beneath the summit of the mountain. Although the temperature in the interior of the earth is unquestionably high enough to melt, and possibly even to vaporise all known substances, the fact that the melting-point of rock-materials is raised by pressure, makes it probable that the earth as a whole is a solid

body, and is not merely a thin hard crust like an egg-shell, encircling a vast molten sphere. Astronomical observations, and the investigations on earth-tremors and tides, indicate that the lithosphere, as a whole, has a rigidity approximately equal to that of steel. The theory of a solid earth in no way hampers the explanation of Volcanoes (q.v.) emitting vast quantities of fused rock-materials, as there may be relatively small accumulations of fluid rocks here and there, or more likely some temporary relief of pressure lowers the melting-point, and allows the rocks to liquefy explosively. The origin and probable age of the earth are treated of in special articles. Considerations of the rate at which stratified rocks are deposited, and the thickness of these deposits, have been interpreted so as to give a period of about 1000 million years as the time during which the earth's crust has been solid. Sir William Thomson, arguing from the rate of loss of heat, cuts down this period to less than 100 million years, and Professor Tait shows reasons for believing 10 million years to be nearer the truth. Geologists, however, demand not less than 100 million years to account for the changes in plant and animal life during geological time. See GEOLOGY. NEBULÆ.

The Surface of the Earth.—After a solid crust had been formed, the contraction consequent on cooling caused the core of the earth to shrink away, parts of the unsupported crust either fell into the cavities formed, or were drawn in by the contracting nucleus, and so gave rise to hollows and ridges on the surface. The oceans conceal so much of the earth's surface from our view, that we are apt to form a wrong idea of its real configuration. If the hydrosphere were of one quarter its present extent, only the deepest hollows would be covered with water, and all the rest would be land, while, if it were four times as extensive, even the highest ridges would be submerged. As it is, the emergent ridges or land areas amount to 28 per cent. of the entire surface, with a mean height of about 2000 feet above the sea, and the submerged hollows occupying the remaining 72 per cent. of surface have an average depth of about 12,000 feet beneath sea-level. The distribution of land and water is such that the land is massed mainly in the northern hemisphere, the Arctic Circle having the largest proportion of land in its course, nearly seven-eighths of its length; the equator crosses land only for one-sixth of its length, and the parallel of 57° S. runs entirely over sea. If the world were divided into two hemispheres, with the English Channel at the centre of one and New Zealand at the centre of the other, the proportion of land to sea in the former would be twelve to thirteen, and it would contain seven-eighths of the land; the proportion of land to sea in the latter would be one to twelve, and it would contain three-quarters of the sea of the globe. The question of the permanence of the main lines of surface-features is referred to in CONTINENT and in SEA. In an exhaustive discussion of the height of land and depth of sea, published in 1888, Dr John Murray states that 54 per cent. of the surface of the land of the globe, and 84 per cent. of its bulk, lies between sea-level and a height of 1500 feet, 36 per cent. of surface between 1500 and 6000 feet, and only 9 per cent. above that elevation. In the ocean, on the other hand, only 17·4 per cent. of area has a depth between sea-level and 6000 feet, and this contains 42 per cent. of its bulk; 77·8 per cent. of area and 56 per cent. of volume lie between 6000 and 18,000 feet. The total volume of the ocean is fourteen times as great as the total volume of the dry land, so that if all the land were levelled down to sea-level, only one-fourteenth of the oceanic depressions would be filled up.

Movements of the Earth.—The fact that the earth rotates always in the same way gives the globe *polarity*, or the property of two-endedness, and the fact that the axis of rotation coincides with the shortest diameter of our planet, strongly confirms the nebular hypothesis by indicating that the earth assumed its existing form, approaching an oblate spheroid, by rotating rapidly about its present axis while in a fluid or at least a plastic state. The rotation of the earth gives the power of distinguishing and defining directions. The direction towards which rotation takes place is the east, that from which it takes place is the west. These terms are purely relative. Compared with Britain, America is the western continent; compared with Japan, it is the eastern continent; there is nothing like an east or west pole. The ends of the earth's axis are fixed points—one called the north pole, the other the south pole. The north pole is defined as that end of the axis which points towards a bright star in the constellation of the Little Bear, the star being named in consequence Polaris, or the Pole-star (see LATITUDE, POLES). While the rate of angular rotation is uniform in all parts of the earth, namely, one complete revolution in 24 sidereal hours (or in 23 hr. 56 min. 4 sec. solar time), or 15° per hour, the tangential velocity varies with the cosine of the latitude. At the equator, with its circumference exceeding 24,000 miles, the velocity of a point on the surface of course exceeds 1000 miles an hour. At the parallel of 60°, which is only half the length of the equator, the tangential velocity is 500 miles an hour, while at the poles themselves there is no tangential velocity, but rest as far as axial rotation is concerned. In virtue of inertia, the property of matter defined in Newton's first law of motion, the direction of the axis of a rotating body tends to remain unchanged. As the earth has a rapid motion of revolution round the sun, varying from a maximum in perihelion to a minimum in aphelion, the plane in which it moves also tends to remain unchanged, and these two directions afford standards in space to which the inclination of all other planes and lines may be referred. The eccentricity of the earth's orbit is subject to changes, maxima of eccentricity occurring at irregular intervals of about half a million years, but its plane is much more constant. The time occupied by the earth in its circuit of 580 million miles is one year, or 365 days, 6 hours, 9 minutes, which implies an average velocity of 66,000 miles per hour.

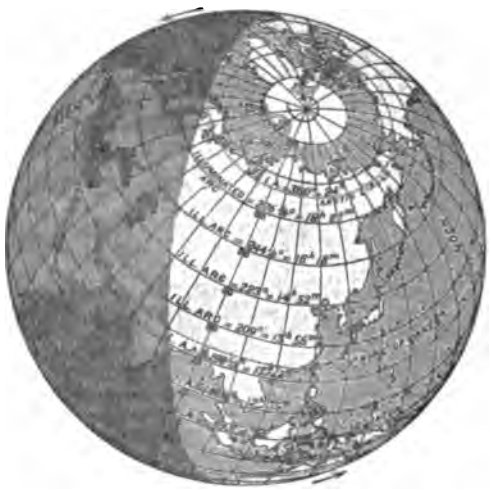
The inclination of the earth's equatorial plane to the plane of the ecliptic is 23° 28′, and the variations are scarcely perceptible. The most important of the earth's motions resulting from perturbations by other heavenly bodies, is Precession (q.v.), which is due to the differential attraction of the sun and moon on the bulging equatorial region. This attraction constantly tends to turn the earth's axis at right angles to its orbit; but it results only in a slow rotation round a perpendicular axis which occupies about 25,800 years, and has the effect of making the pole describe a circular path in the heavens. The possibility of changes in the inclination of the earth's axis having taken place within recent periods, is a question of great importance with regard to geological climate (see GLACIAL PERIOD); but the balance of evidence seems to be against the probability of any such change. Astronomical observations at Pulkowa in Russia indicated a movement of the north pole over the surface of the earth at the rate of a foot per annum, but the equally accurate observations at Greenwich show no trace of such an alteration of the direction of the axis. The proofs of the diurnal rotation of the earth are numerous and complete. A consequence of rotation from west to east has been deduced by Ferrel to the effect that any body

moving on the earth's surface, *in whatever direction*, tends to deviate from a straight path towards the right in the northern hemisphere, and towards the left in the southern. For bodies moving towards or from the equator, this can be easily understood. Suppose an ocean current to start from the equator, flowing due north. At the equator it has, if the earth rotates from west to east, a much greater eastward velocity than has the part of the earth's surface to which it flows, so that it must of necessity flow eastward as well as northward—i.e. it must turn towards the right as it proceeds. Similarly moving southward from the equator, the current must retain an easterly drift as it advances, thus deviating to the left. This is the mode of circulation which actually takes place in the oceans. Many large rivers of the northern hemisphere, such as the Volga, press harder on the right bank, which is accordingly steep and always receding, while the left bank is a more gentle slope. The same thing is observed in a more marked degree in the case of winds; and even in gunnery, allowance has to be made for the deviation of the projectile from this cause. The fact that a bullet dropped from a lofty tower falls a little to the east of the vertical, has been repeatedly verified, and can only be accounted for by the upper part of the tower having a greater tangential eastward velocity than the base, on account of its being farther from the earth's centre, this greater velocity being shared in by the dropping bullet. But the most convincing proof was given by Foucault with the Pendulum (q.v.). A long and heavy pendulum swings in a plane, the direction of which is by Newton's first law of motion constant in space. Yet when such a pendulum is set swinging in a room, its plane of vibration very soon appears to be changing. The plane always appears to twist round in the same direction, and since we know that the plane of the pendulum does *not* change, we must conclude that the room turns round it in consequence of the rotation of the earth. Direct proofs of the revolution of the earth round the sun are less simple. The Aberration of Light (q.v.) proves that the observer accomplishes some yearly journey at a rate that is comparable, though remotely, with the velocity of light; and the parallax of some of the nearer stars when corrected for aberration, indicates that we view them at opposite seasons of the year from opposite ends of a line, 180 million miles long.

The earth performs none of its motions with rigorous precision. The solar system is so balanced and knit together that each of its members exerts some influence in determining the movements of all the rest. See PERTURBATIONS.

Distribution of Solar Energy on the Earth.—The energy of the sun continually beating upon the earth keeps up the circulation of the atmosphere and hydrosphere, through which it acts on the lithosphere and becomes available for the use of living creatures. Only $\frac{1}{2000000000}$ of the energy actually given out by the sun is intercepted by the earth, but this minute fraction is great enough to produce enormous results. As the globe rotates, one half is always exposed to sunlight, one half always immersed in darkness. The refractive power of the atmosphere makes the rising or setting sun appear higher than its true position in the sky, and so keeps it visible for a longer time than if there were no air. The length of the day and the amount of daylight in high latitudes are thus considerably increased.

Not considering the effect of refraction, it is easily understood how at the summer solstice of the northern hemisphere, when the north pole is inclined towards the sun, sunlight falls 23½° beyond the pole, and as the earth rotates all this region remains in daylight the whole twenty-four hours. At this time the south pole is turned from the sun to the same extent, and no light can reach within 23½° of the south pole. The circles bounding those regions of continuous daylight or darkness at the solstices are termed the Arctic and Antarctic circles, and the space within them the North and South Frigid zones. At the summer solstice of the northern hemisphere the sun is vertical at a distance of 23½° N. of the equator. This is the highest north latitude at which a vertical sun is experienced, and is termed the Tropic of Cancer from the constellation in which the sun appears at the time. At the winter solstice of the northern hemisphere the sun is vertical at a distance of 23½° S. of the equator or on the Tropic of Capricorn, which is the highest south latitude for a vertical sun. As the sun appears overhead in all places between these circles twice in the year, and thus exerts its maximum heating power, this broad belt of the earth is termed the torrid zone. Between the tropics and the polar circles there are two regions, each 53° wide, in which the sun is never overhead, nor is it ever beneath or above the horizon continuously for a period of twenty-four hours. These are the northern and southern temperate zones. In high latitudes the sun's rays strike the earth's surface obliquely, and have thus less heating power than in low latitudes (see CLIMATE; see also DAY and SEASONS). The northern winter and southern summer occur in perihelion, so it might be supposed that more heat reaches the southern than the northern hemisphere. Kepler's second law explains, however, that the earth moves so much more rapidly when near the sun than it does when distant from that centre, that the amount of heat received in equal times is the same in both cases.



View of Earth from the zenith of a point in 50° N. lat. and 90° E. long. at 6 o'clock P.M., on its summer solstice (21st June):

The figures on the parallels of latitude indicate the length of the illuminated arc in degrees, and the period of daylight (longest day) in hours.

Work of Solar Energy.—The sun's heat-power is constantly at work breaking down the rocks of the higher parts of the lithosphere, and spreading the triturated substance as soil over the lower ground. The circulation of water is the great instrument for this work; vapour raised from the oceans and carried by wind is condensed as rain on the high-lands, and returning to the sea in the form of springs and streams, has a chief share in wearing down the surface of the land. This process would ultimately reduce all the land to a uniform

low level, were it not counteracted by the continual gentle elevations and depressions of the surface, consequent on internal changes (see UPHEAVAL). The energy of the sun acting through living plants enables these to recombine the elements of the soil and the air, and thus to form a variety of new products, most of which can as yet be produced in no other way. Thus the greater part of the land surface of the earth is covered with growing vegetation. The distribution of plants over the earth's surface depends on configuration, climate, and soil. Where these conditions were favourable, great stores of solar energy have been laid up in the potential state by the preservation as fossils of ancient forests. Coal is the best example, and the distribution of coal is at present one of the most important factors in the life of a modern manufacturing community. Animal life, which is ultimately dependent on plant-life, and cannot get energy from the sun direct, carries on the process of rearrangement and redistribution of matter farther. It also has had a share in producing the present condition and aspect of many parts of the earth. The chalk, limestone, and marble which characterise many regions of the land, and the coral reefs and islands of tropical seas, are immediate consequences of the action of animal life. The distribution of plants and animals in their natural state is determined solely by the physical conditions of their surroundings; but the actual distribution has been greatly modified by the action of man.

Man to a large extent modifies and reverses the ordinary course of natural phenomena and the laws of Geographical Distribution (q.v.). The greatest density of human population would occur naturally in those regions where the means of life are most abundant and most easily obtained, such as the alluvial plains of hot regions; hence the valleys of the Nile and Ganges and the plains of China have always been amongst the most populous parts of the world. With the development of means of transport and of manufacturing processes a drift of population set in towards regions of mineral wealth, so that in manufacturing countries, such as western Europe and the eastern United States, the coal-fields are most densely peopled, and the population is fed by grain and flesh raised in far distant parts of the earth. Tribes of the human race early began to claim exclusive rights to the region of the earth's surface they inhabited, and definite districts of the earth have from remote historical times been associated with particular races, who either continue to hold them if strong enough to resist invasion, or are superseded by more powerful immigrants. The artificial boundaries of countries appeal so much more strongly to the popular mind than the natural boundaries of such regions of the earth's surface as plains, plateaus, or river-basins, that in most atlases the maps are coloured to show only the arbitrary human divisions. It is the purpose of Geography (q.v.) to consider the earth in its special relations to man.

The intense manufacturing activity of modern life has an important bearing on the future of the earth as a habitable planet. Mineral fuel and metals are being extracted and consumed with great and increasing rapidity, and from many causes they are being produced and stored up at a slow and decreasing rate. Hence, viewing the subject from the standpoint of geological time, the supply of potential energy is nearly at an end. The sun pours upon the earth every day enormous quantities of energy, continually available in wind and water power, and these must be utilised more and more as the accumulated reserve of energy in coal and metals diminishes. In the same way vegetation is a regenerative process; but by the destruction of forests without replanting and the exhaustion of soils the availability of solar energy in this way has been destroyed in some parts of the world (see PALESTINE), and greatly impaired in others. It is necessary, in viewing the earth as a home for man, to bear in mind that if it is to continue capable of maintaining its present population of 1450 millions in comfort—not to speak of the vastly increased population that is accumulating at the rate of more than 10,000,000 a year—the stores of potential energy must be carefully preserved, and care must be taken to allow the daily solar supplies to produce their fullest effect by applying the principles of forestry and agriculture.

The Future of the Earth.—The principle of the degradation of energy teaches that the earth will gradually cool down as the ages proceed. The sun also cooling, although at a slower rate (about 1° in 3000 years), will gradually reduce the supply of external energy, the friction of lunar tides will lengthen the rotation period of the earth until it coincides with its reduced period of revolution round the sun. Ultimately, if this principle holds good, all the bodies of the solar system will clash together, restoring by the impact much of the potential energy to the kinetic state, and in so doing they will start a reduced duplicate of the old solar system, with a less supply of energy. The cycle of nebula, sun, and planet will go through the same round again and again with diminishing speed, until ultimately in the course of infinite time all the matter of the universe will be accumulated in one vast mass, with all the energy of the universe uniformly diffused through it at one level of temperature and utterly unavailable, and the universe will be dead.

The internal composition and gradual changes of the interior, the somewhat complicated distribution and mode of origin of the surface, irregularities of the lithosphere, the various motions of the earth as a whole, and the action, modified by all these conditions, of solar energy on the atmosphere, hydrosphere, and lithosphere, determine all the changes of the earth's condition and appearance, including its relations to living plants and animals. The investigation and description of these features and their rationale constitutes the study known to the Germans as *Erdkunde*, to the French as *Physique de Globe*, and in this country by the unsatisfactory and inadequate names of physical geography, physiography, or earth knowledge.

For the full explanation of the phenomena of the earth, reference may be made to many other articles, some of the more important of which are:

Africa.	Creation.	Indian Ocean.	Ptolemaic System, under Ptolemy.
America.	Day.	Island.	Rain.
Antarctic.	Desert.	Lake.	River.
Arctic Ocean.	Earthquake.	Latitude.	Sea.
Armillary Sphere.	Ecliptic.	Longitude.	Seasons.
Asia.	Europe.	Meridian.	Snow.
Astronomy.	Fiord.	Meteorology	Solar System.
Atlantic Ocean.	Geodesy.	Mountains.	Sounding.
Atmosphere.	Geographical Distribution.	Nebular Hypothesis, under Nebulæ.	Storms.
Australia.	Geography.	Pacific Ocean.	Temperature.
Climate.	Geology.	Planets.	Tides.
Continent.	Glacial Period.	Polar Exploration; Poles.	Volcanoes.
Copernican System.	Gravitation.		World.
	Ice.		

Earth, in Chemistry. See EARTHS.

Earth Closet. See SEWAGE.

Earthenware. See POTTERY.

Earth-houses, or YIRD-HOUSES, the name which seems to have been generally given throughout Scotland to the underground buildings, which in some places are called also 'Picts' Houses' (q.v.), and in others, it would appear, 'Weems,' or caves. Martin, in his Description of the Western Islands, printed in 1703, when their use would appear to have been still remembered, speaks of them as 'little stone-houses, built under ground, called

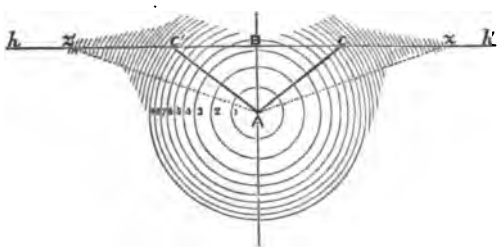
earth-houses, which served to hide a few people and their goods in time of war.' The prehistoric earth-house of the Scottish mainland, however, is a long narrow gallery of a curved form, increasing in height and in width from the entrance to the farther end. These cave-like structures, which are sometimes over 60 feet in length, are built of unhewn and uncemented stones, roofed by unhewn flags, and entered usually at the narrow end. When the chamber is unusually wide, the side-walls converge, one stone overlapping another, until the space at top can be spanned by stones of 4 or 5 feet in length. In some cases the earth-house shows two or more chambers, communicating with one another by a narrow passage. Occasionally, as many as forty or fifty earth-houses are found in the same spot, as in the moor of Clova, not far from Alford, in Aberdeenshire. They are generally so near the surface of the ground that the plough strikes upon the flagstones of the roof, and thus leads to their discovery. The objects most frequently found in them are those of domestic use or personal ornament, and the refuse of food. The indications afforded by the character of the relics assign the occupation of the earth-houses in Scotland to post-Roman times. Occasionally, the surface of the ground beside the earth-house shows vestiges of dwelling-houses, and folds or inclosures for cattle. This, with other things, would indicate that the earth-houses of Scotland and Ireland (for they are found also in that island) were put to the same purpose as the caves which, as Tacitus (writing in the 2d century) tells us, the Germans of his day dug in the earth, as storehouses for their corn, and as places of retreat for themselves during winter, or in time of war. For plans and descriptions of many earth-houses in Scotland, see Anderson's *Scotland in Pagan Times: the Iron Age* (1883).

Earth-nut, a popular name of the tubers of certain umbelliferous plants, particularly *Bunium bulbocastanum* and *B. flexuosum*, which are common in most parts of Europe. Names of the same signification are given to them in a number of European languages. *Arnut*, *Yernut*, *Ground-nut*, and *Jurnut*, Scotch and English provincial names, are corruptions of earth-nut. *Pig-nut* and *earth-chestnut* are also common English names. They are wholesome, nutritious, sweet, starchy, and very slightly acrid on the palate. When boiled or roasted they are delicious; cooked in the latter way under embers they resemble chestnuts, but are more aromatic, and generally preferred to them by the inhabitants of countries where both are indigenous. In Holland, the Alps, and in some parts of England, particularly in Hertfordshire and Cambridgeshire, where they are plentiful, they are used in soups. They form an article of trade in Sweden, and have sometimes been recommended as worthy of an attention which they have never yet received in Britain. The two species are very similar in general appearance, although *B. bulbocastanum* has by some botanists been referred to the genus Carum (Caraway), because its carpels have single vittæ between the ribs, whilst *B. flexuosum* has three. The former is also a plant of stouter habit. Both have umbels of small white flowers, much divided leaves with very narrow segments, and a single roundish tuber at the root of each plant. *B. flexuosum* is common in woods, pastures, waysides, &c., in most parts of Britain. *B. bulbocastanum* is found only in some of the chalk districts of England, but is abundant in many parts of Europe. *B. ferulaceum* likewise affords tubers, which are used as food in Greece.—The somewhat similar tubers of another umbelliferous plant, *Oenanthe pimpinelloides*, which grows in the pastures of some parts of the south of England, are sometimes also used for food, notwithstanding the very poisonous qualities of some of its congeners (see WATER-DROPWORT).—A Himalayan umbelliferous plant (*Chærophyllum tuberosum*), a species of Chervil (q.v.), yields edible tubers or *earth-nuts*.—The name earth-nut is sometimes extended to other small tuberous roots of similar quality, although produced by plants widely remote in the botanical system, as *Apios tuberosa* and *Lathyrus tuberosus;* as also to the very different Ground-nut or Ground-bean (q.v.), the *Arachis*.

Earthquake, the term applied to any tremor or shaking of the ground. Many earthquakes are so gentle as to pass almost unrecognised, others again are sufficiently pronounced to excite general remark or alarm, without, however, causing any damage, while some spread enormous destruction over wide areas. Probably no part of the earth's surface is entirely free from vibration, but, fortunately, destructive earthquakes are confined to comparatively limited regions. According to Mallet, the well-known authority upon seismology (*seismos*, 'an earthquake,' *logos*, 'a discourse'), the almost universal succession of phenomena recorded in notable earthquakes is first a trembling, next a severe shock, or several in quick succession, and then a trembling gradually but rapidly becoming insensible. In most cases, each shock lasts only a few seconds, but the tremblings that follow may be continued for days, weeks, or even months. Noises of sundry kinds usually precede, accompany, or succeed an earthquake. These have been variously described, some likening them to the howling of a storm, the growling of thunder, the clanking and clashing of iron chains, the rumbling of heavy wagons along a road, the shattering and crashing of enormous masses of obsidian or glass, &c. Such noises are conducted through the ground, or they may travel through the sea, or be transmitted through the air. They are often propagated through the ground for very great distances, so that they may be heard in regions far removed from the disturbed area. Cases are on record where such sounds have travelled more than 158 geographical miles. Some earthquakes, however, are not attended by any subterranean sounds. This has been the case with some of the most destructive South American disturbances. Thus at the time of the terrible shock which destroyed Riobamba in Ecuador on February 4, 1797, a complete silence reigned. On the other hand, subterranean sounds may be heard without any earth-tremor being perceived. Humboldt tells us that at Guanaxuato, in Mexico (1784), the inhabitants were terrified by loud subterranean thunder, which continued for more than a month, but was not accompanied by any trace of earthquake. The noise ceased gradually as it commenced, and was curiously local, as it was not heard at the distance of only a few miles.

Earthquakes are felt either as *vertical shocks*, from below upwards, as *horizontal* or *lateral shocks*, or as *undulatory movements*. As illustrating the force of a vertical shock, it is related that in 1837, at the fort of San Carlos in Chili, a flagstaff which was sunk for 30 feet in the ground, and secured with iron rods, was violently shot into the air, leaving a round hole in the ground. Again, at the time of the great earthquake of Riobamba, the bodies of many of the inhabitants were projected across the river and fell upon La Culla, a hill over 300 feet in height. During the Calabrian earthquake of 1783, the undulatory motion was well marked by the way in which the trees swayed to and fro, their branches touching the ground. The same appearance was noted at New Madrid (Missouri) during the earthquakes of 1811–12, where the trees were observed bending as the earth-waves passed under them, and immediately afterwards recovering their

position. Numerous observations of this kind have led physicists to the belief that an earthquake is a wave or true undulation of the crust. The wave produced by the original impulse travels outwards



Earth-waves:

h'h, the horizon; A, centrum; B, epicentrum; AB, Ac', Ac, Az', Az, wave-paths; 1, 2, 3, 4, &c., spherical concentric shells, or similar phases of the earth-wave. The most destructive effects upon buildings are produced at some point between the epicentrum, B, and x' or x, say at c' or c.

in all directions from the 'focal cavity,' or 'centrum,' A, in successive spherical shells (1, 2, 3, &c.), the form of which, however, as we shall see presently, is subject to many modifications. The point or area on the surface of the ground directly above the 'origin' or centrum is called the 'epicentrum,' B, and it is at this point where usually the shock is felt as a vertical stroke coming from below upwards. As we recede from this point, the direction of motion becomes more and more horizontal, and gradually also decreases in intensity until it becomes insensible. Away from the epicentrum, then, it is obvious that the earth-wave at every point comes up obliquely *from below* —the radial lines along which an earthquake is propagated from the centrum being called 'wave-paths,' AB, Ac', Ac, Az', Az. If the earth's crust were composed of perfectly homogeneous materials, then the undulations propagated from the centrum would extend equally in all directions, and might be shown diagrammatically by describing a series of concentric circles round the epicentrum. But the crust is very far from being homogeneous. It is composed of different kinds of rock, arranged often in very discordant ways, and traversed by irregular joints, fissures, cavities, and dislocations. All these differences affect the transmission of an earthquake; and the direction of motion is still further influenced by the configuration or varying topographical features of the disturbed districts. Thus geological structure and topographical features combined lead to continual deflections and delays of the earth-wave; but inasmuch as the topography of the surface is fundamentally influenced by the nature and structure of the underlying rocks, we may assign the irregularities of the isoseismic circles primarily to geological causes. Hitherto we have been supposing that the earth-waves are propagated in successive *spherical shells*, the shape of which is modified in various ways. We must remember, however, that the impulse may not originate from a point or spherical cavity, but from a fissure inclined at a considerable angle from the vertical. In such a case the waves, even in a homogeneous medium, would not be concentric circles, but, originating from all points of the fissure, would spread outwards in *ellipsoidal shells* to the surface, where the waves would take the form of ovals or distorted ellipses. In such a case as this, the greatest effect of shock would not be felt in the area vertically above the centrum, but rather to one side of the epicentrum; in other words, the direction of greatest effect would coincide with the major axis of the ellipsoidal shells. As a matter of fact, isoseismic lines, or lines of equal disturbance, are seldom circles; elliptical or irregular curves being the common forms. And that their form is greatly influenced by geological structure and topography, is shown by the circumstance that earthquakes are propagated not unfrequently in lines or zones—the major axis of elliptical areas of disturbance often having a general direction parallel to the trend of some great valley or considerable mountain-range. In the South American earthquakes, the vibrations are confined to the long narrow strip of low ground between the Andes and the sea, and are not felt on the eastern side of the mountains. Similarly the earthquakes that shake the coast-lands of Venezuela, Caraccas, and New Granada are rarely transmitted inland across the coast-ranges.

The velocity of propagation of an earthquake is very variable. Thus in the case of the earthquake of Lisbon in 1755, it seems to have considerably exceeded 1000 feet per second, while in the Lisbon earthquake of 1761 the rate was three times greater. At Tokio, in 1881, the velocities, as estimated by Professor Milne, varied between 4000 feet and 9000 feet per second. From his own observations, taken in connection with those of previous investigators, Mr Milne thinks we may conclude (1) that different earthquakes, although travelling across the same country, have velocities which may vary between several hundreds and several thousands of feet per second; (2) that the same earthquake travels more quickly across districts near to than far from its origin; (3) that the greater the intensity of shock, the greater is the velocity.

Various attempts have been made to estimate the depth at which earthquakes originate. Mallet was of opinion that the centrum of the Neapolitan earthquake of 1857 was probably 5½ miles from the surface. His calculations were based on the assumption that the earth-wave radiated in straight lines from the centrum. Immediately above the centrum the wave-path was supposed to be vertical, while at points at different distances from the epicentrum the wave-paths would be oblique, and emerge at different angles at the surface. These angles he obtained by drawing lines at right angles to the direction of the large cracks and rents observed in numerous buildings. The lines so drawn converged approximately to a point below the area of greatest disturbance (epicentrum)—the point of convergence indicating the site of the original impulse or earthquake centrum. The same eminent physicist thought that an earthquake centrum probably never exceeded a depth of 30 geographical miles. According to Professor Milne, the angles of emergence of the earth-waves obtained during the Yokohama earthquake of 1880 showed that the depth of origin of that earthquake might be between 1½ and 5 miles; and he gives a table, compiled from the writings of various observers, which exhibits the mean depths at which certain earthquakes have originated. These estimated depths range from 17,260 feet to 127,309 feet. Two of these depths were obtained by Mallet's method, and four were made by the assistance of Seebach's method, which depends, amongst other things, on the assumption of exact time-determinations, direct transmission by waves from the centrum, and a constant velocity of propagation. But Professor Milne thinks that even if the observations of time be practically accurate, yet the other assumptions may often lead to errors of such magnitude that the calculated results may be of but little value.

The area disturbed by an earthquake is generally proportionate to the intensity of the shock.

The great earthquake of Lisbon disturbed an area four times as great as the whole of Europe. In the form of tremors and pulsations, Mr Milne remarks, it may have shaken the whole globe.

Mr Mallet made a preliminary subdivision of all the earthquakes recorded in his great catalogue (British Association Report, 1854) into three classes, as follows: (1) *Great earthquakes*, in which large areas were shaken violently, numerous cities destroyed, and multitudes of people killed, rocky masses dislocated, and powerful secondary effects produced; (2) *mean earthquakes*, sometimes with a wide superficial area, but doing less damage to cities, and attended by scarcely any loss of life, and effecting little or no change on natural objects; (3) *minor earthquakes*, in which buildings were shaken and sometimes fissured, but natural objects were not at all affected, and which left few or no traces of their occurrence after the shock. The first class may be assumed to have a sensible diameter of about 1000 to 1200 miles; the second about 400 miles; and the third about 100 or 150 miles. These of course are only mean results made upon the assumption that the areas of disturbance had sensible surface-boundaries approaching to irregular circles or ellipses. When we come to the great earthquakes of modern times, the boundaries of which have been approximately ascertained, we find that these have been sensible in certain surface radii, or great circles, over 18°, or perhaps even 20°.

Earthquakes are not confined to the land. Many, perhaps the larger number, seem to originate under the sea, particularly along lines parallel to the shores of continents and islands that rise abruptly from great depths. In a violent submarine earthquake, the ordinary earth-wave and sound-wave are accompanied by sea-waves. When the earth-wave is started, a great sea-wave is generated at the same time, while a sound-wave is produced in the air. These waves travel shorewards at different rates. The earth-wave, carrying on its back a small 'forced sea-wave,' is the first to reach the shore, and as it passes inland, it causes a slight recession of the sea as the 'forced wave' slips from its back. The 'great sea-wave' is the last to reach the shore. Its appearance is generally heralded by the flowing back of the sea—the recession varying from 30 or 40 feet or less in some cases, to several miles in others. The time taken for the withdrawal of the water from the shore is equally variable—sometimes it is only a few minutes, in other cases half an hour, or even several hours have elapsed before the appearance of the great sea-wave, or waves. These waves may be 20, 60, or even 80 feet higher than the highest tide, and are usually more dreaded than the earthquake shock itself in such regions as the maritime districts of South America. The greatest sea-wave on record is that which, on October 6, 1737, is said to have broken near Cape Lopatka, at the south end of Kamchatka, 210 feet in height.

The changes which earthquakes produce on the earth's surface deserve the careful attention of the geologist. By causing landslips, and now and again producing crevasses in the ground, they occasionally interrupt or even entirely revolutionise the drainage system of a country, and have thus frequently led to many modifications of a land-surface. Very considerable changes are likewise caused by the great sea-waves which so frequently accompany the violent disturbances of low-lying maritime tracts—blocks of rock, shingle, gravel, and sand, and marine organisms being often swept inland for great distances beyond the reach of the highest tide. Permanent elevations and depressions of the land are sometimes accompaniments of earthquakes. Thus, after the great earthquakes of 1750, the coast of Chili was found to have been permanently raised from three to four feet. Well-known examples of permanent depressions are those of the Runn of Cutch and the coast-lands near Chittagong, which were submerged suddenly during the Bengal earthquake of 1762.

Earthquakes are of most common occurrence in volcanic and mountainous regions. The 'great belt of fire' which circles round the shores of the Pacific Ocean marks out for us the most earthquake-shaken regions of the globe. Professor Milne draws attention to the fact that the shores of those regions slope into the sea at a much steeper angle than the shores of countries where earthquakes seldom occur. Looking at the broad features of the globe, he says, we see on its surface many depressions. Some of these saucer-shaped hollows form land surfaces, as in Central Asia; the majority, however, are occupied by the oceans. Now, most earthquakes seem to have their origin on or near the bottom of these slopes; but to this rule there are of course exceptions.

When we come to inquire into the cause of earthquakes, we are left very much to conjecture. Some earthquakes may be due to the sudden collapse of underground cavities, while others may arise from the snapping of strata subjected to great strain or tension, such as must occur during movements of elevation. The larger number, however, are probably connected with volcanic action, and most of these appear to originate beneath the sea—their immediate cause being, perhaps, the flashing into steam of the water which finds its way down through fissures to the underlying heated rocks. Many earthquakes, however, appear to originate in volcanoes themselves, and these doubtless are in like manner due to the explosion of elastic vapours. Mallet considered an earthquake to be only an uncompleted effort to establish a volcano—the forces of explosion and impulse being the same in both. Neither is the cause of the other, but both are unequal manifestations of a common force under different directions. Many other causes of earthquakes besides those already referred to have been suggested. Amongst these are the attractive influences of the sun and moon, fluctuations in temperature, and the pressure of the atmosphere, &c. But according to Professor Milne, exogenous phenomena such as these play but a small part in the production of earthquakes—their greatest effect being to cause a slight preponderance in the number of earthquakes at particular seasons. Thus, most earthquakes occur during the cold months or winter, and it is then also that barometrical fluctuations are most numerous.

EARTH-TREMORS are vibratory motions of the ground so gentle as seldom to be perceived without the aid of instruments. These microseismic movements appear to be experienced in every region where scientific observations have been made, and may be common to the surface of the whole globe. Their cause has not been determined. They may be due, according to Professor Milne, to slight vibratory motions, the result of the bending or crackling of rocks, produced by their rise upon the relief of atmospheric pressure. Another notion is that they may be caused by an increased escape of vapour from the molten matter under the earth's crust consequent upon similar relief of pressure.

EARTH-PULSATIONS are another set of phenomena discussed by Mr Milne. According to him, these pulsations are slow but large wave-like undulations travelling over or disturbing the surface of the globe. Their existence may be indicated by changes in the levels of seas and lakes, by pendulums, by delicate levels, &c. Some of these pulsations are attributable to earthquakes, while on the other hand certain earthquakes are attributable to earth-

pulsations. Thus, according to Mr Milne, the short quick vibrations of the Lisbon earthquake which overthrew the cities of Portugal had, by the time they had radiated to distant countries, become changed into long flat waves, having a period of perhaps several minutes. These movements were too gentle to be perceived, except in the effects produced by tipping up the beds of lakes and ponds.

Among memorable earthquakes may be noted that of Lisbon, 1st November 1755, which left the city a heap of ruins, destroyed 35,000 lives, and was felt from the Madeiras to Britain; that which destroyed Aleppo in 1822; that at Mount Ararat in 1840; at Broussa, Asia Minor, in 1855; at Quito, 1859; Mendoza, South America, 1860; Manilla, 1863; in Peru, 1868; Cúenta, in Colombia, 1875; Manilla, 1880; Valparaiso, 1880; Ischia, 1881 and 1883; the earthquake phenomena accompanying the volcanic eruption of Krakatao, 1883; Colchester, and the eastern counties of England, 1884; Malaga and Granada, 1884 and 1885; Charleston, 1886; Japan, 1891. Professor Milne reckons that there is at least one earthquake daily in Japan, and probably from twenty to fifty daily on the earth's surface. Buildings are specially erected to withstand earthquakes in Japan, South America, and elsewhere (see *Nature*, vol. xxix.); and similar principles have been applied even to lighthouse-building. For a description of the method of measuring earth-waves see SEISMOMETER.

See Humboldt's *Cosmos* and *Travels*; Mallet's *Reports to the British Association* (1850-52, 1854, 1858, 1861); Milne's *Earthquakes, and other Earth-movements* (1886); and F. Fouqué, *Les Tremblements de Terre* (Paris, 1888). Milne's work and Mallet's Report of 1858 contain long catalogues of works dealing with earthquakes and volcanic phenomena.

Earths, the name applied by the alchemists and earlier chemists to certain substances now known to be oxides of metals, which were distinguished by being infusible, and by insolubility in water. The term was made to include the oxides of calcium, strontium, and barium, which undergo chemical change by contact with water, and yield alkaline solutions. On account of this property these oxides were called the alkaline earths. The term earth is now disappearing from modern text-books of chemistry. See SOILS.

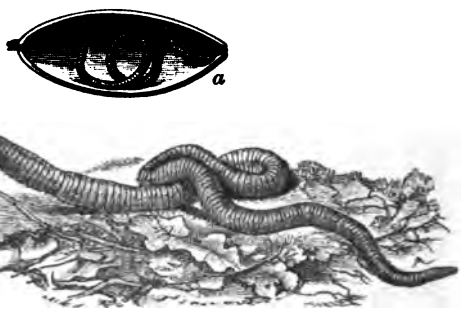
Earth-shine, the light by which the dark portions of the moon's surface are rendered faintly luminous for a few days before and after new moon, resulting in an appearance popularly known as 'the old moon in the new moon's arms.' It is caused by the light reflected to the moon from the sunlit surface of the earth. It is stronger before than after new moon. See MOON.

Earthworks. See FORTIFICATION.

Earthworm (*Lumbricus*), a genus of bristle-footed or chætopod 'worms,' in the section Oligochæta, where the bristles are few compared with those of related marine types. Several species, especially *L. terrestris* or *agricola* and *L. communis*, are very common and familiar.

Structure.—Almost every zoological text-book contains a detailed description of the structure of the earthworm; only the general features are here sketched. The ringed body, the iridescent Cuticle (q.v.), the segment overhanging the mouth, the swollen glandular 'girdle,' or *clitellum*, the four double rows of tiny bristles, eight for each ring, are familiar external characters. By contracting its well-developed muscles, some of which are connected with the bristles, the animal moves along the surface of the soil, sticking its bristles like pins against the ground. Its burrowing progress underground is helped by its habit of eating the soil as it goes, and the head is also used as a lever. The body-cavity is divided by cross partitions into segments corresponding to the external rings. The food canal has a number of distinct parts: first, the muscular pharynx, by aid of which the worm grasps leaves or stones; then the gullet, with three pairs of lateral lime-glands, which act chemically upon the food; then the swollen crop; then the muscular mill or gizzard where the soil is ground up; and lastly, the long digestive portion, covered with yellow cells, which are familiar to those who pierce the worm with the hook. The nervous system exhibits the usual dorsal brain, ring round the gullet, and ventral chain of double ganglia, with numerous lateral nerves. There are no special sense organs, but the worms are sensitive to light, and though they have no ears, they disappear 'like rabbits into their holes,' when somehow aware of vibrations on the ground or even in the air. The circulatory system is well developed. The excretory system is represented by a pair of small kidney-tubes (*nephridia*) in almost every segment; through these waste particles may be by means of cilia removed from the body-cavity to the exterior. The reproductive organs are hermaphrodite and complex.

Habits.—Earthworms are shy of the light, and keep underground during the day. Of the activity of their nocturnal peregrinations the abundant trails left on the damp soil bear witness. At night they often keep their tails fixed in the mouth of the burrow, while they explore with their bodies in a circle round about. They feed on vegetable matter in the soil, on leaves, &c.; the food is chemically



Common Earthworm:
a, young worm escaping from the cocoon.

acted on by the gullet-glands, ground up in the gizzard, digested in the intestine; the debris is expelled in the familiar castings. A number of eggs, along with spermatozoa and albumen, are surrounded by a common cocoon, which is formed from a secretion of the skin. The cocoon is stripped off towards the head of the worm by contractions of the body, and when it is freed the ends close. There is no asexual reproduction, but the animals are able to regenerate a lost head or tail. Some species of Lumbricus exhibit superficial Phosphorescence (q.v.). Leaves are frequently carried below ground, sometimes for food, but also for making the burrows comfortable. Darwin's observations showed that the earthworms display considerable dexterity in seizing even strange leaves in the manner most convenient for transport. Stones of relatively large size are cleverly moved along, and used to protect the mouths of the tunnels. Moles and birds are their chief enemies. Gregarines (see GREGARINIDA) are always found parasitic in the male reproductive organs, and little threadworms are common in the kidney-tubes.

Related Forms.—Besides Lumbricus—the earthworm *par excellence*—of which several species occur, widely distributed in Europe and North America,

there are many other related genera. The list of over one hundred species of terrestrial Oligochæta is continually being increased. Some exotic forms are very long, others very thick. There are giant earthworms over 3 feet in length, and an Australian species (*Megascolex gippslandicus*) measures towards 6 feet, and produces a gurgling noise as it retreats underground.

Geological Importance.—Earthworms have strong claims to be ranked as the most useful animals. They were ploughers before the plough. In the long past they have made a great portion of our most valuable soil, and now they are improving and renewing it without ceasing. They burrow and open the way alike for the rain-drops and the plant-roots; they bruise the soil particles in their gizzard mills, and liberate the mineral elements. They are continually burying the surface by triturated castings brought up from below. The importance of their humble labour is sublime. This was long ago appreciated by Gilbert White and Jenner, but was only realised after Darwin's marvellously patient observations. Some of these lasted about thirty years. The result was to show that earthworms have been the principal agents in the formation of vegetable mould. In some cases vegetable mould does seem to accumulate without much aid from earthworms, and the constant rain of dust, as Richthofen emphasised, must not be overlooked; yet there is not a shadow of a doubt as to the momentous action of earthworms as soil-makers. Darwin showed that there are on an average over 53,000 worms in an acre of garden, that ten tons of soil per acre pass annually through the bodies of the inhabitants, that they bring up mould from below at the rate of 3 inches thickness in fifteen years. Greater results have seldom been demonstrated by the adding up of infinitesimal items. Darwin's loving patience included many most interesting observations on the habits of earthworms, and his whole work most clearly shows that the truth of nature is stranger than romance. The archæologist owes the worms thanks for the way in which they have buried and thus preserved tesselated pavements and other antiquities. The use of worms to anglers needs no comment.

'Earthworms, though in appearance a small and despicable link in the chain of nature, yet, if lost, would make a lamentable chasm. . . . Worms seem to be the great promoters of vegetation, which would proceed but lamely without them, by boring, perforating, and loosening the soil, and rendering it pervious to rains and the fibres of plants, by drawing straws and stalks of all kinds into it; and, most of all, by throwing up such infinite numbers of lumps of earth. . . . Worms probably provide new soils for hills and slopes where the rain washes the earth away. . . . The earth without worms would soon become cold, hard-bound, and void of fermentation; and consequently sterile.'—Gilbert White, 1777.

'It may be doubted whether there are many other animals which have played so important a part in the history of the world as have these lowly-organised creatures.'—Darwin, 1881.

See Darwin, *The Formation of Vegetable Mould through the action of Worms* (Lond. 1881); Vejdovsky, *System und Morphologie der Oligochæten* (Prague, 1844); Perrier, 'Lombriciens Terrestres,' *Nouv. Arch. Mus. Hist. Nat.* (Paris, viii. 1872); zoological text-books, especially Hatchett Jackson's edition of Rolleston's *Forms of Animal Life* (1888); for recent progress, see studies by Beddard (*Ann. Nat. Hist.* 1886, &c.), and by Benham (*Quart. Jour. Micr. Soc.* 1886, &c.).

Earwig (*Forficula*), a well-known genus of insects, often ranked along with cockroaches, &c., in the order Orthoptera, but better kept apart to form, along with a few related genera, the order Dermaptera. As important general characters, the following may be noted: the two pairs of wings are very dissimilar, the anterior pair being short and horny (*hemi-elytra*), the posterior pair folded longitudinally and transversely; the mouth parts are well developed and suited for biting; the antennæ are thread-like; there is no true metamorphosis in the life-history.

The common earwig (*Forficula auricularia*) is best known for the pincer-like organ at the end of the abdomen. The two component parts possibly represent a pair of persistent abdominal appendages. The forceps are larger (in some forms very markedly) and more curved in the males. The hind pair of wings serve for occasional flight; they are much larger than the firm front pair, and are folded when at rest in a complex way, not only like a fan but also transversely. When folded up they are almost completely covered by the anterior pair. The mobile abdomen is used in folding the wing together. The shape of the expanded hind-wings is somewhat ear-like, and this has given origin to the etymology which regards earwig as equivalent to earwing. In a few forms the wings degenerate.

Common Earwig:
a, larva; *b*, pupa; *c*, perfect insect.

Earwigs avoid the light, and do most of their work in the dark. They feed, as gardeners well know, on petals and other parts of flowers, on fruit, seeds, and leaves, nor is animal debris refused. They are usually and readily caught in artificial shelters provided for their destruction. They are very sensitive to tobacco smoke. During the day they shelter underground or under stones and bark. In spite of their names—*earwig*, Ger. *Ohrwurm* ('ear-worm'), Fr. *Perce-oreille* ('pierce-ear'); the Armenian name also means 'ear-enterer'—they are not known to enter the ears of sleepers.

The eggs of the common species are laid in spring, fifteen to twenty, in some convenient cavity. These are carefully watched, and even after the birth of the young earwigs, the mother still tends them as a hen does her chicks.

The distribution of the common earwig is very wide, and the same is true of the order. The largest European species (*F. gigantea*) measures about an inch in length. A little earwig (*Labia minor*) is common in Britain and elsewhere, and may be often seen flying on warm summer afternoons. In the genus Chelidura the hind-wings are lost, and the front pair rudimentary. Labidura is another important genus.

Easdale, a small isle on the west coast of Argyllshire, in the Firth of Lorn, 16 miles SW. of Oban. It contains 1½ sq. m., and is separated from the much larger Seil Island by a channel 400 yards wide. It is noted for its great primary or metamorphic slate-quarries belonging to the Earl of Breadalbane, which produce from seven to nine millions of slates annually. The workings date from about 1630, and extend to a depth of 220 feet below sea-level.

Easel (Dut. *ezel*, 'an ass,' cf. clothes-*horse*), the wooden frame on which painters place pictures while at work upon them.

Easement. In English law, a person may have rights of several kinds in the land of another. He may have the right to take or receive part of the produce or profit of the land; this right is called a Profit. He may have the right to use his neighbour's land for his own convenience (as e.g. by making use of a road over it, by laying out nets to dry upon it, &c.), and this kind of right is called a Positive Easement. Again, he may have the right to prevent his neighbour from making an inconvenient use of the land—e.g. the right to prevent him from erecting buildings which obstruct the light—and this kind of right is called a Negative Easement. An easement can only be enjoyed by an owner and occupier of land; the property in respect of which the right is enjoyed is called the dominant tenement; the property over which it is enjoyed is called the servient tenement. Profits and easements are both regarded as rights of property in land; they are 'incorporeal hereditaments.' Easements are of many kinds; they include rights of way, rights to water, light, and air, rights to support from neighbouring land, rights to transmit the vapours and noises of an offensive trade, &c. They are acquired by express or implied grant (as when a house is conveyed together with a right of way), and also by prescription and custom; they may be extinguished by express or implied release and in other ways. The period of enjoyment which gives a good title is for an easement 20 years and for a profit 40. The American law on this subject is in its general principles the same as the English. In the Roman and Scotch law, profits and easements are both included under the title of Servitudes. See SERVITUDE. See C. J. Gale, *Treatise on the Law of Easements* (6th ed. 1888).

East is, vaguely speaking, that quarter of the horizon where the sun rises, or which a person with his face to the south has on his left hand. It is only at the equinoxes that the sun rises exactly in the east point. A line at right angles to the meridian of a place points exactly east and west. From very early times, the east has been invested with a certain sacred character, or at least held in higher respect than other points of the compass. It was the practice of many ancient pagans to fix their altar in the eastern part of their temples, so that they might sacrifice towards the rising sun (see SUN-WORSHIP). Contrariwise, in the temple of Jerusalem the Holy of Holies was at the western end; and hence it was customary for Jews in other parts of the world to turn towards the west in prayer. But the custom of praying towards the east was adopted by the early Christian church from at least the 2d century, as a symbol of Christ as the 'Sun of righteousness,' the 'Dayspring from on high,' and the 'Morning Star,' a reason assigned by Clement of Alexandria, who died about 220 (*Stromata*, vii.), and who is followed by Tertullian and St Athanasius. Accordingly, in the ancient baptismal forms, the candidate was made to face westward when renouncing the devil and his works, but then to turn round to the east in order to make his profession of faith in Christ; while, for a similar reason, the sanctuaries of Christian churches, wherein the altar stood, were built at the east end, a custom enjoined as early as the compilation of the *Apostolical Constitutions* (ii. 57). It was said, further, that Christ had been placed in the tomb with his feet towards the east, and that at the day of judgment he should come from the eastward in the heavens. From these various circumstances (see ORIENTATION) bowing to the east on uttering the name of Jesus, and burying with the feet to the east, were also introduced as customs in the church. The churches of the city of Rome do not conform generally to the principle of orientation, probably because some of the more important among them were originally secular buildings of the imperial times, and served as examples for subsequent erections. It is a curious instance of the inveteracy of popular custom, that in Scotland, where everything that savoured of ancient usage was set aside as popish by the reformers, the practice of burying with the feet to the east was maintained in the old churchyards, nor was it uncommon to set down churches with a scrupulous regard to east and west. In modern cemeteries in England, Scotland, and America, no attention appears to be paid to the old preference for burying with the feet to the east, the nature of the ground alone being considered in the disposition of graves.

The eastward position of the officiating priest at the prayer of consecration of the eucharist has been matter of much controversy in the Church of England. The High Church party interpret the rubric (1552) as allowing or enjoining that position (the consequence of which is that the celebrant has his back to the congregation); but the legality of the position, decided against in the Purchas case (1870), was again called in question in that of the Bishop of Lincoln (1889).

East Anglia. See ANGLIA.

Eastbourne, a favourite Sussex watering-place, especially for the wealthier classes, in the Rape of Pevensey, nearly midway between Brighton and Hastings, and 66 miles S. of London by the London, Brighton, and South Coast Railway. Roman remains bear witness to its antiquity, but nothing is known of its ancient history. In the Domesday Book it is called Borne (after the burn or stream which still flows there), and is stated to have been held by the Confessor at forty-six hides. The Conqueror bestowed it upon the Earl of Morton, and it subsequently passed through the Barons of Badlesmere and De Roos to the Manners family, and thence to Selwyns, Gildridges, and Burtons, from whom the present owners, the Duke of Devonshire and C. Davies Gilbert, inherited the manorial rights. The fine 12th-century church clearly belonged to a much more important place than the four groups of houses and cottages which constituted the fishing-hamlets of East-Borne, South-Borne, Meads, and Sea-Houses, not a century ago. The last generation has witnessed the growth of the modern watering-place, which now challenges comparison, in respect of its attractions to visitors and advantages to residents, with any of its south-coast rivals. Its air is singularly healthy, and on the hillside bracing. The death-rate for four years averaged 14·4 in the 1000, including many cases brought from outside to Eastbourne hospitals. The close vicinity of the bold promontory of Beachy Head and the 'front-hills' of the South Downs affords unusual facilities for exercise, and the country is regularly hunted by the Eastbourne Harriers and Southdown Foxhounds. The sea-front, defended by a redoubt of eleven guns and other fortifications, boasts a parade two miles long, laid out in spacious terraces in three tiers, bordered by creeping plants. The streets are broad and lined with trees, and the electric light is rapidly extending its branches through the town; there are a theatre, cricket, football, lawn-tennis, and social clubs, and admirable golf links. A large part of the improvements is due to the Duke of Devonshire, but the town has also taken an enterprising share in them, for which public loans were incurred since 1864 to the amount of £173,000. The handsome town-hall was opened in 1886. The acreage of Eastbourne borough is 5400; the population in 1821 was but

2007; in 1861, 5795; and in 1891, 34,977, having multiplied fivefold in a quarter of a century. The number of houses in 1861 was 1096, and in 1888 the enrolled burgesses (all householders) numbered 3512. The rateable value in 1810 was £5000, and in 1888, £206,000. Eastbourne is a parliamentary division, and was incorporated a borough in 1883. The borough returns five members to the East Sussex County Council on an electorate of 3900, besides one member for the rural division, which numbers 915 electors. See Chambers, *Handbook for Eastbourne* (1868; 19th ed. 1888).

East Cape, the name of the south-eastern extremity of New Guinea, in Goschen Strait, and of the most easterly headlands of Madagascar, the North Island of New Zealand, and Siberia. The last, on Behring Strait, and in 169° 38′ W. long., is the easternmost extremity of Asia, and is a bold, rocky promontory of syenite, almost cut off from the mainland by swamps and shallow lakes. On the north side is a village, Uédle, of between eighty and ninety huts, with a population of about 260.

Easter (Ger. *ostern*, Fr. *pâques*, Scot. *pasch*, from Gr. *pascha*, 'the passover'), the festival of the resurrection of Jesus Christ, derives probably its name from Eastre, a Saxon goddess, whose festival was annually kept about the same time as Easter. In the ancient church, the celebration of Easter lasted an octave (eight days). After the 11th century, however, it was limited to three, and in later times, generally to two days. It was formerly the favourite time for performing the rite of baptism. The courts of justice were closed, and alms dispensed to the poor and needy, who were even feasted in the churches—a custom which led to much disorder. Slaves also received their freedom at that season; and as the austerities of Lent were over, the people gave themselves up to enjoyment; hence the day was called the 'Sunday of joy' (*Dominica gaudii*). In the East it is still known as the 'Bright Day,' and in Bohemia it is designated the 'Great Night.' To the popular sports and dances were added farcical exhibitions, in which even the clergy joined in some places, reciting from the pulpits stories and legends, with a view to stir the hearers to laughter (*risus paschalis*). Against this indecency the Reformers of the 16th century loudly and successfully raised their voices. During the whole week before Easter—i.e. in the interval between Palm Sunday and the beginning of the Easter festival—daily services were held (see HOLY WEEK, and GOOD FRIDAY).

On Easter Day, the people saluted each other with the Easter kiss, and the exclamation *Surrexit* ('He is risen'); to which the reply was *Vere surrexit* ('He is risen indeed')—a custom still retained in the Greek Church. Thus, in Russia, at the time of salutation, red eggs are exchanged, and cage-birds are let loose, as emblematical of that liberty which is consecrated by the Easter solemnities. The chief solemnity has always consisted of the celebration of the Lord's Supper; and Easter is the one time in the year at which, by the Fourth Lateran Council, Roman Catholics must communicate.

The proper time for the celebration of Easter has occasioned no little controversy. In the 2d century a dispute arose on this point between the Eastern and Western Churches. The great mass of the Eastern Christians celebrated Easter on the 14th day of the first Jewish month or moon, considering it to be equivalent to the Jewish Passover. The Western churches kept it on the Sunday after the 14th day, holding that it was the commemoration of the resurrection of Jesus. The Council of Nice (325 A.D.) decided in favour of the Western usage, branding the Eastern usage with the name of the 'quartodeciman' heresy. This, however, only settled the point that Easter was to be held, not upon a certain day of the month or moon, but on a Sunday. The proper astronomical cycle for calculating the occurrence of the Easter moon was not determined by this council. It appears, however, that the Metonic Cycle (q.v.) was already in use in the West for this purpose; though great discrepancies obtained as late as 541; and the British churches clung closely to an old cycle of eighty-four years, originally adopted from the Roman Church. The controversy as to the celebration of Easter in England was practically authoritatively settled by the adoption of the Roman usage at the Council of Whitby in 664, Wilfrid being the spokesman of the victorious party, Colman the defender of the traditional Celtic usage. It was on the metonic cycle that the Gregorian Calendar, introduced in 1582, was arranged. The method on which this calendar is constructed is too complex for description here. An elaborate account of the whole matter was published by Professor De Morgan in the *Companion to the British Almanac* in 1845. The time of Easter, being the most ancient and important of all the movable feasts of the Christian church, determines all the rest. It was debated, at the time of the introduction of the Gregorian Calendar, whether Easter should continue to be movable, or whether a fixed Sunday, after the 21st of March, should not be adopted. It was deference to ancient custom that led the ecclesiastical authorities to adhere to the method of determination by the moon. It must be remembered, however, that it is not the actual moon in the heavens, nor even the mean moon of astronomers, that regulates the time of Easter, but an altogether imaginary moon, whose periods are so contrived that the new (calendar) moon always follows the real new moon (sometimes by two, or even three days). The effect of this is, that the 14th of the calendar moon—which had, from the times of Moses, been considered 'full moon' for ecclesiastical purposes—falls generally on the 15th or 16th of the real moon, and thus after the real full moon, which is generally on the 14th or 15th day. With this explanation, then, of what is meant by 'full moon'—viz. that it is the 14th day of the calendar moon—the rule is, that Easter Day is always the first Sunday after the paschal full moon—i.e. the full moon which happens upon or next after the 21st of March (the beginning of the ecclesiastical year); and if the full moon happens upon a Sunday, Easter Day is the Sunday after. For any given year, the day on which the paschal full moon falls, and then Easter Day, are found by the following table and rule:

Days of the Month.	Dom. Letter.	Golden Number.	Days of the Month.	Dom. Letter.	Golden Number.
March 21	C	14	April 9	A	15
" 22	D	3	" 10	B	4
" 23	E	..	" 11	C	..
" 24	F	11	" 12	D	12
" 25	G	..	" 13	E	1
" 26	A	19	" 14	F	..
" 27	B	8	" 15	G	9
" 28	C	..	" 16	A	..
" 29	D	16	" 17	B	17
" 30	E	5	" 18	C	6
" 31	F	..	" 19	D	..
April 1	G	13	" 20	E	..
" 2	A	2	" 21	F	..
" 3	B	..	" 22	G	..
" 4	C	10	" 23	A	..
" 5	D	..	" 24	B	..
" 6	E	18	" 25	C	..
" 7	F	7			
" 8	G	..			

First ascertain the Dominical Letter (q.v.)—

taking the second, where there are two—and the Golden Number (see EPACTS); look for the golden number in the third column of the table, and opposite to it stands the day of the full moon; then look for the dominical letter, next after the day of full moon, and the day standing opposite the dominical letter is Easter Day. It sometimes happens that Easter Day, as thus determined, is different from what it would be if by 'full moon' were understood the astronomical full moon. Thus, in 1818 Easter Day, by the calendar, fell, and was celebrated on the 22d of March, the earliest possible day, although the full moon was on that day; and in 1845 it again fell on the day of the actual full moon (the 23d March).

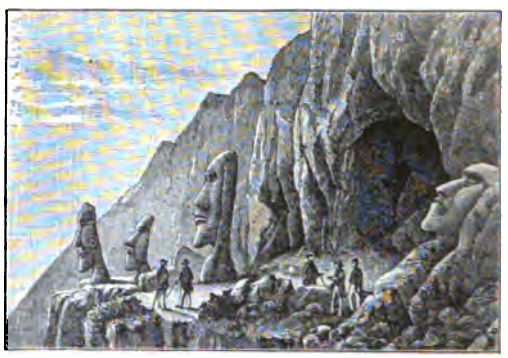
One object in arranging the calendar moon was that Easter might never fall on the same day as the Jewish Passover. They did occur together, however, in 1805 on the 14th of April; and in 1825 on the 3d April; and will do so again in 1903 on the 12th April; in 1923 on the 1st April; in 1927 on the 17th April; and in 1981 on the 19th April. The Jewish festival usually occurs in Passion-week, and never before the 26th of March or after the 25th of April (new style). On the other hand, the Christian festival is never before the 22d of March, or after the 25th of April. In 1761 and 1818 Easter fell on the 22d of March; but neither in this nor the following century will such be the case again. In 1913 it will fall on the 23d of March, as it did in 1845 and 1856. The latest Easters in the 19th and the 20th century occur in 1886 and 1943 on the 25th of April. In 1848 Easter fell on the 23d of April; and in 1859, on the 24th of April.

Popular Observances.—Many of the popular observances connected with Easter are clearly of pagan origin, and traceable to the feast of the Saxon deity 'Eastre;' the Anglo-Saxon name of April having been Eáster-mónath, which still survives in the German Ostermonath. The worship of this deity, introduced into England by the Saxons, continued to be celebrated in many parts in the north of Germany down to the beginning of the 19th century by the kindling of bonfires and numerous other rites (see BELTANE). Like the May observances of England, it was especially a festival of joy. With her usual policy, the church endeavoured to give a Christian significance to such of the rites as could not be rooted out; and in this case the conversion was particularly easy. Joy at the rising of the natural sun, and at the awaking of nature from the death of winter, became joy at the rising of the Sun of Righteousness—at the resurrection of Christ from the grave. The bonfires can be traced in the great 'paschal tapers,' or 'Easter candles,' sometimes weighing 300 lb., with which the churches were lighted on Easter Eve. In the ancient church disbursements of St Mary-at-Hill, in the city of London, there is even an entry 'for a quarter of coles for the hallowed fire on Easter Eve, 6d.'

The Easter offerings or dues are 'customary sums' which from time immemorial have been paid, and are recoverable as small tithes before the justices of the peace.

One of the most popular features of Easter was the Pasch or Easter egg, an old emblem of the resurrection; although the egg, as symbolical of renewed life, may be traced back to a very primitive period. De Gebelin has connected it with the ancient Egyptians, Persians, Greeks, and Romans; and Schwartz says it was customary among the Parsees to distribute red eggs at their spring festival. In Germany, instead of the Easter egg, is presented an emblematical print, in which three hens are holding a basket wherein are three eggs; whereas in Vienna the Easter egg is composed of silver, mother-of-pearl, or bronze, and filled with knick-knacks of some kind. Formerly in this country the Easter egg was solemnly blessed by the priest, and being elaborately coloured, was often kept as an amulet. Most of the old customs and superstitions associated with the Easter festival have fallen into disuse, but as a holiday season its popularity is not likely to decrease. Easter cards are greetings like Christmas Cards (q.v.). For the Easter term, see TERM.

Easter Island, a lonely Pacific islet in 27° 8′ S. lat., and 109° 24′ W. long. Discovered by Roggeveen on Easter Day 1722, and visited in 1773 by Captain Cook, it is 47 sq. m. in area; is entirely volcanic, with many extinct craters rising more than 1000 feet; and is fertile, but badly off for water. Sheep and cattle grazing was started by a French house in Tahiti, after the departure in 1878 of the missionaries, with 300 natives, for the Gambian Archipelago, 500 having been shipped to Tahiti four years earlier. The natives still left are fair Polynesians; between 1860 and 1882 they dwindled from 3000 to 150, as well from polyandry as from emigration. They have little to say as to the origin of the picturesque remains that have made Easter Island famous.



Stone Statues on the side of the Volcano Ronororaka, Easter Island.

These include multitudes of rude stone statues, thin-lipped, disdainful of aspect, and capped by crowns of red tufa. They are 4 to 37 feet high (16 on an average), and stand on seaward platforms, 200 to 300 feet long, of cyclopean masonry. There are besides nearly a hundred stone houses with walls 5 feet thick, and interiors bearing paintings of birds, animals, &c. See Wallace's *Australasia* (1880); and Geiseler's *Die Osterinsel: eine Stätte prähistorischer Kultur* (Berlin, 1883).

Eastern Church. See GREEK CHURCH.

Eastern Empire. See BYZANTINE EMPIRE.

Eastern Question is the name given primarily to the problem what is to become of the east of Europe—specifically, the area in Europe now or lately under the authority of the Turks. In the 18th century the western European powers were jealous of Russia and Austria in their wars with Turkey, and sympathised more or less openly with the Turks. England supported Turkey against Bonaparte in Egypt in 1798. The question has from time to time been raised by Russia's claim to be the protector of the Christian populations in the Turkish area, which till 1878 comprised more or less directly Roumanians, Montenegrins, and Servians, as well as Greeks (of Macedonia, &c.) and Bulgarians; as also by Russia's aim to be regarded and treated as the heir-in-chief of the 'sick man.' The question became acute in 1854, and the Crimean War (q.v.) was an attempt to

solve or shelve it, France supporting England in the struggle to maintain the *status quo*. The Russo-Turkish war in 1877–78, the European diplomacy of 1876–78, and the Berlin Congress of 1878 were chapters in the history of the question. The area affected by the question has since 1854 been extended, and the phrase often means practically the question how to prevent the undue aggrandisement of Russia, especially as against England; and Asia Minor, Persia, Turkestan, Afghanistan, even Egypt and India, are treated as within the sphere of this complicated and formidable question, and not merely the Balkan Peninsula, as well the parts now independent of Turkey, as those still more or less completely under Turkish authority.

See BALKAN PENINSULA, RUSSIA, TURKEY; also Hagen, *Gesch. der Orientalischen Frage* (1877); Berner, *Die Orientfrage* (1878); Döllinger, *Die Orientalische Frage* (1879); Boulger, *England and Russia in Central Asia*; Marvin, *The Russians at Merv and Herat* (1883); Vambéry, *The Coming Struggle for India* (1885); S. Lane-Poole, *The Life of Viscount Stratford de Redcliffe* (1888).

Eastham, a township and parish of Cheshire, on the Mersey, 6½ miles SE. of Birkenhead by rail. Near Eastham is the seaward terminus of the Manchester Ship Canal.

East India Army. When the East India Company (q.v.) first sent factors or agents to India, an army was not thought of. Military forces arose out of the exigencies of the times, and at first included adventurers, convicts, and deserters from European armies. Gradually organisation was introduced, and as the power of the Company increased, natives entered the service, until at length most of the troops were Hindus or Mohammedans, drilled by non-commissioned officers sent out from England. A few regiments were raised in England, a much larger number in India; but all alike were officered by the Company's English officers. Before the outbreak of the Mutiny the forces in the pay of the Company comprised about 280,000 men, including 180,000 native regulars, and 60,000 native irregular horse; and these troops formed three distinct armies, one for each presidency, and each with its own commander-in-chief, although the commander-in-chief in Bengal exercised authority over the other two, an arrangement still maintained under the later organisation. To what extent this fine force melted away during 1857 and the two following years is described under INDIA. Under the Act of 1858 the army also was transferred to the crown, the government, to prevent a threatened disturbance, allowing such as chose to retire. As the Sikhs had behaved well, most of the regiments from the Punjab were retained, as well as most of the native regiments in the Bombay and Madras presidencies; but it was not deemed expedient to restore the native regiments of Bengal proper which had proved so treacherous.

The strength of the British forces *lent* to India is annually fixed in the army estimates laid before parliament, the number amounting in 1893–94 to 73,981. The native army in the same year embraced artillery, 4543; cavalry, 23,426; sappers and miners, 3965; infantry, 113,702; total, 145,636. Total of European and native army, 219,617. These figures are exclusive of the armies maintained by the feudatory or independent states; returns published in 1884 stated their total strength at 349,835 men, with 4237 guns. During the Eastern crisis a force of native Indian troops was sent to Malta; and in the Egyptian war of 1882 Indian troops fought with distinction along with their English fellow-subjects.

East India Company. The establishment of an East Indian trade dates from the time when the Portuguese navigator, Vasco da Gama, having effected the eastern passage to India by doubling the Cape of Good Hope, cast anchor off the city of Calicut on the 20th May 1498. The Portuguese, however, never actually founded a trading company; their admirals were the king's officers, whose efforts were directed rather towards the conquest and conversion of the eastern races than to mere commerce, except as a royal monopoly. Nevertheless they were supreme in the seas they had opened from 1500 to 1600, and dispensed the treasures of all the islands of the East, from Goa to Celebes, and as far northward as Japan; for it was on the islands that the Europeans, one and all, first gained a permanent footing. In the next century their place was rapidly taken by the Dutch, whose first vessel had rounded the Cape only in 1596, and whose East India Company was founded in 1602. The earliest incorporated East India Company was the English, to which Queen Elizabeth granted a charter on the last day of the 16th century (31st December 1600), under the title of 'The Governor and Company of Merchants of London trading to the East Indies.' Two later companies, after a short period of competition, united with the original association; and in 1709 its last and most formidable rival, the English Company (1698), was amalgamated with the London Company, under the style of 'The United Company of Merchants of England trading to the East Indies.' About 1624 the English were compelled by the Dutch to withdraw nearly all their factories from the archipelago, and, shut out from the trade of the islands, they began to found settlements on the coast of the Indian peninsula. The nucleus of Madras dates from 1639; Bombay came to the Company in 1668; Calcutta was founded in 1686; finally, in 1689 the Company passed the resolution to acquire territorial sway, to 'make us a nation in India,' which was to change its factors and clerks into governors and conquerors. The old Company's charter, granting exclusive trading rights in the Indian and Pacific oceans, had been renewed from time to time, with various modifications, though not without much contention and difficulty; and these exclusive privileges were extended, in consideration of sundry loans to the government aggregating £3,200,000, to the united Company, whose constitution thus established was maintained with little alteration as long as the Company existed. Every shareholder who held £500 of the Company's stock became a member of the Court of Proprietors, which annually chose twenty-four to form a Court of Directors from those of their number who held not less than £2000 of stock. Six of the directors went out of office every year; they retired in rotation, so that each had four years of office. It was a general custom with the proprietors to elect the same persons as directors over and over again. Theoretically, the constitution of the Company was very democratic, but practically the affairs were in the hands of the directors; for the proprietors took little other interest than in receiving their half-yearly dividends. The proprietors had from one to four votes each, according to the amount of stock held by them. The Board of Control, of later formation (1784), bore relation to the governmental affairs of India.

Properly speaking, the Company were only merchants: sending out bullion, lead, quicksilver, woollens, hardware, and other goods to India; and bringing home calicoes, silk, diamonds, tea, porcelain, pepper, drugs, saltpetre, &c. from thence. Not merely with India, but with China and other parts of the East, the trade was monopolised by the Company; and hence arose their great trade in China tea, porcelain, and silk. Until Clive's day, however, paltry and insufficient salaries were paid

to the servants of 'John Company,' who were permitted to supplement their income by every means in their power—to 'shake the pagoda tree.' By degrees avarice and ambition led the Company, or their agents in India, to take part in the quarrels among the native princes; this gave them power and influence at the native courts, and hence arose the acquisition of sovereign powers over vast regions. India thus became valued by the Company not only as commercially profitable, but as affording to the kinsfolk and friends of the directors opportunities of making vast fortunes by political or military enterprises. It is not the purpose of the present article to trace the political affairs of the Company, or the rise of a British empire in India; that will be found under INDIA.

In 1744 the Company obtained a renewal of their charter till 1780, but not without a loan of £1,000,000 to government; for the monopoly was distasteful to the nation at large. France, too, had an East India Company (six had been established between 1604 and 1719), and the struggles between the two companies for power in the southern part of India led to constant warfare between them during the 18th century. Other loans to government were the means of obtaining further renewals of the charter in later years. In 1833 the legislature took away all the *trading* privileges of the Company. The dividends to proprietors of East India stock were thenceforward to be paid out of taxes imposed by the Company on the people of India, in such provinces as were under British dominion. From that year the Company's powers became anomalous; the Company could not *trade*, and could not *govern* without the sanction and continued interference of the imperial government. The wars in India since that year have been waged by Britain as a nation, rather than by the Company; and Britain practically, though not nominally, became responsible for the enormous cost of those wars. In 1853 the charter was renewed for the last time, for an indefinite term of years, but with a further lessening of the power of the Company, and an increase of that of the crown; patronage also was abolished.

After the Mutiny the Company was forced, in spite of a strenuous resistance, to cede its powers in 1858 to the crown, under an act for the better government of India. Most of the distinguished men, military and political, till then in the Company's service, accepted office under the crown, to assist the government by their general knowledge of Indian affairs. These affairs are now managed by a Secretary of State for India. The East India House (1726) was demolished in 1862; and Haileybury (q.v.), the East India college since 1806, was closed in 1858, to be four years later converted into a public school.

See Sir John W. Kaye, *The Administration of the East India Company* (1853); J. T. Wheeler, *India under British Rule, from the Foundation of the East India Company* (1886); and other books cited under INDIA.

East Indies, as distinguished from *West Indies*, include not merely the two great peninsulas of Southern Asia, but likewise all the adjacent islands from the delta of the Indus to the northern extremity of the Philippines (see INDIA). For the Dutch East Indies, called sometimes *Insulinde*, see HOLLAND.

Eastlake, SIR CHARLES LOCK, President of the Royal Academy, was born at Plymouth in 1793, and studied in London and Paris. When the *Bellerophon*, with Napoleon on board, appeared in the port of Plymouth, Eastlake profited by the opportunity, and produced, from a number of rapid sketches taken in a shore-boat, two full-length portraits of the emperor. From 1816 to 1830 he made his home in Rome, where he executed the 'banditti' pictures that first attracted attention to him in England. In this period also he exhibited 'Isidas the Spartan,' 'Pilgrims in sight of Rome,' and 'Byron's Dream.' In 1827 he was elected an Associate, and in 1830 a full member of the Royal Academy. In 1839 appeared 'Christ blessing little Children,' and in 1841 his great work, 'Christ weeping over Jerusalem,' now in the National Gallery. In 1850 he was elected President of the Royal Academy, and received the honour of knighthood. In 1855 he was appointed Director of the National Gallery, in which capacity his services were as valuable as they were unsparingly given; and it was during one of his journeys in search of pictures for the national collection that he died at Pisa, 14th December 1865. Eastlake acquired a high reputation as a writer on art. Besides other works, he published *Materials for the History of Oil Painting* (1847), a work of great learning and research; he also translated Goethe's *Theory of Colours* (1840), and prepared numerous valuable papers, largely collected in *Contributions to the Literature of the Fine Arts* (1848 and 1870), to the second series of which an excellent Memoir is prefixed by Lady Eastlake, the authoress of *Letters from the Baltic*. Eastlake was a Fellow of the Royal Society, D.C.L. of Oxford, and a Chevalier of the Legion of Honour.

East Liverpool, a post-village of Ohio, on the Ohio River, 44 miles WNW. of Pittsburg by rail, with machine-shops and potteries. Pop. 5568.

East London, a South African seaport, at the mouth of the Buffalo River, 36 miles SE. of King Williamstown, and 700 miles E. of Capetown, with a large export and import trade. It is the terminus of the railway to Queenstown. Harbour works have been erected to protect the formerly exposed anchorage. The division of East London, with an area of 1225 sq. m., was formed from part of British Kaffraria in 1866.

East Lothian. See HADDINGTONSHIRE, LOTHIAN.

East Main, a region of Canada, belonging to the North-west Territories, and consisting of the greater part of the peninsula of Labrador (see map at article CANADA). It is bounded N. by Hudson Strait, and W. by Hudson Bay down to its southern extremity, meeting Labrador proper on the E., and the province of Quebec on the S. It is a bleak and desolate country, yielding little to commerce but fish-oil and a few furs. The East Main or Slade River enters James Bay about 52° 15′ N. lat., after a course estimated at 400 miles.

Easton, capital of Northampton county, Pennsylvania, stands in the fork between the Delaware and Lehigh rivers, 67 miles N. of Philadelphia by rail. A number of railways meet here, and the town forms also the terminus of the Delaware, Lehigh, and Morris canals, by which a considerable transport trade is carried on, while it has several foundries, rolling-mills, and manufactures of locks, wire, rope, flour, &c. Easton is the seat of Lafayette (Presbyterian) College (1832), with a library of 20,000 volumes. Pop. (1890) 14,481.

East River, the strait between Long Island Sound and New York Harbour, separating the cities of Brooklyn and New York. It is about 10 miles long, and ½ mile wide at the narrowest point, and is navigable by the largest ships.

East Saginaw (P. O. 'Saginaw East Side'), the former name of that portion of the city of Saginaw, Michigan, lying east of the Saginaw River. It has large planing, flouring, and saw mills, and foundries, machine-shops, and shipyards. It was incorporated with Saginaw (q.v.) in 1890.

East St Louis, an incorporated town of St Clair co., Illinois, on the Mississippi River, opposite St Louis, Missouri, and at the convergence of numerous important railway lines, the cars of which cross the Mississippi on a fine steel bridge. The town has 6 churches, 2 banks, a public library, Baptist and Roman Catholic colleges, and manufactures of iron products, cars, soda, glass, &c. Here are stock-yards which are said to be the largest in the United States. Pop. (1890) 15,169.

Eastwick, EDWARD BACKHOUSE, English Orientalist and diplomatist, was born at Warfield, in Berkshire, 13th March 1814. Proceeding to India as a cadet of the East India Company in 1836, he was soon chosen to fill political offices in Kathiawar and Sind. From 1845 to 1859 he was professor of Hindustani at Haileybury College, and in the latter year was appointed assistant political secretary in the India Office. He then spent three years (1860–63) as secretary of legation in Persia. He died at Ventnor, Isle of Wight, 16th July 1883. His best works are translations from the Persian (Saadi's *Gulistan*, 1852; *Arrival of the Parsees in India*, 1845; *Life of Zoroaster*, 1843; and *Anvar-i Suhaili*, 1854); a *Hindustani Grammar* (1847; 2d ed. 1858); *Journal of a Diplomate in Persia* (1864); and *Kaisar-nama-i-Hind* or *Lay of the Empress* (1878–82). He also translated into English Bopp's *Comparative Grammar* (1856) and Schiller's *Revolt of the Netherlands* (1844).

Eau Claire, capital of Eau Claire county, Wisconsin, at the mouth of the Eau Claire River, and at the head of navigation on the Chippewa River, 183 miles NW. of Madison by rail. It has a vast trade in lumber, and contains numerous saw-mills, besides planing-mills, grist-mills, foundries, and machine-shops. Pop. (1870) 2293; (1880) 10,119; (1890) 17,415.

Eau Créole, a very fine liqueur, made in Martinique, by distilling the flowers of the Mammee Apple (*Mammea americana*) with spirit of wine.

Eau de Cologne, a celebrated perfume, the reputed inventor of which is Johann Maria Farina (1685–1766), a native of Piedmont, who settled in Cologne in 1709, though his claim to be the inventor is not undisputed. The secret of the process of its manufacture is claimed by from thirty to forty firms, bearing the name of Farina, now existing in Cologne. The recipe is said to be twelve drops of each of the essential oils neroli, citron, bergamot, orange, and rosemary, along with one drachm of Malabar cardamoms and one gallon of rectified spirit. The whole is distilled together, and the condensed liquid constitutes Eau de Cologne. In Great Britain, where chemists and others make an article little, if at all, inferior to the imported one, the oils are usually mixed with a highly purified spirit, and the subsequent distillation dispensed with.

Eau de Vie. See BRANDY.

Eaux Bonnes, a watering-place of France, in the department of Basses-Pyrénées, is situated in a narrow gorge of the Pyrenees, at an altitude of 2454 feet, and 29 miles S. of Pau. Pop. 795, with 6000 to 10,000 visitors in the season (July to August). The springs, both hot and cold, the former with a temperature ranging from 53° to 91° F., contain sulphur and sodium; the water is used for disorders of the chest and respiratory organs.

Eaux Chaudes, a watering-place of France, 27 miles S. by W. of Pau, situated in a narrow Pyrenean valley, 2215 feet above sea-level. Its waters, which are sulphurous, and range in temperature from 50° to 93° F., are useful in cases of catarrh and rheumatism, also for skin-diseases.

Eavesdrip, an ancient Saxon custom, corresponding to the well-known urban servitude of the Romans called stillicide (*stillicidium*), where a proprietor was not allowed to build to the extremity of his estate, but must leave a space regulated by the charter by which the property was held, so as not to throw the eaves-drop on the land of his neighbour.

Eaves-droppers 'are such as listen under walls or windows, or the eaves of houses, to hearken after discourse, and thereupon to frame slanderous or mischievous tales' (Blackstone). Such persons are, by the law of England, regarded as common nuisances, and are punishable by fine.

Ebal. See GERIZIM.

Ebb and Flow. See TIDES.

Ebbw Vale, an urban sanitary district in the north-west corner of Monmouthshire, 21 miles NNW. of Newport, lies in the middle of a rich iron and coal district, and has numerous iron-works. Pop. (1881) 15,519; (1891) 17,025.

Ebenaceæ, an order of dicotyledonous trees and shrubs allied to Sapotaceæ. About 250 species are known, mostly tropical, of which many furnish hard and durable timber (see EBONY); several are natives of the United States. The fruits are often edible. See DATE PLUM.

Ebenezer (Heb. 'stone of help'), a monument raised by Samuel after his victory over the Philistines, was assumed by early Christian hermits to be at a place now called Deiraban, near the western border of Judah. But the site is not really known.

Eberhard, AUGUST GOTTLOB, a well-known German writer, was born at Belzig in 1769, studied first theology at Leipzig, then devoted himself to a busy life as a man of letters at Halle, Hamburg, and lastly at Dresden, where he died, 13th May 1845. Eberhard's literary reputation depends upon his *Hannchen und die Küchlein* (1822), an idyl which has been translated into many languages, and is still popular, and his long poem in hexameters, *Der Erste Mensch und die Erde* (1828). His collected works fill 20 vols. (1830–31).

Eberhard, JOHANN AUGUST, philosophical writer, was born at Halberstadt, 31st August 1739; studied theology at Halle, and after some years preaching in Berlin and Charlottenburg, became professor of Philosophy at Halle in 1778. He died 6th January 1809. Eberhard's first work was his *Neue Apologie des Socrates* (1772), an able and outspoken book, in which the rights of common sense are vindicated against the assumptions of a narrow theology. Among his numerous books may be mentioned, *Sittenlehre der Vernunft* (1781), and *Versuch einer allgemeinen Deutschen Synonymik* (6 vols. 1795–1802), a work which was enriched and improved by Maas (12 vols. 1818–21), and again by Gruber (6 vols. 1826–30). Towards the close of his life, Eberhard vainly strove to controvert the metaphysics of Kant by vindicating the earlier theories of Leibnitz and Wolf.

Ebers, GEORG MORITZ, a distinguished Egyptologist and novelist, was born 1st March 1837, at Berlin, was educated at Froebel's school, and studied law at Göttingen. He afterwards devoted himself to the study of Egyptology at Berlin, in pursuit of which he visited the chief museums of Europe. He established himself in 1865 as a lecturer at Jena, where in 1868 he was made professor. Next year he made a long journey to the East, and in 1870 was called to Leipzig as professor of Egyptology. His visit to Egypt had resulted in the discovery of the celebrated hieratic medical *Papyrus Ebers*, which he published in 1875. His most important work besides this is *Aegypten und*

die Bücher Moses (vol. i., all published, 1868). His interesting and picturesque, if slight, *Durch Gosen zum Sinai*, and *Aegypten in Bild und Wort*, have been translated into English (*Through Goshen to Sinai*, 1872; and *Egypt, Descriptive, Historical, and Picturesque*, 2 vols. 1880). In 1876 he became paralysed, and necessary inaction induced him to continue the writing of historical novels, which he had begun as early as 1864 with his *Egyptian Princess*, in which a good plot is made the foundation for much Egyptological learning. Other romances are *Uarda* (1877), *Homo Sum* (1878), *The Sisters* (1880), *The Emperor* and *The Burgomaster's Wife* (1881), *Only a Word* (1883), *Serapis* (1885), and *Margery* (1889). We quote the titles of the admirable English translations of C. Bell. The Egyptian novels have a distinct Egyptological value apart from their intrinsic merits as romances.

Eberswalde, an industrial town of Prussia, 28 miles NE. of Berlin by rail, has a nail-factory, sawmills, railway machine-shops, manufactory of paper roofs, and some trade in timber, corn, and coal. Pop. (1875) 10,069; (1890) 16,144. In the neighbourhood are paper-mills and ironworks.

Ebert, KARL EGON, a Bohemian poet, was born at Prague in 1801, was for many years a librarian at Donaueschingen, and died at Prague, 24th October 1882. His poems include lyrics, epics, tragedies, and dramas from Bohemian history, and collected fill 7 volumes (Prague, 1877).

Ebionites (Heb. *ebion*, 'poor'), a term applied probably at the beginning of the Christian church to all Christians, afterwards the general name by which all Jewish Christians who remained outside the Catholic Church were designated after the apostolic age down to the time of Jerome. The name was, doubtless, derived in part from the poverty of the early community at Jerusalem, partly from the close connection between poverty and piety dwelt on in the Psalms and Prophets and by Christ himself. A distinction between the Ebionites and Nazarenes (q.v.), indicated by Justin and Origen, and first clearly made by Jerome, has been carefully drawn out by Bishop Lightfoot in the dissertation on 'St Paul and the Three' in his commentary on Galatians (6th ed. Lond. 1880); but Harnack holds that the Judaising Christians, though of many shades, were not divided into two distinct parties, and were not originally distinguished from the 'Great Church' by differences of 'doctrine,' but only in the forms of their religious life, while they had the following ing points of controversy among themselves: (1) Whether the observance of the law was a necessary condition of the reception of the Messianic salvation; (2) whether it was to be insisted on in the case of Christians born in heathenism, before they could recognise them as Christians; (3) whether, and in how far, they ought to hold fellowship with Gentile Christians, who did not keep the law; (4) whether Paul had been an elect servant of God, or an intruder hateful to God; (5) whether Jesus was a son of Joseph, or miraculously conceived by the power of the Holy Ghost. Their Gospel was some form of that known as the *Gospel to the Hebrews*. On the foundation of earlier Ebionite writings arose the Pseudo-Clementines, which must be used with great caution as evidence of the tendencies and inner history of syncretistic Jewish Christianity, as it is not till the 3d century that acquaintance with them is clearly traceable in the literature of the church. Hippolytus and Origen (in Eusebius) describe a kindred Syrian variety of Jewish Christians, who from their sacred book, supposed to have fallen from heaven, called themselves *el kesi* ('hidden power'), and are hence distinguished as Elkesaïtes. In the time of Epiphanius, who calls them 'Ebionites,' they were in large numbers in the Dead Sea district. To them Jesus was merely a prophet, whose teaching had been completed by a succeeding prophet, and by a new revelation, which seems to have been a confused mixture of Christian, Essene, and heathen elements. Their characteristic tenets reappear in Mohammedanism. See Ritschl's *Altkatholische Kirche* (1857), and Harnack's *Dogmengeschichte* (1888).

Eblis. See DEMONOLOGY.

Eboli (ancient *Eburi*), a town of Italy, 49 miles SE. of Naples by rail. Pop. 8405.

Ebonite. See VULCANITE.

Ebony (Lat. *ebenum*), a wood remarkable for its hardness, heaviness, and deep black colour, is the heart-wood of different species of Diospyros (order Ebenaceæ), the genus of the Date Plum (q.v.) and other fruits. The best ebony is the produce of *D. ebenum*, a large tree of India and Ceylon; but a number of species or varieties are also of value; others present variations in colour, density, and durability, and acquire different names —e.g. *D. hirsuta* of Ceylon is Calamander Wood (q.v.), and *D. lotus* (see LOTUS) is Green Ebony. Part of the true ebony of commerce is furnished by the closely allied *Maba ebenus* of the Moluccas. The African ebony of the Cape is from species of Euclea. The Texas Persimmon (*D. texana*) affords a small amount of excellent ebony. Of unrelated forms may be mentioned *Jacaranda brasiliana* (Bignoniaceæ), Blue Ebony, Jacaranda or Palisander Wood (see ROSEWOOD). Several leguminous trees also share the name, notably *Ebenus cretica*, which yields the red or brown ebony of Crete, *Dalbergia melanoxylon*, ebony of Senegal, and *Brya* (*Pterocarpus*) *ebenus*, West Indian ebony, false or green ebony. German ebony is simply yew-wood stained, and other imitations are current (see TIMBER, VENEER). Ebony is chiefly used by cabinetmakers for veneering. The ancient Greeks and Romans are thought to have obtained it either from India or Madagascar. They frequently inlaid it with ivory, for contrast of colour. It is mentioned by Ezekiel (xxvii. 15) as an article of Tyrian commerce. It was at one time used in medicine.

Eboracum. See YORK.

Ebro (Lat. *Hibērus*), a river of Spain, rising at an altitude of 2778 feet, in the province of Santander, within 20 miles of the Bay of Biscay. Thence it flows 442 miles south-eastward past Frias, Miranda, Haro, Logroño, Tudela, Zaragoza, Mequinenza, Mora, and Tortosa, till it falls into the Mediterranean. Its basin comprises 38,580 sq. miles. The mouth is choked up with sand, but a canal called the San Carlos has been carried through the delta. Affluents are the Najerilla, Jiloca, and Guadalope from the right, and the Aragon, Gallego, and Segre from the left. The Ebro runs chiefly through narrow and sometimes rocky valleys, and its course is obstructed by many shoals and rapids. This is partly remedied, however, by Charles V.'s Imperial Canal, which extends from Tudela to 40 miles below Zaragoza.

Écarté, a game played with thirty-two cards (all cards from the two to the six being removed from the pack). It is played by two persons. The player cutting the lowest écarté card deals. King is highest, then queen, knave, ace, ten, nine, eight, seven. The dealer gives five cards to each player, by three at a time and by two at a time, or *vice versâ*, and turns up the eleventh card for trumps. If the turn-up card is a king, the dealer marks one; if the king of trumps is in either hand, the holder marks one. If the non-dealer is not satisfied with his hand, he may *propose* to discard. The dealer

may either *accept* or *refuse*. If he accepts, each player discards as many cards as he pleases, an equivalent number of cards being dealt from the stock. After taking cards, the non-dealer may propose again, and the dealer may again accept or refuse. The hand is next played (the king, if in hand, being first marked). The highest card of the suit led wins the trick; trumps win other suits. The second player must win the trick if he can. Three tricks count one; five tricks count two. If the non-dealer plays without proposing, and fails to make three tricks, or if the dealer refuses the first proposal and fails to make three tricks, the adversary counts two. The game is five up. Ecarté was first played in the Paris *salons* early in the 19th century; but a similar game, called *Triomphe* or French Ruff, in which there was no score for the king, is of considerable antiquity.

Ecbat'ana (Heb. *Achmetha*, as in Ezra, vi. 2), the capital and chief fortress of Media. It was situated 1½ mile from Mount Orontes (now *Elvend*), and at the foot of a hill crowned with the royal citadel and a magnificent temple of the sun. According to Herodotus, Ecbatana was founded by Deioces (about 700 B.C.), who surrounded it with seven walls, each higher than the next outside it, and having its battlements of a different colour. The inmost wall inclosed the citadel, with the treasury and the archives, among which Darius found the roll containing the edict of Cyrus for the rebuilding of the temple at Jerusalem (Ezra vi.). Ecbatana was taken by Cyrus in 549 B.C., after which it became the chief seat of his government. Its cool mountain climate made it a favourite summer residence of the Persian kings; and Alexander the Great lingered here for two months in 324 B.C. After his death Ecbatana sank to a mere provincial town, till, under the Parthians, it became once more the summer residence of kings. From the time of its conquest by the Sassanidæ it is scarcely again mentioned in history. In the Mohammedan period there rose on the site of the ancient city the modern *Hamadan*. Inscriptions of Xerxes have been found on the summit and slopes of Mount Elvend (10,728 feet).—There were six other Asiatic cities or strongholds to which the name Ecbatana was given by Greek writers, and Sir H. Rawlinson identifies the Ecbatana of Herodotus not with *Hamadan*, but with a hill half-way between it and Tabriz.

Ecce Homo ('Behold the man!' from the words of Pilate, cf. John, xix. 5), a name in art for a picture representing the Saviour wearing the crown of thorns, either in a half-length figure in a group (as Correggio's 'Ecce Homo' in the National Gallery), or the one head alone (as Guido Reni's).

Eccentric, in Machinery, is a contrivance for taking an alternating rectilinear motion from a revolving shaft. It consists of a disc or circular

Eccentric.

frame, fixed on a revolving shaft or axis which does *not* pass through the centre of the disc. The disc is surrounded by a hoop of metal, and to this hoop a rod is attached. When, therefore, the shaft revolves, carrying the eccentric with it, the rod attached to the encircling hoop receives a reciprocating motion, just as it would do if attached to a crank in the shaft (see CRANK).

Eccentric, in pre-Copernican Astronomy. See under Ptolemy, Vol. VIII., PTOLEMAIC SYSTEM.

Ecchymosis (Gr. from *ek*, 'out of,' and *chymos*, 'juice'), a discoloration of the surface, produced by blood effused below, or in the texture of, the skin. It is attended by swelling to a greater or less extent, and is usually the result of injury (see BRUISE), but also occurs in disease. See PURPURA, SCURVY.

Ecclefechan, a small village of Dumfriesshire, nearly a mile from a station on the main-line of the Caledonian Railway, 20 miles NW. of Carlisle. Pop. (1841) 768; (1891) 746. Its only interest is that it is the birth and burial place of Thomas Carlyle, and is unmistakably the 'Entepfuhl' of his famous spiritual autobiography, *Sartor Resartus*. The house in which he was born (4th December 1795) still stands, and in the west corner of the churchyard around the U. P. church, which represents the old Secession church, he was laid, as he wished to be, beside his father and mother.

Ecclesfield, a township in the West Riding of Yorkshire, 6 miles N. of Sheffield. The chief manufacture is cutlery, then flax, linen, paper, and nails; whilst in the vicinity there are coal and iron mines. Pop. (1881) 21,156; (1891) 25,885.

Ecclesia (Gr., 'convocation'), a popular assembly, especially that of Athens (q.v.), where the people exercised full sovereignty, and at which every citizen of twenty years of age was entitled to vote. The Athenian ecclesia held originally four, ultimately forty, ordinary meetings in the year (see SOLON). The term was applied by the Septuagint translators to the Jewish commonwealth, and so was naturally adopted by New Testament writers to designate the church (compare Fr. *église*; cf. Welsh *eglwys*).

Ecclesiastes (Gr., 'preacher'), the title given in the Septuagint translation to a didactic poem called in Hebrew *Kohéleth*, which, according to the old tradition, was composed by Solomon. Solomon is not once expressly mentioned in it. *Koheleth* is identified with the ideal Solomon in i. 12 and elsewhere, and is represented as looking back on his life as finished, just as a departed spirit might be supposed to do. The word itself is a feminine participle, and means 'the preaching.' Some think the name *Solomon* is understood, according to others it is rather the word *Hokhmah*, 'Wisdom,' that is understood, and wisdom is called *Koheleth*, because she 'taught the people knowledge' (Eccles. xii. 9; cf. Prov. i. 20 *et seq.*, viii. 1 *et seq.*). Grotius and (more fully) Delitzsch have proved, what Luther in his *Table-talk* asserted, that the poem belongs to the latest of the Old Testament Scriptures. The style is very different from that of Proverbs, for it is charged with Aramaic elements, 'even to the finest veins of the language,' as Ewald has said and Knobel has elaborately demonstrated. Further, there is no trace in Proverbs of the doubts of Koheleth, and the historical background of the one is as bright as that of the other is gloomy. Koheleth was written by a Jewish thinker some time between 320 and 217 B.C. The date must be fixed later if Plumptre is right in discovering a tincture of Stoic and Epicurean philosophy in the book, but this Kleinert and Davidson emphatically deny, while both admit that here and there the language bears traces of Greek influence. No book of Scripture has been so variously judged; scarcely one commentator entirely agrees with another in its interpretation. The New Testament and the church fathers of the 1st century

do not refer to it. Many of the Jewish doctors considered that it ought to be 'secreted.' The school of Shammai held that it did not 'defile the hands' (i.e. was not canonical), the school of Hillel held that it did, and its canonicity was not clearly decided till the Synod at Jamnia in 90 A.D. The homilies on the first three chapters by Gregory of Nyssa (4th century) form the earliest exegetical treatise on the book. The allegorical treatment by Gregory was still further developed by Jerome and Augustine, and throughout the middle ages Koheleth was credited with the twofold aim of demonstrating the nothingness of all worldly things and commending the ascetic and contemplative life, while Gregory the Great's explanation of the passages that resisted this view as 'ironical mockeries of the wicked' was universally accepted. Hugo of St Victor, Bonaventura, and other scholastics held that 'the intention of the book is to persuade men to despise the world.' The first Protestant commentator on Ecclesiastes was Brenz, who brought out its practical character as commending 'a pious use of the creatures,' and in this he was followed by Luther, who regarded viii. 15 as the *scopus* of the book. Few books have been favourites of so many different persons, and for such divers reasons. Renan finds in the author an 'amiable *roué* of the upper ten,' to whom the only certainty is that the pious are weaklings, and between whom and Heinrich Heine '*il n'y a qu'une porte à entr'ouvrir.*' Frederick the Great called it a 'mirror of princes:' Jerome, Comenius, and Hengstenberg used it as a manual of religious consolation.

Many since Grotius have regarded it either as an anthology from different authors, or a dialogue between the false wisdom and the true. But Koheleth is doubtless a unity, and it would be hard, as Ewald remarks, to find elsewhere so much comprehended in such small compass. It presents in kaleidoscopic series the varying aspects of human life, tests the aims and results of each, and concludes of each in turn that 'this also is vanity.' This is the thread running through the book, which also tends to the practical conclusion that life being without result, a man should take the best of it by the exercise of good sense, and 'make his soul enjoy good in his labour.' The book of Koheleth shows the limitation of the Old Testament form of Revelation, and indicates negatively the transition from the Old Covenant to the New, which was set forth in the declarations of the Messianic Prophecies. According to Professor Davidson, through the book there is 'the cry of the human spirit for continuance, that it be not extinguished in death, that it may carry the gains accumulated here with it; the cry for a sphere adequate to the powers of which it is conscious, that it be no more the toy of outward things, but have all things under its feet; the cry that its moral instincts be not violated, that it should be taken more into the counsels of God, and know something even as it is known. If all this be like the flutterings of an eagle long chained, it has in it something prophetic. On the other hand, the preacher earnestly counsels every man, "Hold fast that which thou hast." God and his moral rule, however obscure its incidence be, and the moral life of man are sure.'

The most important modern commentaries and studies on Ecclesiastes are those of Ewald (*Dichter des alten Bundes*, vol. ii. 1867), Hitzig (1847), Elster (1855), Hahn (1860), L. Young (1865), Ginsburg (1861), Zöckler (1868; American ed. by Dr Tayler Lewis, 1872), Grätz (1871), T. P. Dale (1873), Tyler (1874), Delitzsch (1875), Plumptre (1881), Renan (1882), Wright (1883), Cheyne (*Job and Solomon*, 1887), Bradley (*Lectures on Ecclesiastes*, 1885), Nowack (forming part of the *Exegetisches Handbuch*), Professor Davidson ('Some Recent Books on Ecclesiastes,' in the *Theological Review*, Edin., November 1888). See also Professor A. Palm's bibliographical monograph, *Die Qohelet Literatur* (1886).

Ecclesiastical Commissioners. In 1835 commissioners were appointed to inquire into the revenues of the bishoprics, cathedrals, &c. of England and Wales, with a view to the more equal distribution of such revenues, and to a better provision for the spiritual necessities of the people. The commissioners presented four very valuable reports, and on their recommendation a permanent Commission was established by act of parliament in 1836. The Commission now consists of the archbishops and bishops, the deans of Canterbury, St Paul's, and Westminster, certain judges and ministers of state, eleven eminent laymen appointed by the crown (of whom two are appointed to act as Church Estates Commissioners), and a third Church Estates Commissioner appointed by the Archbishop of Canterbury. The commissioners are a corporation, empowered to hold lands and other property. The powers of the Church Building Commissioners were transferred to them in 1856. Though the acts which relate to the Ecclesiastical Commissioners are numerous and complicated, the general outline of their duties is tolerably clear. Certain canonries, prebends, and other offices have been suppressed by parliament; the revenues of other offices have been restricted to a fixed sum, under schemes of reform prepared by the Ecclesiastical Commissioners and sanctioned by the Queen in Council. The revenues thus set free have been carried to a common fund, out of which grants are made in aid of poor benefices and of the new districts created to meet the wants of the more populous and necessitous parts of the country. Under the Church Building Acts the Commissioners have power to divide and unite parishes, and to make new districts for ecclesiastical purposes. Reports of the work of the Ecclesiastical Commissioners are laid annually before parliament. Their proceedings have seldom led to political discussion; but the very large powers which they exercise render them liable to keen criticism from clergymen and others interested in church matters.

The Ecclesiastical Commissioners are the largest landowners in England; their land extending to about 300,000 acres, comprising a large part of the best agricultural land in the country. The net income from all sources was in 1888 £1,120,000.

Ecclesiastical Courts. In the early Christian church there were courts, presided over by bishops and presbyters, which dealt with questions of discipline, and with disputes which arose among the brethren. It is to these courts that St Paul refers when he condemns those who go to law with a brother 'before the unbelievers, and not before the saints.' When Christianity became an established religion, these courts changed their character. The state permitted church courts to exercise jurisdiction over the whole civil community in ecclesiastical matters, and in matrimonial and other causes which had to be decided by the 'law Christian.' In England and elsewhere the goods of a deceased person were distributed, or his will was proved, in the court of the 'ordinary' ecclesiastical judge, usually the bishop of the diocese: this was done, because a part of the goods went by custom to the bishop, to be spent for pious uses. The early history of the English church courts is obscure; such information as we possess will be found in the report presented to parliament by a Royal Commission in 1883. These courts became in time a fruitful source of disputes between the crown and the see of Rome. After a long struggle, the crown prevailed: clergymen were made subject to the law of the land; the king's court maintained its right to prohibit ecclesiastical judges from going beyond

their jurisdiction; appeals to Rome were forbidden, under penalty of *Præmunire* (q.v.). At the Reformation the king was acknowledged as the legal head of the church, charged as such with the administration of the 'law spiritual;' the final appeal was to delegates or commissioners of review appointed by him. The final appeal in ecclesiastical cases is now to the Judicial Committee of the Privy-council. Modern legislation has greatly diminished the importance of church courts; their jurisdiction in matrimonial and testamentary causes is gone; and Acts of Toleration prevent them from exercising coercive powers over the general community (see CONVOCATIONS, DOCTORS' COMMONS, and DIVORCE). Under the Public Worship Regulation Act of 1874, a new ecclesiastical judge was appointed to try offences in the matter of ritual. There is a party in the church which objects to the jurisdiction of this judge and of the Judicial Committee on the ground that their decisions are not those of ecclesiastical courts in the proper sense of the term. The Bishop of Lincoln's case, tried in 1889 by the Archbishop of Canterbury, with the assistance of four bishops, raised the interesting question, by what court a bishop may be tried for alleged offences against the law of the church.

In Scotland, the church judicatories are kirk-sessions, presbyteries, synods, and general assemblies. The 'spiritual independence' of these tribunals has been the theme of much controversy, especially at the time of the Disruption of 1843 (see FREE CHURCH). The Commissary Court and the Court of Teinds are semi-ecclesiastical in their character. Both in England and in Scotland, dissenting churches have courts of their own; the jurisdiction of such courts depends entirely on contract or voluntary submission. See Sir R. Phillimore's *Ecclesiastical Law of the Church of England* (2 vols. 1873–76), and T. E. Smith's *Summary of Law and Practice in Ecclesiastical Courts* (3d. ed. 1888).

Ecclesiastical Law. See CANON LAW.

Ecclesiastical Titles Assumption Act, a measure passed in 1851 as the outcome of a ferment of Protestant zeal, awakened by an edict issued by the Papal court in 1850, dividing Great Britain into territorial bishoprics, under an Archbishop of Westminster. The Act of 1851, passed by Lord John Russell, declared the papal edict null and void, and imposed penalties on persons assuming Catholic titles named from bishoprics, deaneries, &c. in England or Ireland. No prosecution took place under the act, the popular excitement died down, and the act was finally repealed in 1871. No opposition was made to the constitution of a regular Catholic hierarchy in Scotland in 1878, with territorial titles.

Ecclesiastical Year. See YEAR, CHRONOLOGY, EASTER, FESTIVALS.

Ecclesiasticus (Lat., with *liber*, 'book,' understood; i.e. 'the church-book'), the title which from about the middle of the 4th century came to be applied in the Western Church to a collection of apothegms, whose author calls himself at the close of his book 'Jesus, the son of Sirach, the Jerusalemite.' According to the prologue of the Greek translation, the work was originally composed in Hebrew (not in Aramaic). Jerome testified that he had seen the Hebrew text, no part of which is now extant beyond a number of quotations in the Talmud, and that the original title was *Meshalim* (Heb., 'apothegms'). In the Greek MSS. the constant title is *Sophia* ('wisdom,' Heb. *Hokhmah*), the name also used to designate the canonical book of Proverbs. From another statement in the translator's prologue, it can be concluded with certainty that the translator, who was the author's grandson, came to Egypt in the year 132 B.C. The author of Ecclesiasticus may thus have lived and written about 190–170 B.C. In accordance with this is the tribute to the memory of the high-priest Simon, son of Onias (i.e. Simon II., who lived at the beginning of the 2d century B.C.). The earliest Christian writer who expressly quotes the book is Clement of Alexandria, but there are not a few probable indications that it was known to the writer of the epistle of James (cf. e.g. James, i. 19 with Ecclus. v. 11). No definite plan can be traced in the arrangement of this collection of aphorisms, which was doubtless composed piecemeal. But there is a moral unity of motive throughout. The son of Sirach everywhere teaches that man's true wisdom is the fear of God and the keeping of his commandments, though here and there his zeal in applying his teaching of wisdom to every least detail of human life leads him to inculcate petty, homely rules of prudence not without a savour of utilitarianism. We owe the preservation of the book to the pious desire of the author's grandson to recommend the theology of Palestine to the Jews of Alexandria, who in return inserted it in the Greek Bible. 'That it did not find a place,' says Fritzsche, 'among the canonical Scriptures was probably owing to its late origin, and the fact that it was not anonymous, or rather, that it did not appear under an ancient and venerable name, like the somewhat later book of Daniel, but under that of its real author.' From the end of the 2d century downwards Ecclesiasticus was regarded as an edifying book, and it was not till the Council of Trent pronounced it to be canonical that Protestant orthodoxy discovered those signs of spiritual deficiency of which most of the Reformers seem to have been unaware. Bunyan, in his *Grace Abounding*, tells that after being 'greatly enlightened and encouraged' by the text Ecclus. ii. 10, it 'did somewhat daunt' him to find it in the *Apocrypha*, yet he considered it was his 'duty to take the comfort of it.' The noble 'Hymn of the Forefathers' at the conclusion of the book is familiar to our ears from the words read on founders' days and sung in Handel's Funeral Anthem.

The best commentary is that of Fritzsche (1859). See also Bruch, *Weisheitslehre der Hebräer* (1851); Horowitz, *Das Buch Jesus Sirach* (Breslau, 1865); Merguet, *Die Glaubens- und Sittenlehre des Buches Jesus Sirach* (Königsberg, 1874); Seligmann, *Das Buch der Weisheit des Jesus Sirachs* (Breslau, 1883); and Schürer's *History of the Jewish People in the time of Jesus Christ* (2d div. vol. iii. Eng. trans. Edin. 1886).

Ecclesiology, the study of church architecture, decoration, and archæology, a subject discussed in innumerable separate articles throughout this work. See CHURCH.

Ec'dysis. See CRAB, CRUSTACEA, MOULTING, and under Skin, Vol. IX., page 488, SKIN-CASTING.

Échelon (from the French *échelle*, 'ladder') is such a formation or arrangement of troops that, if viewed from a height, they would present some analogy to the successive steps of a ladder or staircase. The several divisions of the force, although parallel, are no two on the same alignment. Each has its front clear of that in advance, so that, by marching directly forward, it can form line with it. There are two kinds of échelon, *direct* and *oblique*.

Echidna, or PORCUPINE ANT-EATER, a genus of mammals representing a primitive type, included along with the Ornithorhynchus (q.v.) and another genus in that lowest sub-class of Mammalia which has been variously designated Monotremata, Ornithodelphia, or Prototheria. In many ways the few animals in this section are primitive—in skeleton, brain, heart, and reproductive organs especially.

None of their peculiarities, however, are more striking than their oviparous, instead of viviparous habit. They lay eggs instead of bringing forth their young as such, like other mammals. The temperature of the body is very low (in Echidna 28° C.), and this may be taken as a sort of physiological index of the low pitch of the life. In several features besides the egg-laying habit the Prototheria resemble birds, but this is not due to any relationship other than that of a far back common ancestry.

The genus Echidna is found in Australia, Tasmania, and New Guinea. The cut shows the general appearance of the animal. The hair is partly replaced by the porcupine-like spines, which are doubtless useful in protection and in burrowing; the toes are armed with strong claws, dexterously used in rapid digging both for food and for concealment; the tail is rudimentary; the skull is prolonged into a narrow snout; the mouth, which has a very small aperture, is entirely toothless, but contains a long extensile worm-like tongue, viscid with saliva, which is quickly moved out and in for catching ants. The hind-leg or heel of the males bears a horny spur, connected with a gland on the thigh, but of unknown significance. The

Echidna aculeata.

Echidna has a better brain than the duckmole, the cerebral hemispheres being not only larger, but well convoluted. A unique skeletal peculiarity for a mammal is the incompletely ossified socket (*acetabulum*), where the thigh-bone works on the hip-girdle. In skull, mouth, feet, tail, skin, and general habit, the Echidna is obviously very different from the ornithorhynchus. The animal is emphatically a burrower. In walking, the hind-toes are turned outwards and backwards. It feeds on ants, caught as above described, and crushed by spines on the tongue and palate. The Echidna is thus a prophecy of the true Ant-eaters (q.v.). The eggs are large, and inclosed in a tough egg-shell. After being laid, they are carried in a pouch developed round about the depressed area on which the milk-glands open. There are no teats.

There are several species of Echidna, the best known being *E. aculeata*, in Australia and Tasmania. Another form, 'with longer fur almost concealing the spines,' is distinguished as *E. setosa*. A third species—*E. lawesii*, from New Guinea—has also been distinguished. All these have five claws on each foot. A larger form, with only three claws, occurs in New Guinea, and is separated as a distinct genus, *Acanthoglossus* or *Pro-echidna bruijnii*. The upper arm of a fossil Echidna has been found among Pleistocene remains.

See Gould, *Mammals of Australia* (3 vols. 1845–63); Gervais, *Ostéographie des Monotrèmes* (Paris, 1878); Oldfield Thomas, *Proc. Zool. Soc. Lond.* (1885); Baldwin Spencer, *Nature*, xxxi. (1884–85); and Haacke on 'Oviparity,' in *Proc. Roy. Soc.* xxxviii. (1884–85).

Echinococcus. See TAPEWORMS.

Echinodermata (Gr., 'thorny-skinned'), a well-defined division of Invertebrates, including seven classes: Holothurioidea (q.v.) or Sea-cucumbers, Sea-urchins (q.v.) or Echinoidea, Starfishes (q.v.) or Asteroidea, Brittle-stars (q.v.) or Ophiuroidea, Feather-stars or Crinoidea (q.v.), and the wholly extinct Cystoidea (q.v.) and Blastoidea. The larva is bilateral, but the adults are more or less radially symmetrical. Limy depositions, forming skeletal framework, are developed to a variable, but usually predominant, degree in the middle layer or mesoderm. There is in all a special development of a water-vascular (locomotor or respiratory) system. A metamorphosis occurs in the life-history. They are all marine, barring a few Holothurians in brackish water. They appear in the Lower Silurian strata. On the genealogical tree the Echinoderms form a very distinct offshoot from the main stem. The larva of the remarkable worm Balanoglossus has a striking resemblance to the typical Echinoderm larva. The sea-urchins and sea-cucumbers are associated along one line; the starfishes, brittle-stars, and crinoids along another. See the separate articles.

Echinoidea, a sub-class of Echinodermata (q.v.). See SEA-URCHINS.

Echinorhynchus (lit. 'thorny-snout'), a genus of peculiar parasitic worms, forming the class Acanthocephala, which approaches but is quite distinct from the Nematodes. The proboscis armed with hooks, the absence of mouth or food-canal, the exclusively parasitic habit and its results, are characteristic features. There are many species, one of which has been found, but that is all, in man. The adults occur in the alimentary canal of some vertebrates—e.g. pig, duck, pike, perch; the immature forms inhabit small invertebrates (eaten by the final hosts), especially small aquatic crustaceans. See PARASITIC ANIMALS.

Echium. See VIPER'S BUGLOSS.

Echo, a nymph whom Zeus employed to talk incessantly to Hera in order to keep her from observing his infidelities. The goddess discovering his artifice, changed Echo from a nymph into a mere echo. She next fell in love with Narcissus, but finding her love unreturned, pined away in hopeless grief till nothing but her voice remained.

Echo (Gr., 'sound'). Sound is produced by waves of compression and rarefaction in the air; when such a wave comes against a wall or other opposing surface, it is reflected, and proceeds in another direction, and the sound caused by this reflected wave is called an echo. Even the surface of a cloud suffices to reflect sound, as may be observed during thunder and the discharge of cannon. That the echo of a sound may return to the point where the sound originated, the reflecting surface must be at right angles to a line drawn to it from that point. Oblique walls send the echoes of a person's voice off in another direction, so that they may be heard by others, though not by him. In order to echo words distinctly, the reflecting surface must on the whole be plane, or so curved as to resemble a concave mirror. A curved form is necessary for returning a distinct sound when the distance is considerable. Great evenness of surface, however, is not essential, as it is no uncommon thing for the edge of a wood to return an echo. The distance of the reflecting surface must also be such as to allow a sufficient time to elapse between the sound and the return of the echo for the ear to distinguish them; when they succeed too closely, they merge into one. An interval of about $\frac{1}{9}$ of a second is necessary to discriminate two successive sounds; so that if we assume 1125 feet as the distance traversed by sound in a second, $\frac{1}{18}$ of 1125, or 62 feet, will be the least distance at which an echo can be heard, as the sound will go that distance

and return in ½ of a second. If the distance is less, the echo only clouds the original sound, and is not heard distinct. It is these indistinct echoes that interfere with hearing in churches and other large buildings (see ACOUSTICS); hence anything that breaks the evenness and continuity of the reflecting surfaces is an improvement in this respect. The number of syllables that any particular echo will repeat, depends upon how many can be uttered in the time that the sound takes to go to and return from the reflecting surface. The echo at the tomb of Metella, in the Campagna, near Rome, of which Gassendi speaks as repeating a hexameter line requiring 2½ seconds to utter it, must therefore come from a distance of about 1500 feet. Such echoes are rare, as the various conditions are seldom all fulfilled. When there happen to be several reflecting surfaces at different distances in the direction of the sound, with a sufficient interval between them, each gives a separate and distinct echo. A similar effect is produced when two surfaces are inclined to each other in such a way as to give repeated reflections of the sound from the one to the other like the mirrors of a kaleidoscope, thus producing echoes of echoes. To this multiple and repeating class belong the famous echoes of Killarney, and that produced between the wings of the castle of Simonetta, near Milan, which repeats the report of a pistol 60 times.

Echuca (formerly Hopwood's Ferry), a town of Victoria, Australia, stands on a peninsula formed by the Murray and Campaspe rivers, 156 miles N. of Melbourne, on the Murray River Railway. It has considerable trade in red-gum timber, wool, and wine, and important river traffic by steamer. A bridge which carries a roadway and railway connects Echuca with Moama on the New South Wales side of the Murray. It cost £124,000. Pop. about 5000.

Ecija, a city of Spain, in the province of Seville, 34 miles SW. of Cordova by rail, is situated in a fertile district, producing corn, wine, and some cotton. An old Roman and Moorish town, it possesses several traces of the architecture of those peoples. On account of its great heat, it is popularly known as the 'Frying-pan of Andalusia.' The manufacture of oil and weaving are the chief industries. Pop. about 35,000.

Eck, JOHANN (properly JOHANN MAIER), the zealous opponent of the Reformation, was born at the village of Eck, in Swabia, 13th November 1486. From his twelfth year he was a student, first at Heidelberg, and afterwards at Tübingen (1499–1501), Cologne, and Freiburg in Breisgau (from 1502). Having entered the priesthood in 1508, he left Freiburg in 1510 to be canon of Eichstädt and professor of Theology at Ingolstadt, and was the ruling spirit of that university till he died there, 10th February 1543. Learned and vainglorious of his great reputation for dialectic skill, he offered a challenge to Luther in his *Obelisci* (against Luther's *Theses*), attacking Carlstadt at the same time. This led to the famous disputation held in the Pleissenburg at Leipzig from the 27th June to the 16th July 1519. Eck first disputed with Carlstadt about grace and free-will, and defended the Roman Semi-Pelagianism with superior ability. Thereafter he contended at greater length with Luther for the primacy of the pope, penance, indulgences, and purgatory, and pressed the Reformer hard with the charge of Hussite heresy. Eck fought with quotations from Fathers and Councils, and sought to dazzle his numerous hearers with scholastic learning; Luther appealed to history and Scripture, and at last cried to Eck that he 'ran away from the Bible like the devil from the Cross.' Both parties claimed the victory, and at Leipzig Eck certainly achieved his object, which was to compel the great heretic to declare that disobedience to pope and council might under certain circumstances be right, and thus complete the breach between Luther and the pope. After this Eck wrote his chief work, *De Primatu Petri*, and went to Rome in 1520 to reap the fruits of his labours. He returned to Germany with the bull of 15th June 1520, which declared Luther a heretic. Eck henceforth continued with passionate violence his struggle with the Reformation. He made two more journeys to Rome; took part in the convention at Ratisbon in 1524; opposed Œcolampadius in the Baden conference in 1526; was engaged at the Augsburg Diet (1530) in the preparation of the confutation to oppose the Augsburg Confession, and was present at the conference begun at Worms in 1540, and ended at Ratisbon in 1541. Eck's appearance at the Leipzig disputation is thus described by the humanist Petrus Mosellanus: 'Eck is a tall man, with a fat, square-built body and a full, thoroughly German voice, which, supported by his powerful loins, would do well not only for an actor, but even for a public crier; still, it is more harsh than clear. His mouth and eyes, indeed his whole countenance, are such that one would sooner take him for a butcher or a barbarian mercenary than a theologian. With respect to his mind, he has a remarkable memory; and, if he only had an understanding equal to it, the work of nature on him would be complete.' Eck collected his polemical writings under the title *Operum Joh. Eckii contra Lutherum, tom. I.–IV.* (1530–35). See Seidemann, *Die Leipziger Disputation* (Dresden, 1843); and Wiedemann, *Dr Johann Eck* (Regensburg, 1865), which has a bibliographical list of his writings (81 in number).

Eckermann, JOHANN PETER, friend of Goethe, was born at Winsen, in Hanover, in 1792. After serving as a volunteer in Kielmannsegg's rifle corps during the war of 1813–14, he was for some time employed in the war office at Hanover, and was a student (from 1817) at the gymnasium of Hanover and university of Göttingen. The publication of his *Beiträge zur Poesie, mit besonderer Hinweisung auf Goethe* (Stutt. 1823), led to his removal to Weimar, where he was employed by Goethe as his assistant in preparing the final edition of his works. After being tutor to the grand-duke's son, he travelled in Italy with Goethe's son in 1830. He edited the poet's posthumous works in 1832–33, and in conjunction with Riemer brought out in 1839–40 a complete edition of his works in 40 vols. Eckermann was librarian to the grand-duchess at the time of his death at Weimar, 3d December 1854. He has won for himself a lasting name by his *Gespräche mit Goethe in den letzten Jahren seines Lebens 1823–32* (2 vols. Leip. 1837; 6th ed. edited by Düntzer, 3 vols. Leip. 1884). These *Conversations* are of the greatest value for the light they throw on the character of Goethe both as a poet and as a man, and contain, in Eckermann's own words, 'many valuable explanations and instructions with regard to art, science, and the practical affairs of life.' The book has been translated into all the languages of Europe. The English translations are by Margaret Fuller (Boston, U.S. 1839), and John Oxenford (Lond. 1850).

Eckhart, MEISTER, one of the profoundest speculative thinkers among the German mystics. Of his personal history very little is known. He was born in either Strasburg or Saxony towards the end of the 13th century; entered the Dominican order; studied and afterwards taught in Paris; acted as prior at Erfurt, and as vicar of his order for Thuringia, before 1298; filled the office of provincial for the Dominicans in Saxony for eight years from

1303, and in 1307 was also appointed vicar-general of Bohemia; some years later he preached at Strasburg and Frankfort, and from 1325 until 1327, the year of his death, at Cologne. Living in an age when the religious consciousness was very sensitive and alert, when the writings of such thinkers as Plotinus, Pseudo-Dionysius, Augustine, Amalrich of Bena, Albertus Magnus, and Thomas Aquinas were being eagerly studied, and the religious fervour of men's hearts was being kept aglow by the practical self-denying lives of the Beghards and Beguines, and the Brethren of the Free Spirit, Eckhart, from the first a religiously inclined nature, easily became inspired, under these almost irresistible educative influences, with the spirit of mystic speculation. But his genius led him beyond the position of his immediate forerunners, and brought him to what was virtually an independent standpoint. Instead of using his speculations as vehicles for the exposition of the orthodox theology of the church, he broke through its traditions and dogmas to the fundamental, permanent realities underlying them. His teaching begins with an explanation of the nature of God, and passes on to the consideration of man and of man's relations to God.

Being (*Wesen*) in its ultimate and most abstract form is without personality, and without differential characteristics; nevertheless, it contains within itself potentially the differentiæ of all existence. It is the unknown, the nothing, the negative of concrete being; the only fact known about it is that it is pure self-contained unity. This ultimate incomprehensible being is the godhead, in which God himself exists as absolute personality, but in a state of potential being, as the real selfhood of abstract being not yet personalised. Absolute personality, however, become actual self-conscious personality constitutes God the Father. The Father gives origin to the Son in the very act and moment of thus becoming conscious of himself; and the Holy Spirit is the love and will that are common to both Father and Son—that is to say, the blossoming of the process of God's revelation of his own nature to himself. But this process does not take place under any law of temporal succession: it is a single act enduring eternally. Nor are Father, Son, and Holy Spirit three separate personalities, but one and the same quintessential personality of being. And it is precisely because the abstract potential personality in the godhead does penetrate to the comprehension of its own being, and just in this very act of self-fathoming, that it is God. In this process of God's self-revelation the world is likewise contemporaneously created; for all things exist in God ideally from eternity. In the eternal now of God's conception all things belong to the unity of the divine nature. Hence all creatures are God, and the world and God are one, the original selfhood of all things partaking of the being of God. In like manner, I too am God. For the soul of man is an outflow from God's essence, and it exists in man without God's essence thereby in any way suffering diminution. In the soul of every individual therefore there exists a part which is in essence of the divine nature; this is the spark (*Funkelein*), which always yearns to return unto God, in order to find in him that perfect tranquillity and rest from energising which characterise the godhead. In the moment when the soul becomes thoroughly conscious of its essential selfhood, then is it divine, and enters into God's nature, and becomes united with him. But it does not become wholly absorbed in God's nature, for in the consciousness of itself it has permanent ground and warranty for its own personality and creatureship. Man, in order to achieve his ethical consummation, must therefore annihilate within himself all that appertains to self, must, in fact, expurgate all that is not of the essence of God, until his soul becomes filled with nothing but God; then does he understand God, and is indeed God, and his love is God's love. Thus the nullification of all self-regarding, all egoistic desire, an imperturbable serenity of spirit, not so much the doing of virtuous acts as the being virtue itself, the which is love, this is the supreme practical moment in the perfection of personal righteousness, the reality of life in its highest potency. This sanctification attained, all a man's acts are right and good.

Eckhart, however, in spite of the abstruse nature of his speculative teaching, was not neglectful of the practical precepts of pure Christianity, as is proved by many a passage in his sermons, and especially by his tractate *Schwester Katrei*. Nor did he lend any countenance to fastings, vigils, ecstatic visions, and similar over-devotional exercises, to which mystically inclined natures were in those days so prone. His power, both as thinker and as preacher, is attested by the commanding influence he won over his contemporaries and the best among his successors. Probably the deepest and most original thinker of his time, bold and paradoxical in the utterance of his opinions, gifted with a keen intuitive apprehension of truth that penetrated to the very heart and root-essence of things, with a mind that was essentially scientific, that refused to be satisfied with anything short of the surest realities and verities of religion, and with a heart that regarded inner discipline, the moral perfecting of man's nature, as supreme above the punctilious observance of churchly ordinances, Eckhart, by preaching the sufficiency of the individual soul to attain of itself unto immediate communion with God, struck a dangerous blow at the hierarchical pretensions of the clergy and the church. Nor did he escape the destiny that overtook original moral reformers in ante-reformation days. He was arraigned by the Archbishop of Cologne, in 1325, for having preached and taught heresy; but the accusation could not be sustained in face of Eckhart's self-justification; at all events it fell to the ground, at least for a time, but only to be revived again two years after his death, when his writings were condemned as heretical by a papal bull of John XXII. Meister Eckhart's extant works consist of sermons and tractates, written in Latin and German. The German works are printed in vol. ii. of Pfeiffer's *Deutsche Mystiker des 14ten Jahrhunderts* (1857). Compare also Preger, *Deutsche Mystik* (1874), and Lasson's monograph (Berlin, 1868).

Eckmühl, a little village on the Laber, in Bavaria, 15 miles by rail S. of Ratisbon, is notable for the battle fought there, on the 22d April 1809, between Napoleon I. and the Archduke Charles of Austria, in which the latter was defeated, with the loss of 6000 men and 16 guns.

Eclampsia is a term often erroneously employed as synonymous with Epilepsy (q.v.). It is really the equivalent of Convulsion (q.v.), whatever may be the cause; but its use is usually restricted to such cases of convulsions as are due to some obvious local or general cause, such as teething in childhood (infantile eclampsia), child-bearing (puerperal eclampsia), or the blood poisoning of Bright's disease of the kidneys (uræmic eclampsia). The occurrence of eclampsia may be an isolated phenomenon of comparatively slight importance; or, on the other hand, it may be of the gravest significance. The seriousness of the attack is estimated not by the character of the convulsions, which are identical with those of epilepsy, but by a careful consideration of the cause.

Eclecticism. The term eclectic (from Gr. *eklegein*, 'to choose,' 'select') was first applied in

philosophy to certain Greek thinkers in the 2d and 1st centuries B.C. Stoicism and Epicureanism had subordinated the search for pure truth to that for happiness and practical virtue: Scepticism had denied that such truth could be found: Eclecticism was the attempt to reach the highest probability by selection from the already existing systems of philosophy. It arose from despair of attaining absolute truth, and from the desire for knowledge which should suffice for guidance in action. Panætius and Posidonius (later Stoics), Carneades (of the new Academy), Philo of Larissa are the chief early representatives of eclectic thought in later Greek philosophy. Philosophic eclecticism had appeared in the Sophists about the middle of the 5th century B.C. It was here also associated with, and sprang immediately from, scepticism, with which was combined a certain dogmatic tendency. Plato and Aristotle were eclectic only in a very wide meaning of the term, for the philosophic genius of each was original, and their concern for pure truth was very intense.

The chief causes of Roman eclectic philosophy were similar to those of eclecticism in Greece. Philosophic speculation was ill suited to the practical Roman mind, which was content with the most easily found explanation of man and the universe. Cicero's philosophic writings (46–43 B.C.) are chiefly ethic. They express only probable truth, and, to a large extent, like the philosophy of the Sophists, reflect what was common to all popular opinion. Cicero had studied with Epicurean, Stoic, and Sceptic teachers, and tried to unite Peripatetic, Stoic, and Sceptic doctrines. His friend Varro developed his views with greater knowledge of the history of philosophy. In the following century Seneca, the Stoic, propounded a scheme of philosophy much of which was eclectic, and most of which was determined by ethical considerations.

The last period of Greek philosophy—i.e. in the 2d and 1st centuries B.C., was characterised by a weak eclecticism—viz. that of the Neo-Pythagoreans, the Pythagorean Platonists, and the Platonic Stoics. In the 1st century B.C. a new eclecticism appeared at Alexandria, the chief representative of which was Philo, a Jew (perhaps about 25 B.C. to 45 A.D.), who interpreted the Old Testament in an allegoric sense, and in harmony with selected doctrines of Greek philosophy. These, in turn, were modified so as to remove their inconsistency with the sacred writings. He was directly indebted to Pythagorean, Platonic, Peripatetic, and Stoic schools for much of his thought. Neoplatonism, the last product of Greek speculation, was not syncretic, for it sifted and transformed the principles which it borrowed from other systems. Its fundamental doctrine of ecstasy, or immediate knowledge of God, in which the distinction of the human soul from the divine reason is completely removed, differs greatly from preceding similar theories both Greek and Oriental. It was a fusion of Greek philosophy with Oriental religion in which, however, the first element greatly predominated. The principal exponents of this philosophy are Plotinus (205–270), Porphyry (233 to about 302), Iamblichus (died about 330), and Proclus (410–484). Its purpose was religious—viz. the attainment of right relations between God and man.

There was much eclecticism in the earliest Christian philosophy. Among the Fathers of the Church Clement of Alexandria and his pupil Origen were greatly influenced by their study of Greek philosophy in Alexandria, and Christian scholasticism was pervaded by an eclectic spirit. Eclecticism was naturally a chief factor in the philosophy which immediately followed the revival of learning. It appears towards the end of the 13th century in the works of Meister Eckhardt in Germany, and in those of G. Bruno and Campanella in Italy in the 16th century. In Leibnitz (1646–1716) it becomes strictly scientific. He wove into his philosophy materials from widely separated sources—e.g. from Aristotle and from Descartes. Like Hegel and Cousin, he regarded the tenets which he adopted as being imperfect in the systems from which they were taken, but as capable of being made parts of one harmonious whole in which pure truth would be completely realised. He tried to unify principles which should be applied and developed in future systems, and to find a method which philosophers of diverse schools could employ in common. Perhaps it is in the effort to establish such a method, that philosophic eclecticism produces its best results. The followers of Leibnitz, C. Wolf (1679–1754) and his school, degraded the eclecticism of their master into a popular, dogmatic, fixed, and formal body of doctrine. Kant and Hegel are only eclectic in the sense in which Plato and Aristotle are so. Each seeks first, through criticism, to establish his fundamental principles. The greatest modern eclectic philosopher is Victor Cousin (1792–1867). He was the pupil of Royer-Collard and Maine de Biran, through whom he became acquainted, respectively, with Scotch philosophy and the sensationalism of Locke and Condillac. He was particularly guided by the philosophy of Scotland and Germany, although he sought to discover the common and permanent elements in all preceding schemes of thought. His principle of selection was supplied by his psychologic analysis, which, however, was somewhat superficial. Cousin's school in France was large and influential. Its most distinguished members were Theodore Jouffroy and B. Saint-Hilaire.

There is a strongly eclectic tendency in the recent philosophic movement in Italy of which Count Mamiani was the head, and which the historian of philosophy, Vera, has most effectually supported. It is only provisionally that eclecticism can aid philosophic research, for systems may arise in which psychologic investigation, or historic interpretation, or metaphysical speculation, reveals new truth. What is common to all philosophy in one age will cease to be so in another, and reality must be sought not merely for its own sake, but by the original exercise of the individual intellect.

Eclipses. An eclipse is an obscuration of one of the heavenly bodies by the interposition of another, either between it and the spectator, or between it and the sun. The causes of eclipses, as suggested in this definition, are so simple and familiar that it is difficult for us to imagine how deeply eclipses affected men's minds before the dawn of astronomical science. To the ancients they were without the order of nature—terrible presages of dire events; and at Rome, at one time, it was blasphemy, and punished by law, to talk publicly of their being due to natural causes. So strong a hold had this superstition on the popular mind that even after it came to be generally believed that eclipses of the sun were caused by the moon coming betwixt us and that orb, eclipses of the moon were still referred to supernatural agency. When the moon was in eclipse, the people turned out and made a great noise with brazen instruments—the idea being that by doing so they gave her ease in her affliction. According to some, Luna, when in eclipse, was in the pains of labour; according to others, she was suffering from the arts of wicked magicians. Similar notions have prevailed among all barbarian tribes. The Chinese populace, as is well known, imagine eclipses to be caused by great dragons trying to devour the sun and moon, and accordingly they beat drums and brass kettles to terrify the monsters into letting go their prey. Several stories are told of these popular super-

stitions being turned to good account by knowing persons; among which are those which represent Thales as bringing about peace between the Medes and Lydians, and Columbus, when in a great strait, procuring provisions from the natives of Jamaica through the prediction of eclipses.

Stars, planets, and the satellites of planets, may suffer eclipse. The principal eclipses, however, are those of the sun and moon, called the solar and lunar eclipses. The transits of the lower planets over the face of the sun are partial solar eclipses; but solar eclipses, properly so called, are those caused by the interposition of the moon between the sun and earth. Regarding solar eclipses, it is observed that they happen always at the time of new moon, when the sun and moon are in conjunction—i.e. on the same side of the earth. In a partial eclipse, the sun's disc suddenly loses its circular form; it becomes indented on one side, the indentation slowly increasing for some time, and then diminishing until it disappears altogether. In a total eclipse, the indentation goes on increasing till the whole orb for a time disappears; after a short interval, the sun reappears again, passing through the same phases of obscuration in an inverse order. In an annular eclipse, the whole orb is obscured except a ring or annulus. Lunar eclipses, again, it is observed, happen always at full moon, or when the sun and moon are in opposition, or on opposite sides of the earth, and are caused by the moon passing through the earth's shadow. Such eclipses are sometimes partial, and sometimes total, but never annular, and in their general phases they resemble those of the sun.

In speaking of eclipses, we shall have occasion to use certain terms, which we shall now define. The *duration* of an eclipse is the time of its continuance, or the interval between immersion and emersion. *Immersion* or incidence of an eclipse is the moment when part of the luminary begins to be obscured; *emersion* or *expurgation* is the time when the luminary begins to reappear or emerge from the shadow. When the quantity of an eclipse is mentioned, the part of the luminary obscured is intended. To determine this part, it is usual to divide the diameter of the orb into twelve parts called *digits;* and the eclipse is said to be of so many digits, according to the number of them contained in that part of the diameter which is obscured.

Having given this general explanation of the facts of observation on which the theory of eclipses turns, and of the language employed in speaking of them, we now proceed briefly to explain the theory itself, and how it is possible to predict the time of occurrence, and the duration and quantity of eclipses.

(1) *Eclipses of the Moon.*—It has been said that these are caused by the moon passing through the earth's shadow. Before this explanation can be accepted, it must be shown that that shadow extends as far as the moon. This is easily done. Supposing the earth to have no atmosphere, then the shadow is the cone marked in shade in fig. 1,

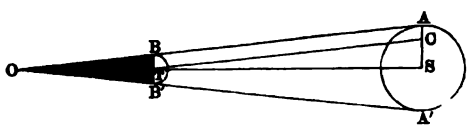


Fig. 1.

whose apex is at O; and the question is, whether the distance OT from the apex to the earth's centre exceeds the moon's average distance from the earth. Drawing TB, SA, from the centres of the earth and sun respectively, perpendicular to the line OBA, touching both spheres, and the line TC parallel to the line OBA, we have from the similar triangles OTB, TSC, the proportion OT : TB :: TS : SC. Now, we know that TS, the (mean) distance of the sun, is equal to about 23,000 times TB; also, from the construction, AC = TB; and we know that SA = 107 times TB, whence it follows that SC = 106 times TB. The above proportion then gives OT = 217 times TB, since $\frac{23000}{106} = 217$ nearly. But the moon's average distance is only 60 times TB (the earth's radius). Hence it appears that the length of the earth's shadow is between three and four times the average distance of the moon, and that the moon can enter it. Further, it is clear that, should it do so, it may be totally obscured; for it must enter at a point much nearer T than half the distance OT, which is nearly 109 times TB; and everywhere within that distance it might be shown the breadth of the shadow is much greater than the moon's disc. But one consideration now remains to be stated to complete the proof of the theory of lunar eclipses. It was mentioned that they only occur at full moon, and we know that to be the only time when the earth is between the sun and moon, and so *has a chance* of throwing her shadow upon it. Why they do not occur every full moon will be explained in treating of the prediction of eclipses.

In the foregoing explanation, we proceeded on the assumption that the earth has no atmosphere. If the assumption were correct, the earth's shadow would be darker and narrower than it is, and the phenomena of eclipses shorter in duration, but more striking. The effect of the atmospheric refraction (see REFRACTION) is to bend the rays which are incident on the atmosphere in towards the axis of the cone of the earth's shadow, those which pass through the lowest strata of the air being most refracted, and converging to a point in the line OT (see fig. 1), at a distance equal 42 radii of the earth from the earth's centre. Accordingly, the moon, which, as we have seen, crosses the shadow at a distance of about 60 radii, never enters that part of it which is completely dark; thus, she never loses her light entirely, but appears of a distinct reddish colour resembling tarnished copper—an appearance caused by the atmospheric absorption, in the same way as the ruddy colour of the clouds at sunset. There is another reason why the phenomena of a lunar eclipse are less striking than, from the explanation given relative to fig. 1, might be expected. Every shadow cast by the sun's rays necessarily has a penumbra, or envelope, on both sides of the true shadow. In the case before us (fig. 2), suppose a

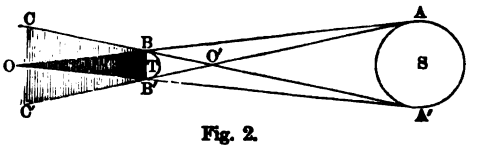


Fig. 2.

cone having its apex O' between the sun and earth, and enveloping each of them respectively in its opposite halves, CO'C' and AO'A' (fig. 2). It is clear that from every point in the shaded part of the cone CO'C', and without the shadow BOB', a portion of the sun will be visible—and a portion only—the portion increasing as the point approaches either of the lines CB, C'B; and diminishing as it approaches the lines BO, B'O. In other words, the illumination from the sun's rays is only partial within the space referred to, and diminishes from its extreme boundary lines towards the lines BO, B'O. When, then, the moon is about to suffer eclipse, it first loses brightness on entering this penumbra, so that when it enters the real shadow, the contrast is not between one part of it in shade and the other in full brilliancy, but between a part

in shade and a part in partial shade. On its emersion, the same contrast is presented between the part in the umbra and the part in the penumbra. What we should expect on this geometric view of the earth's shadow actually happens. From the breadth of the penumbra, it happens that the moon may fall wholly within it before immersion in the umbra commences; and so softly do the degrees of light shade into one another, that it is impossible to tell exactly when any remarkable point on the moon's surface leaves the penumbra to pass into the umbra, or the reverse. Also, even when the moon is wholly within the penumbra, it is impossible by the eye to discover any diminution of her light. This is only appreciable over a part of her surface when she is just about to enter on the shadow.

(2) *Prediction of Lunar Eclipses.*—We said that lunar eclipses only happen at full moon. They do not happen every full moon, because the moon's orbit is inclined at an angle of 5° 9′ nearly to the ecliptic, on which the centre of the earth's shadow moves. Of course, if the moon moved on the ecliptic, there would be an eclipse every full moon; but from the magnitude of the angle of inclination of her orbit to the ecliptic, an eclipse can only occur on a full moon happening when the moon is at or near one of her nodes, or the points where her orbit intersects the ecliptic. An eclipse clearly can happen only when the centres of the circle of the earth's shadow and of the moon's disc approach within a distance less than the sum of their apparent semi-diameters, so that their edges touch; and this sum is very small; so that, except when near the nodes, the moon, on whichever side of the ecliptic she may be, may pass above or below the shadow without entering it in the least. The moon's *mean* angular diameter is known to be 31′ 25″·7, and from the *Nautical Almanac* we may ascertain its exact amount for any hour—its variations all taking place between the values 29′ 22″ and 33′ 31″. As for the diameter of the circle of the shadow, it is easily found by geometric construction and calculation, and is shown to vary between 1° 15′ 24″ and 1° 31′ 44″; to its value for any time astronomers usually add 1′ as a correction for its calculation proceeding on the assumption that the earth has no atmosphere. Starting from these elements, it is a simple problem in spherical trigonometry—which may be solved approximately by plane trigonometry by supposing the moon and the earth's shadow to move for a short time near the node in straight lines—to fix the limits within which the shadow and moon must concur to allow of an eclipse. Recollecting that the earth's shadow on the ecliptic is at the opposite end of the diameter from the sun, and that therefore as it nears one node the sun must approach the other—the sun and shadow being always equidistant from the opposite nodes—we find, from the solution of the above problem: (1) That if, at the time of full moon, the distance of the sun's centre from the nearest node be greater than 12° 3′, there cannot be an eclipse; (2) if at that time the distance of the sun's centre from the nearest node be less than 9° 31′, there will certainly be an eclipse.

If the distance of the sun's centre from a node be between these values, it is doubtful whether there will be an eclipse, and a detailed calculation must be resorted to, to ascertain whether there will be one or not. If, also, at full moon, the moon is more than 13½° from her node, there can be no eclipse. Into the nature of the detailed calculation of eclipses we shall not attempt here to enter; suffice it to say that, knowing from the *Nautical Almanac* the true time of the sun and moon being in opposition, the true distance of the moon from the node at the time of mean opposition, with the true place of the sun at that time, as well as the moon's latitude, we may, by means of these elements, combined with the obliquity of the moon's path and her motion relative to that of the sun, not only fix whether there shall be an eclipse or not, but predict its exact magnitude, duration, and phases. It may here be mentioned, that before the laws of the solar and lunar motions were known with anything like accuracy, the ancients were able to predict lunar eclipses with tolerable correctness by the means of the lunar cycle (see CYCLE) of eighteen Julian years and eleven days. Their power of doing so turned on this, that in 223 lunations the moon returns *almost* exactly to the same position in the heavens. If she did return to *exactly* the same position, then, by simply observing the eclipses which occurred during the 223 lunations, we should know the order in which they would recur in all time coming. As it is, eclipses do recur in the same order during several such successive periods, and so can be predicted fairly well. Lunar eclipses, however, change their phase at each return. They appear at first as partial and very small, increasing at each cyclical return as the small defect of exactness in the period accumulates. Becoming at last total, they again diminish until gone. This process requires a considerable time. A lunar eclipse, beginning some centuries ago, was total in 1692, and last returned, as one of only $\frac{1}{4}$th of the moon's disc, in 1872. Solar eclipses recur similarly, but as the point of the moon's shadow touches at each return a different place on the earth, their returns are not so noticeable. A series of remarkable total eclipses occurs in 1850, August 7, 4h. 4m. P.M., in the Pacific Ocean; 1868, August 17, 12 P.M., in India; 1886, August 29, 8 A.M., in Southern Africa; and 1904, September 9, noon, in South America.

All lunar eclipses are universal, or visible in all parts of the earth which have the moon above their horizon, and are everywhere of the same magnitude with the same beginning and end; and this universality of lunar eclipses is the reason why it is popularly thought, contrary to the fact, that they are of more frequent occurrence than solar eclipses. The eastern side of the moon, or left-hand side as we look towards her from the north, is that which first immerges and emerges again. The reason of this is, that the proper motion of the moon is swifter than that of the earth's shadow, so that she overtakes it with her east side foremost, passes through it, and leaves it behind to the west. It will be readily understood, from the explanations above given, that total eclipses and those of the longest duration happen in the very nodes of the lunar orbit. But from the circumstance of the circle of the shadow being much greater than the moon's disc, total eclipses may happen within a small distance of the nodes, in which case, however, their duration is the less. The farther the moon is from her node at the time, the more partial the eclipse is, till, in the limiting case, she just touches the shadow, and passes on unobscured.

(3) *Eclipses of the Sun*, so called, are caused, as we have stated, by the interposition of the moon between the earth and sun, through which a greater or less portion of the sun is necessarily hid from view.

By a process similar to that used in ascertaining the length of the earth's shadow, it can be shown that the greatest value of the length of the moon's shadow is 59·73 semi-diameters of the earth; at the same time, we know that the least distance of the moon from the earth is about 55·95 semi-diameters. It follows that when a conjunction in line of the sun and moon happens at a time when the length of the shadow and the distance of the moon from the earth are, or are nearly, equal to the values above stated, the moon's shadow extends to the

earth and beyond it. In this case there will be a total eclipse of the sun at all places over which it moves (fig. 3). If L be the moon, T the earth, and *ab*L the moon's shadow cast by the sun, there will be a total eclipse of the sun at every point that is completely within the portion *ab* of the earth's surface. Again, the smallest value of the length

Fig. 3.

of the moon's shadow may be shown to be 57·76 semi-diameters of the earth, and the greatest distance of the moon from the earth is 63·82 semi-diameters. So that in reality the point of the shadow at O may be as much as 15,500 miles beyond the earth, or fall short of it more than 23,000 miles. In the latter case, the sun cannot be altogether hid from any point of the earth's surface; but this case, or one approximate to it, is that in which there will occur an annular eclipse. In fig. 4, suppose O to be the apex of the shadow which falls short of the earth, and conceive the cone of the shadow produced earthwards beyond O into a second cone O*cd*; then, from every point

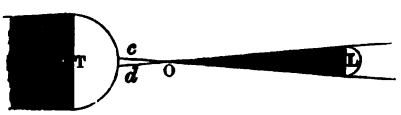


Fig. 4.

within the section *cd* of the earth's surface, the moon will be seen projected as a black disc on the bright disc of the sun, the portion unobscured forming a ring or annulus of light. While in the two cases just described the eclipse is total or annular at places within *ab* or *cd*, it will be partial at other places; the moon will appear projected against a portion of the sun's disc, making a circular indentation. To ascertain the places at which the eclipse will be partial, we have merely to form the cone of the penumbra of the moon's shadow in the manner explained in treating of lunar eclipses; at all places on the earth's surface within that cone there will be a partial eclipse. A simple calculation shows what is the observed fact, that the cone of the penumbra is not nearly large enough to embrace the whole of the face of the earth directed to the sun; in other words, solar eclipses are not universal, like those of the moon—i.e. they are not seen from all places that have the sun above their horizon at the time of the eclipse, which is the reason that though they are of more frequent occurrence than lunar eclipses, the latter are commonly supposed to occur more frequently.

If one could take up a position in space from which he could command a view of the whole face of the earth turned to the sun during a lunar eclipse, the phenomena which he would observe would be somewhat as follows. Marking the point of the earth first touched by the penumbra of the moon's shadow, he would observe the obscuration spreading therefrom over a wide and wider area as the penumbra advanced, till at last, supposing him to be viewing the case of a total eclipse, there appeared the umbral cone marking the earth with a dark spot. By-and-by, the whole penumbral shadow would be on the earth. The black spot would then appear to travel onwards with the motion of the shadow, and in its centre, in a course determined by the composition of the proper motion of the shadow or moon, and the motion of rotation of the earth. Part of the globe would be free from the affection, and, in the course of time, the umbral spot would progress over different portions of the earth in succession, till at last it passed off the earth's surface, drawing after it the penumbral shadow. Could the spectator mark on the globe the various places affected by the shadow, with their degrees of shading, he would have a perfect chart of the course of the eclipse. The small belt of the globe traversed by the umbra would mark all places at which the eclipse would be total, while the degrees of shading over places adjoining that belt on both sides would indicate the magnitude of the partial eclipse as seen from them. The breadth of the belt traversed by the umbra, when the sun's distance is greatest and the moon's least, is estimated at about 180 miles; and in the same case the penumbra is estimated to cover a circular space of 4900 miles in diameter, the eclipse happening exactly at the node. If the eclipse does not happen at the node, it is clear that the axis of the shadow must be inclined to the plane of the ecliptic, that the shadow will be cut obliquely, and therefore that the part of the earth in shade will be oval. It may here be stated that astronomers usually calculate beforehand the motion of the shadow over the earth's surface, and prepare charts to exhibit its motion. Such a chart an observer from a position outside the earth would have it in his power to make from observation.

Of the commoner phenomena attending an eclipse of the sun, as regards the appearance of that luminary, nothing need be said; they are perfectly analogous to those of lunar eclipses, except in the case of the eclipse being annular. There are other appearances, however, attending an eclipse of the sun, especially when it is total, that are very remarkable. The almost instantaneous darkening of the orb of day, more particularly when it is unlooked for, is calculated to impress a spectator with vague terror; even when expected, it fills the mind with awe, as a demonstration of the forces and motions of the mechanism of the universe. The sudden darkness, too, is impressive from its *strangeness* as much as from occurring by day; it resembles neither the darkness of night nor the gloom of twilight. The cone of the moon's shadow, though it completely envelops the spectator, does not, as we have explained, inclose the whole atmosphere above his horizon. The mass of unenclosed air accordingly catches the sunlight, and reflects it into the region of the total eclipse, making there a peculiar twilight. Stars and planets appear, and all animals are dismayed by the dismal aspect of nature. Mr Warren De la Rue, speaking of the total eclipse of July 1860, as witnessed in Spain, says: 'When the sun was reduced to a small crescent, the shadows of all objects were depicted with great sharpness and blackness, reminding one of the effects of illumination with the electric light. The sky at this period assumed an indigo tint, and the landscape was tinged with a bronze hue.' At totality, there was still light enough to enable the observer to draw without the aid of his lamp, while the sky near the sun presented a deep indigo, and thence passed through a sepia tint to red and brilliant orange near the horizon. It must be said, however, that the strange appearance here recorded is exceptional, and probably not such as could ever occur in our latitude. There is one set of phenomena attending total eclipses of the sun which are at once strange and invariable, and the causes of which cannot be said to be yet fully understood. As long as the total eclipse lasts, there appears

round the sun and moon a luminous corona as in fig. 5, while at its base, and projecting beyond the dark edge of the moon, appear very brilliant prominences, generally of a red colour. These may be referred to in an observation noted by Firmicus in

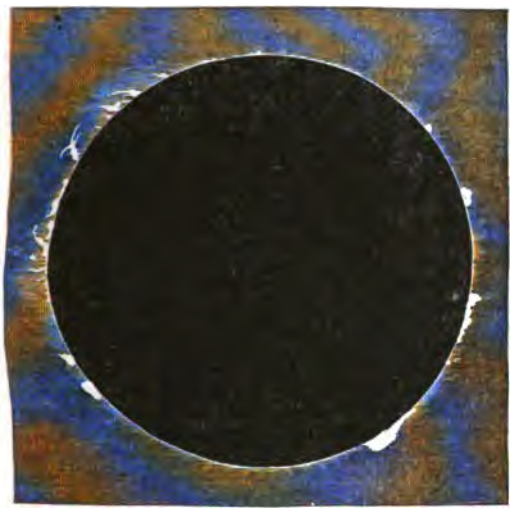


Fig. 5.—Total Eclipse observed in America, August 1869.

334 A.D. They were first certainly referred to by Captain Stannyan in 1706. They are found to be constant attendants on eclipses, and methods have been invented of rendering them visible at any time without the interposition of the moon. The spectroscope shows that they consist mainly of hydrogen gas in an incandescent state, and a comparatively narrow belt of the same colour and substance runs round the whole circumference of the sun. The prominences are sometimes seen to shoot up like flames, in wild fantastic shapes, with incredible velocity, and to the height of tens of thousands of miles. See the subject discussed at SUN.

(4) *Prediction of Solar Eclipses.*—The period of 18 Julian years 11 days, referred to in treating of the prediction of lunar eclipses, applies to solar eclipses equally with lunar; but the ancients, who understood that fact, could find no law of recurrence of solar eclipses within that period, so as to predict them. The reason of the failure is obvious; for though solar eclipses recur in a fixed order within the cycle, they are not visible at the same places on their recurrence as when first observed. By modern methods similar to those applied in the case of lunar eclipses, however, eclipses of the sun may be predicted, with all their circumstances of time and places of observation, with the most perfect certainty. At the time of a solar eclipse the sun and moon are in conjunction; they are also in or near the same node; and no eclipse can happen if they are farther than 17° from the node, or if the latitude of the moon, viewed from the earth, exceeds the sum of the apparent semi-diameters of the sun and moon. When within these limits, it is a problem of numbers and of spherical trigonometry to ascertain the nature of the eclipse, if any, which will happen.

The number of eclipses of the sun and moon together in a year cannot be less than two, or more than seven; the most usual number is four, and it is rare to have more than six. The explanation of the limitation of the number of eclipses is connected with the fact that the sun passes by both nodes but once in a year, except in the cases of his passing one early in the year, in which case, owing to the recession of the moon's nodes, he will again pass it a little before the end of the year. From the sun's thus passing *each* lunar node usually every year, it results that eclipses occur at particular periods, called *eclipse seasons*. In 1887 these occurred in February and August. They come about twenty days earlier every year, and last thirty-six days for solar, and twenty-three days for lunar eclipses. Their annual change of date is due to the motion of the lunar node (see MOON). From the smallness of the cone of the moon's shadow, total solar eclipses are extremely unfrequent in any one place, compared with the frequency of their actual occurrence. At Paris there was only one total eclipse of the sun in the 18th century, that of 1724, and there will not be another till near the close of the 19th century. In London, not one total eclipse was witnessed durthe 575 years, 1140 to 1715. For eclipses of the satellites, see SATELLITES.

Ecliptic is the name given to the great circle of the heavens round which the sun *seems* to travel, from west to east, in the course of a year. It took its name from the early observed fact, that *eclipses* happen only when the moon is on or near this path. A little attention about sunset or sunrise shows that the sun is constantly altering his position among the stars visible near him, leaving them every day a little farther to the west; and that this motion is not exactly east and west, or parallel to the equator, becomes also evident by observing that the sun's height at mid-day is constantly altering. It is further observed that, twice a year, about March 21 and September 23, the sun is exactly on the equator. The two points of the equator on which the sun then stands are the equinoctial points, and are the intersections of the equator and ecliptic. Again, there are two days in the year on which the sun reaches his greatest and his least mid-day elevation: the first is the 21st of June, the second is the 21st of December. On these days the sun has reached his greatest distance from the equator either way, and the points in his course where he thus seems to pause or halt in his retreat from the equator are called the solstices (*solis stationes*). These four points are distant from one another by a quadrant of the circle, or 90°. Each quadrant is divided into three arcs of 30°, and thus the whole ecliptic is divided into twelve arcs of that length, called Signs of the Zodiac (q.v.). These arcs or signs have been named after constellations through which the ecliptic passes. As the equinoctial points are not fixed, but recede yearly westwards on the ecliptic about 50 seconds, and in a century about 1° 23′, the same constellations and signs that coincided when the division of the ecliptic took place, no longer coincide. The constellation of the Ram, for instance, which originally stood in the first arc or sign, now stands in the second, every constellation having advanced forward 30°, or a whole sign. This is due to a movement of the *equator* (see PRECESSION OF THE EQUINOXES). Modern astronomers, therefore, pay little attention to these constellations and signs.

Not only do the equinoctial points change, but the angle of inclination of the ecliptic to the equator, called the obliquity of the ecliptic, is also variable. It is at present nearly 23½°, and is diminishing at the rate of about 48 seconds in a century. The decrease, however, has a limit, the obliquity oscillating between two definite bounds. It has been calculated that it was at its greatest 2000 B.C., and was then nearly 23° 53′. Since then it has been decreasing, and will continue to do so till about the year 6600 A.D., when it will be at its least, and about 22° 54′. This is due to a real movement of the *ecliptic*.

The physical cause of this change of the obliquity is the action of the other planets, especially Jupiter, Mars, and Venus, on the mass of the earth. Its existence was known to astronomers in very ancient times; Herodotus mentions an old tradition of the Egyptians, that the ecliptic had formerly been perpendicular to the equator—a notion into which they were most probably led by observing, for a long series of years, that its obliquity was constantly diminishing. It is probable that the Chaldeans arrived at the epoch of 403,000 years before the entry of Alexander into Babylon, to which they proudly referred for their first astronomical observations, by computing the time when the ecliptic was perpendicular to the equator, on the supposition of its obliquity diminishing 1′ in 100 years. The first known measures of this obliquity were made in the East by Tcheou Kong, regent of China (1100 B.C.), and in the West by Pytheas (330 B.C.) and Eratosthenes (200 B.C.).

Eclogite, or EKLOGITE, a crystalline rock composed of the beautiful grass-green amphibole, called smaragdite, and red garnet. Another variety of eclogite is composed of omphacite, a grass-green granular variety of pyroxene, and garnet. Eclogite is not an abundant rock; it is usually associated with the older crystalline schists, but as a rule is not itself schistose.

Eclogue (Gr. *eklegein*, 'to select'), a short pastoral poem, in which the swains converse with one another in turn, as in the eclogues of Virgil, also called Bucolics (q.v.). The earliest modern bucolics were Petrarch's; the earliest in English were the eclogues of the Scottish poet Alexander Barclay (q.v.).

École Polytechnique. See POLYTECHNIQUE.

Economy (Gr. *oikonomia*, 'household management') is etymologically equivalent to what is usually called Domestic Economy (q.v.); Political Economy (q.v.) is the usual but somewhat inconvenient name for economics or economic science. We speak also of the vegetable economy, the animal economy, the social economy; and theologically the Jewish economy is equivalent to the Jewish dispensation. Economic botany is discussed at BOTANY, PLANTS, VEGETABLE PHYSIOLOGY.

Écorché (Fr., 'flayed'), a figure in which the muscles are represented, stripped of the skin, for purposes of artistic study.

Ecraseur, the name of an instrument invented by M. Chassaignac, and consisting of a stem with a fine chain passed through it, which, passed round any tissues, gradually constricts them, and finally crushes its way through them by means of a screw or rack for tightening it, which is worked at the end of the handle. Other forms of the instrument are arranged for a single wire, or a cord of twisted wires, instead of the chain. The advantage of this instrument over the knife is that it causes little or no bleeding, the torn vessels spontaneously contracting and closing. It is specially applicable to pedunculated growths, such as piles and polypi, but has been used extensively in removal of the tongue for cancer. In the galvanic ecraseur, the general arrangement is the same; but the wire noose is insulated and connected with a battery, that it may be heated to redness during its passage through the tissues, and may cauterise as well as crush them. As the pain which is caused by this instrument is very great, the patient should be placed completely under the action of an anæsthetic before it is applied.

Ecstasy (Gr. *ekstâsis*, 'displacement,' 'trance'), a word applied to those states of mind which, without amounting to Insanity (q.v.), in respect of the temporary character of the affection, are marked by mental alienation, and altered or diminished consciousness. The varieties of this affection are infinite. In some physical states, as catalepsy, hysteria, mesmerism, a true ecstasy is one of the phenomena, inasmuch as the proper consciousness of the individual is temporarily abolished, or so much changed in character as to lead almost to the loss of the sense of personal identity; and probably the same may be said of the mind in many dreams and visions, and also in somnambulism. Religious ecstasy, in which a man, 'being withdrawn from the senses, is raised to the contemplation of supernatural things,' and may receive the beatific vision, has been recorded of very many modern saints, notably St Teresa. It is represented as accompanied by such phenomena as being raised several feet from the ground (St Philip of Neri, St Ignatius, &c.), and bilocation or double personality. It might be produced by diabolic agency as well as by God. For the literature of the subject, see CANONISATION; and see CONVULSIONARIES, DANCING MANIA. The word ecstasy is loosely used for paroxysms of love, fear, hate; and it has a special sense in the philosophy of Neoplatonism (q.v.).

Ec'thyma is a pustular disease of the skin, in which the pustules often reach the size of a pea, and have a red, slightly elevated, hardish base. In the course of two or three days after the appearance of the pustule it is replaced by a scab, which adheres firmly to the base, and is somewhat concave. On its removal, a deep red mark, a new scab, an ulcer, or a healed scar remains. The disease may be acute or chronic. The acute form is ushered in by slight constitutional, not amounting to febrile, symptoms, and by a burning or pricking pain at the seat of the eruption, which is most commonly the back and shoulders. The disease runs its course in ten days or a fortnight. In chronic ecthyma, the pustules which follow in crops (often for several months) are usually scattered over the extremities. This form of eruption indicates a low state of the system. It sometimes follows the acute disease, and not unfrequently is a tertiary symptom of syphilis. Pustules, which in no respect seem to differ from those of ecthyma, are produced by various local irritants. Thus the affection of the hands, popularly known as *the grocer's itch*, is produced by the irritation of brown sugar, perhaps by the *acari* which are so often present in it. Stone-masons are said occasionally to suffer from a similar disease. With regard to *treatment*, the acute form would in most cases doubtless disappear in the course of a fortnight if left entirely to itself; but as the bowels are usually disordered, an occasional alterative aperient, as a few grains of gray powder with a little rhubarb, may be prescribed, and tepid water applied locally gives great relief. The patient should, moreover, be kept on a moderately good, nutritious diet. In the chronic form of the affection a liberal diet is necessary; the use of wine or porter is sometimes desirable; while tonics, such as a combination of bark and nitric acid, are called for. Tepid baths are often useful, and if there is sleeplessness, an opiate should be taken at or shortly before bedtime.

Ectoderm, or EPIBLAST, the external germinal layer of the embryo, giving rise especially to the outer skin, nervous system, and the essential parts of the sense organs in the adult. See EMBRYOLOGY.

Ectozoa, external parasites—e.g. lice, ticks, some crustaceans, &c. See PARASITIC ANIMALS.

Ectropion (Gr., from *ek*, 'out,' and *trepo*, 'I turn'), eversion of the margin of the eyelid, so that the red inner surface (conjunctiva) is exposed. It

is generally caused either by chronic inflammation of the conjunctiva, or by scars in the skin near the eye, following wounds, burns, or disease. It is the converse of entropion, and like it, usually requires an operation for its cure. Recent and slight inflammatory cases, however, may yield to milder measures.

Ecuador', a republic of South America, so named from its position on the equator, lies between 1° 23′ N. and 4° 45′ S. lat., and in about 73°—81° W. long. Its general outline is cuneiform; bounded on the west by the Pacific, it is inserted like a wedge between Colombia and Peru. But its only certain limits are those defined by the ocean, where it has a seaboard of some 400 miles; most of the frontier east of the Andes has never been determined, and no two maps agree in the limits they assign to the state in this direction. In 1832, however, Colombia's claims to the plateau of Pasto were recognised, and since 1876 the same state has held the river Putumayo; the whole of the Marañon valley is occupied by Peru, and the actual possessions of Ecuador are now separated from those of Colombia on the north-east by the rivers Coca and Napo, while the little river Masan, a tributary of the Napo, is looked upon as marking the Peruvian frontier. Thus narrowed, the territory of the republic embraces some 100,000 sq. miles, or about half the area of Spain, and barely two-fifths of that usually assigned to it; but to the state proper must be added the Galápagos Islands (q.v.), which have an area of 2940 sq. miles. The population, at the census of 1885, was given at 1,004,651, of whom 204 belonged to the Galápagos; in these returns the savage and heathen Indians (*Infieles*) of the eastern province are not included, their number, though estimated at from 100,000 to 150,000, being really unknown. The principal cities are Quito, the capital (60,000 inhabitants), Guayaquil, the chief port (40,000), Cuenca (30,000), Riobamba (18,000), Latacunga (15,000), and Ambato (12,000), the last three names associated with earthquakes of unusual force; good authorities, however, question the accuracy of these returns of population.

Ecuador may be regarded as consisting of three divisions—the lowlands west of the Andes, the mountainous plateau of the interior, and the less elevated forest-country to the east. Besides the main range of the Andes, forming the backbone of the country, there is an outer range extending for about 40 miles, with peaks rising to 15,000 feet; from the cordillera proper numerous long spurs, attaining a height of 14,000 feet, are thrown out towards the east, between which rise great affluents of the Amazons, while the coast-range possesses only short and very precipitous spurs, contributing to the comparatively unimportant Pacific streams. The plateau is cut into eight subdivisions by short and broken cross-ridges; on one of these table-lands lies Quito. For the heights of the principal peaks, see ANDES; but it should be noticed that the parallel structure commonly ascribed by geographers to this section of the cordillera has hitherto had an exaggerated importance attached to it, and, as a matter of fact, scarcely exists. Only the vaguest knowledge of the country is possessed even by its own people: one authority still ascribes to the crater of Altar the only real glacier known to exist in the Ecuadorian Andes, whereas Mr Whymper in 1880 found larger glaciers on the principal mountains he visited; while another describes the floods that almost certainly result from the liquefaction of the glaciers that repose upon the sides of the heated cones, as 'the rivers of mud and water which have so often been vomited from the crater.' The principal mountains of Ecuador either are or have been volcanoes. Tunguragua (16,690 feet) broke out in 1887; Pichincha is by no means extinct; Cotopaxi (q.v.) and Sangai (17,465) are constantly active. In mineral wealth Ecuador has been ranked amongst the poorest states of South America; gold, however, is obtained in the beds of the Amazonian tributaries, and the ore is mined at Zaruma, in the south-west; silver, quicksilver, iron, copper, zinc, asphalt, and petroleum occur, as well as an inferior graphite, and fine veins of anthracite have been found in the mountains. Of the coast-streams the principal are the Guayas, or Guayaquil River, and the Rio Esmeraldas; east of the Andes the most important rivers are the Napo, with its affluents the Curarai and Coca, the Tigre, and the Pastassa, all flowing into the Marañon. Colonel G. E. Church, in a report (printed 1883) to the United States government, estimates that at least 2500 miles of the river-system on the Amazons side are suitable for steamboat navigation, and probably as much more for boats, besides some 500 miles on the western side.

Ecuador is an agricultural country. The dry winds which leave the African coast become saturated as they pass over the Atlantic and up the Amazons; and their moisture is almost ceaselessly precipitated as they approach the snowy peaks of the Andes, producing a dense growth of vegetation on the eastern foot-hills. On the other side also, where the rain-clouds of the Pacific are caught, the gorges of the western spurs become very hot-houses, and most of the land is covered with dark-some forest. Natural *sabanas* or open plains are, however, found on the western lowlands, such as are not met with to the east. Here, in the most prodigal luxuriance of tropical vegetation, valuable trees and plants wage endless war for existence against the stifling embraces of mosses, orchids, parasites, and creepers. With increasing elevation, the sugar-cane *haciendas* and the cacao and orange groves give place to fields of inferior wheat, barley, clover, lucerne, beans, and in some places maize and agave plants; until in the higher stretches of the sierra nothing is met with but lichens and the bare *páramo* grass. The agricultural implements employed are often of the rudest, including in the mountains wooden ploughs, and in the lowlands the *machete* or cutlass; American machinery, however, is imported for the sugar-mills. Sarsaparilla, balsams, caoutchouc, vegetable ivory and wax are collected, and coffee, rice, cotton, tobacco, &c. are grown, but in smaller quantities; while the trade in cinchona, for which bark the world was first indebted to the province of Loja, promises soon to be a thing of the past, owing to the reckless destruction of the trees. The coast rainy season usually extends from December to May, but on the Amazons slope, as already noticed, it rains nearly all the year round. The plateau region and large tracts to the east are comparatively healthy, in spite of the absence of all sanitary measures in the towns and wretched villages; the valleys on the Pacific side are commonly full of disease. In the interior there is a very small thermometric range, and in temperature a perpetual spring reigns in the uplands; to which much-admired equality of climate, which renders it certain that to-morrow will be like to-day, Mr Whymper attributes the incomparable laziness and procrastination of the Ecuadorians. The fauna is rich: the mammalia include the jaguar, puma, ounce, ocelot, deer, tapir, peccary, capybara, and several species of monkeys and bats; fish abound, both in the rivers and along the coast; and among reptilia are the boa constrictor, turtles, and alligators, which swarm in the streams, especially on the Pacific side. Chiefly, however, is Ecuador the paradise of birds and

insects. The former range from the condor to the humming-bird, and include parrots, partridge, pheasants, snipe, wild turkeys, geese and ducks, herons, and pigeons, as well as the flute-bird and many other song-birds; of the insects, besides butterflies innumerable, mosquitoes, scorpions, the tarantula spider, the microscopic 'red tick,' and the maddening Pium-fly are met with, whilst a recent traveller in the sierra remarks emphatically that there 'every kind of domestic insect pest known in England exists with the addition of further infinite varieties.' The live-stock includes cattle, sheep, horses, mules, donkeys, and llamas; but cattle do not thrive in the Amazons section—chiefly, according to Colonel Church, from the immense number of bats which bleed or otherwise irritate them.

The whites have been estimated, in round numbers, at 100,000, the mixed races at 300,000; the rest are pure Indians, with a small proportion of negroes. The whites, who are the landholders and merchants of the country, are hospitable, courteous, and generally intelligent, but extravagant and innocent of habits of industry; the half-breeds are the true savages of the country, the christianised Indians, who belong to the Quichua group, being as a class docile and contented, although the law which permits the Indian who cannot otherwise satisfy his creditor to sell himself into slavery has reduced great numbers to the unhappy conditions of serfs. The uncivilised tribes inhabit the vast Provincia del Oriente, east of the Andes; their chief stems are the independent and warlike Jívaros and Záparos. The state form of religion, to the exclusion of every other, is the Roman Catholic, the establishment including an archbishop of Quito and six bishops; and in no country in the world have the Jesuits had such a paramount influence as in Ecuador, or employed it, on the whole, so well. There are numerous convents, monasteries, and seminaries, and in 1887 the pope sanctioned the organisation of a central theological university. Education is compulsory, but still at a low ebb. Quito, however, possesses a university and an institute of sciences (1884), with three faculties, and there are affiliated universities at Azuay and Guayas; and since the restoration of the church party to power, public instruction, considering the difficulties the government have had to grapple with, has made creditable headway, hundreds of primary schools, in particular, having been established throughout the country. Technical schools and literary societies also have been founded. The manufactures are limited mostly to timber, coarse cloths, kerosene, ice, and the preparation of spirits from the sugar-cane, and of flour or starch from the yuca or cassava root. Guayaquil is famed for its hammocks and Panamá hats, made from the fibre of the 'pita' plant (see AGAVE). Commerce is sadly handicapped by the want of roads. In 1889 only about 125 miles of railway were open, although other lines were in progress. A few steamers are in use, but around Guayaquil rafts also are much employed to-day as in Pizarro's time; and, generally, communication is carried on by means of tracks almost impassable in the rains, and goods are conveyed by mules. East of the cordilleras, moreover, the line of route is often not marked by even bare tracks; the road must be forced through pathless forests, along the rough beds of the rivers, and over swollen streams, either bridgeless, or spanned by the frail erections that existed when Humboldt visited the country. Nevertheless, the chief towns have been connected by telegraph, and there are even telephones in Quito and several of the provinces. Hitherto the trade returns have been often incomplete, but in the five years 1882–86 the exports ranged from £737,268 in 1885 to £1,202,161 in 1886; in 1887 the imports were valued at over £1,700,000, the exports at over £1,500,000, nearly two-thirds of the exports, of which the principal were cocoa, coffee, vegetable ivory, caoutchouc, and hides, coming through Guayaquil. The exports to Great Britain in the same year were £219,062, and the imports, chiefly cotton goods, £378,633, the average values for the five years preceding being respectively £216,435 and £235,200; the trade with the United States is about equal to that with Britain.

Constituted as an independent state on the dissolution of Bolívar's Colombia (q.v.), the Republic of the Equator has, in little more than half a century, passed through a succession of violent political changes that would render its history equally difficult and profitless to follow; in his report to congress in 1888 the Minister of the Interior sorrowfully confesses, 'our historical tradition is—revolution.' The turbulent career of the despotic little republic, with its complicated series of presidents, supreme chiefs, provisional commissioners, and dictators, has been almost one long insurrection, amid which the nearly equally constant loss of territory has passed unheeded by the factions and their leaders. The latest revolt was stamped out only in 1886. Under its last constitution the executive is vested in a president, elected for four years, with a vice-president, a cabinet of four ministers, and a council of state; the legislative power is intrusted to a senate and house of representatives. The state forms three military districts, containing seventeen provinces, which are administered by governors, and subdivided into cantons. The standing army was limited in 1884 to 1600 men, and there is a navy of one steel transport and three gunboats. Of the financial position of the country it has always been difficult to obtain exact and trustworthy information, although evidence has at all times been forthcoming of its chronic and apparently hopeless embarrassment. The revenue for 1887 was 4,447,067 sucrés (a sucré having a nominal value of four shillings, and an actual value of about three), the expenditure 4,428,597 sucrés. The liabilities of the republic were stated at 1st January 1888 at 14,217,202 sucrés, which is a modest estimate, even disregarding unpaid interest; in the same year it was announced that the country was not yet in a position to make any practical offer to its foreign creditors.

See Velasco, *Historia del reino de Quito* (Quito, 1789; French by Ternaux-Compans, Paris, 1840); Humboldt, *Voyage aux Régions équinoxiales*, especially the 'Vues des Cordillères;' Villavicencio, *Geografía de la República del Ecuador* (New York, 1858); Hassaurek, *Four Years among Spanish Americans* (Lond. 1868); Kolberg, *Nach Ecuador* (3d ed. Freiburg, 1885); Stübel, *Skizzen aus Ecuador* (Berlin, 1886); Simson, *Travels in the Wilds of Ecuador* (Lond. 1887); Mr Edward Whymper's paper in the *Proc. Roy. Geo. Soc.* (1881); Colonel Church's Report, and a paper in *Petermann's Mitteilungen* (1884); and the Report of the Minister of the Interior (Quito, 1888).

Ecumenical, from Gr. *oikoumenikos*, 'of' or 'from the whole earth'—*oikoumenē* (*gē*) meaning 'the inhabited (world)'—is a term applied to the general councils of the *universal* church from that of Nicæa onwards (see the article COUNCIL). The 'Apostles' Creed,' the creed of Nice and Constantinople, and the creed of Athanasius are distinguished as the 'ecumenical symbols' of the Christian church. Though the title 'Ecumenical Bishop' was one that originally in the Eastern church might be applied to any patriarch, yet Pelagius II. and his successors in the Roman see persistently protested against its being given in imperial documents to the patriarchs of Constantinople, who had adopted it since 587.

Ec'zema (Gr., from *ekzeo*, 'I boil over') is in this country by far the commonest of all diseases of the skin, and also the most variable in its manifestations. It may be acute or extremely chronic, may affect any portion of the skin, and may occur at any age from infancy to old age.

In typical acute eczema the affected portion of skin is red, and is covered with numerous small papules, which speedily turn into vesicles. These may quickly dry up, but more commonly break, and discharge a clear, glutinous secretion, which hardens and forms scabs or crusts, or if copious keeps the surface in a moist 'weeping' condition. In some cases the vesicles are replaced by pustules, and the discharge is partly purulent. Chronic eczema may follow the acute form, or may arise without an acute stage. Here the skin is thickened and hard, and covered with crusts or scales; deep cracks are sometimes present, especially where the skin is subjected to much movement, as near the joints.

One of the most prominent and important symptoms is itching of the part affected; it is never entirely absent, and in some cases intolerably severe, but in the acute stage is often replaced by a burning sensation; it may precede any visible sign of the disease, and may persist after the skin has resumed its natural appearance. The scratching which it occasions always aggravates the disease, and is often very difficult to prevent. Except in extensive acute attacks, there is no fever and very little constitutional disturbance. The disease is not contagious. When cured it leaves no scar.

Causes of Eczema.—In many cases it is very difficult, perhaps impossible, to assign a definite cause for an attack. Generally speaking, however, the constitutional or predisposing cause is some defect in the digestion or assimilation of the food; strumous and gouty individuals are particularly subject to the disease. The local or exciting cause may be anything whatever which irritates the skin—e.g. great heat or cold, rough underclothing, bad soap, hard water, arsenical dyes, lice or other parasites, and the scratching they occasion.

Treatment.—There is no specific for eczema; different cases and different stages of the disease require widely different management, and each must be considered and treated on its own merits. Usually both local and constitutional treatment are required to effect a cure. It is of the greatest importance to seek for and attend to any cause which may have given rise to it. The diet must be nutritious, but as simple and unirritating as possible; digestion may require aid from medicines; the bowels should be regularly evacuated, by aperients if necessary; a gouty or strumous tendency if present must be counteracted. In obstinate chronic eczema small doses of arsenic are often useful. The use of soap on the part affected must be discontinued, and strained oatmeal gruel, or rice water, or white of egg with boiled water, used for cleansing purposes, but even these as seldom as possible. Thorough removal of scales and crusts by these means, or by oil, or simple bread poultices, is the necessary preliminary to satisfactory local treatment. In the acute stage, where the swelling is great or the discharge profuse, a sedative lotion applied on rags or lint and kept moist by a waterproof covering is generally most useful—e.g. thin starch or gruel with a teaspoonful of boracic acid to the pint, soft water with a similar proportion of baking-soda, or dilute lead lotion. In the later stages, when the skin is moist, soothing ointments are preferable—e.g. zinc ointment, zinc and boracic ointments mixed in equal parts, or cold cream. The ointment should be evenly spread on linen rag, and kept in close contact with the affected skin. If dry chronic forms do not yield to similar treatment, tar ointment should be cautiously tried; but they sometimes require the use of a strong irritant, as a solution of caustic potash, or a fly-blister, before they heal. Such treatment should only be resorted to under medical advice.

Edam, a town in North Holland, 13 miles NNE. of Amsterdam. Its specialty is cheese. Pop. 5824.

Edar, a Rajput state of Guzerat in the Mahi Kantha agency, tributary to the Guicowar of Baroda, and subject to the political superintendence of the presidency of Bombay. Area, 4966 sq. m.; pop. 260,000. Its capital, of the same name, contains 6223 inhabitants.

Edda ('great-grandmother'), the name of two very different collections of old Scandinavian literature. Of these the 'Younger' or prose *Edda* was written by the Icelander Snorri Sturluson (q.v.) about 1230, and was discovered by Arngrim Jonsson in 1628. It consists of three parts: (1) *Gylfaginning* ('the deceiving of Gylfi'), mythological stories told by Odin to Gylfi, a Swedish king, forming the chief source of our knowledge of the Scandinavian theogony; (2) *Skáldskaparmál*, or the Art of Poetry; and (3) *Háttatal*, a system of prosody. Prologues and epilogues are added by later hands. The work contains quotations from about seventy early poets. It is found in three great MSS.—the *Codex Regius* (about 1300), discovered by Brynjulf Sveinsson in 1640; the *Codex Wormianus* (about 1330), so called because it was sent to Ole Worm in 1628; and the *Codex Upsalensis* (about 1300), where the name 'Edda' first occurs. Editions of the prose Edda were published by Resenius (Copenhagen, 1665), Rask (Stockholm, 1818), Egilsson (Reykiavik, 1848), and Jonsson (Copenhagen, 1875). Of the elaborate edition of the Arne-Magnæan commission, two vols. (Copenhagen, 1848–52) are published, and part of a third (*ib.* 1880). There is a valuable edition of *Háttatal* by Möbius (Halle, 1879–81); and Bergmann's *Fascination de Gulfi* (2d ed. Strasburg, 1871) furnishes a French translation of *Gylfa-ginning*, with learned prolegomena, and an extensive critical commentary. Dasent's English translation (1842) may be noticed.

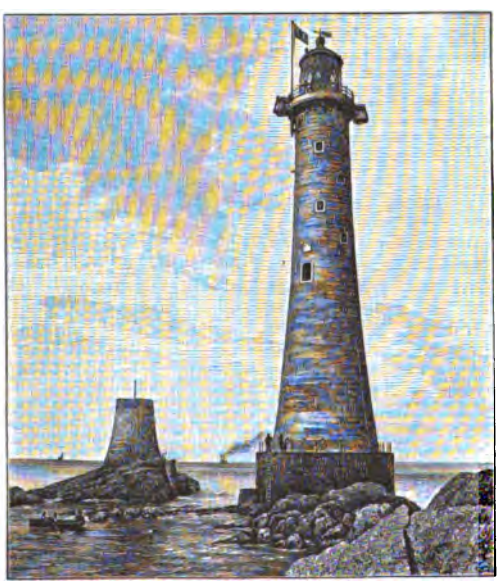
The 'Elder' *Edda* is a collection of lays which contain legends of Scandinavian gods and heroes, and are productions mainly of Iceland, and of different periods from the 9th to the 11th century. It was discovered about 1643 by Brynjulf Sveinsson, who applied the name 'Edda' to this collection also, which he attributed to Sæmund Sigfusson (who lived in Iceland about 1055–1132). The poems belonging to the Elder Edda are thirty-three in number, with prose passages interpolated here and there by the collector. They are on subjects partly of Scandinavian mythology, partly of heroic and legendary history. A few of the latter are derived from legends purely Scandinavian, the remainder treat of heroes common to the Teutonic races. They are written in two forms, distinguished as *kvidhuháttr* (epic metre) and *ljódhaháttr* (didactic metre). The first of these consists of strophes of eight lines, every two of which are connected by alliteration, each line having two (usually two-syllabled) feet, with an accent on each foot; the alliterative initial letters in the accented syllables being regularly three in number—two in the first, and one (the most emphatic of the three) in the second of each pair of lines, as in Anglo-Saxon poetry (see ALLITERATION). The peculiarity of *ljodhaháttr* is that in it the strophe (*Visa*) has regularly only six lines, of which the first, second, fourth, and fifth are constructed exactly as in the other form (i.e. they have

two accents, and are connected in pairs by alliteration). The third and sixth lines, however, have each three accents and alliteration of its own, the alliterating letters in each of these lines being two (sometimes three) in number, and different from those in the two preceding it. The collection now called the Elder Edda was unknown to Snorri, yet almost all the lays are paraphrased or quoted by him in his own work from the oral tradition of his time. The earliest complete editions were those of the Arne-Magnæan commission (3 vols. Copenhagen, 1787-1828), Rask (Stockholm, 1818), and Munch (Christiania, 1847), which were followed by those of Lüning (Zurich, 1859) and Möbius (Leip. 1860). These were superseded by Bugge's edition (Christiania, 1867), on which those of Grundtvig (2d ed. Copenhagen, 1874) and Hildebrand (Paderborn, 1876) are based. They are all now embodied in Vigfusson and Powell's *Corpus Poeticum Boreale* (2 vols. Oxford, 1883). The most recent translations in German are by Holtzmann (Leip. 1873), Wenzel (*ib.* 1877), and Simrock (8th ed. Stutt. 1882); in Danish by Winkel-Horn (Copenhagen, 1869) and Möller (1871); in Swedish by Gödecke (Stockholm, 1877); in French by E. de Laveleye (Brussels, 1866); and in English by Thorpe (1866) and R. B. Anderson (Chicago, 1879).

See Bergmann, *Počmes Islandais* (Paris, 1838), and *Chants de Sol* (Paris, 1858); Grimm, *Geschichte der deutschen Sprache* (4th ed. 2 vols. Leip. 1880); Möbius, *Verzeichniss der auf dem Gebiet der altnordischen Sprache und Litteratur erschienen Schriften* (*ib.* 1880); and Vigfusson's *Prolegomena* to his edition of the *Sturlunga Saga* (2 vols. Oxford, 1878).

Eddoes. See Cocco.

Eddystone, a group of gneiss rocks, daily submerged by the tide, in the English Channel, 9 miles off the Cornish coast, and 14 SSW. of Plymouth Breakwater. The rocks lie in 50° 10′ 54″ N. lat., and 4° 15′ 53″ W. long., and have 12 to 150 fathoms water around. The frequent shipwrecks on these rocks led to the erection of a lighthouse on them by Winstanley, 1696–1700. It was



The New Eddystone Lighthouse.

a wooden polygon, 100 feet high, with a stone base; but the great storm of 20th November 1703 completely washed it away, with the architect. Another lighthouse was built, 1706–9, also of wood, with a stone base, and 92 feet high, by Mr Rudyerd, a silk-mercer. This erection was burned in 1755. The next, noted for its strength and the engineering skill displayed in it, was constructed by Smeaton in 1757–59, on the model, it is said, of the trunk of the oak-tree. It was built of blocks, generally one to two tons weight, of Portland oolite, incased in granite. The granite is dovetailed into the solid rock, and each block into its neighbours. The tower, 85 feet high, had a diameter of 26½ feet at the base, and 15 feet at the top. The light, 72 feet above the water, was visible at a distance of 13 miles. As the rock on which this tower was built is undermined and greatly weakened by the action of the waves, the foundation of another was laid on a different part of the reef in 1879. The new lighthouse, completed in 1882 by Sir James N. Douglass, F.R.S., is, like its predecessor, ingeniously dovetailed throughout. Its dioptric apparatus gives, at an elevation of 133 feet, a light equal to 159,600 candles, and visible in clear weather to a distance of 17½ miles. Owing to the state of the foundation, Smeaton's lighthouse was taken down to the level of the first room as soon as the new one was completed. The removed upper portion was re-erected on Plymouth Hoe, while the lower portion, as shown in the picture, remains intact on the rock as a distinguishing mark, an iron pole being fixed in its centre. See LIGHTHOUSE.

Edelinck, GERARD, a celebrated engraver, born at Antwerp in 1649, died in Paris in 1707. He was patronised by Louis XIV., and produced over 420 plates.

Edelweiss (*Gnaphalium Leontopodium*) is a small but pretty composite found growing in damp places at considerable altitudes (5000 to 7000 feet) throughout the Alps. On account of the characteristic beauty of its aspect, which is due to a covering of long white woolly hairs, and partly, of course, also on account of the difficulty of obtaining it, it is much prized. It is worn by guides and tourists in their hats, and becomes in summer quite an article of minor commerce, dried as a book specimen made up into little tufts, so that measures have lately been necessary in Switzerland to prevent its total extirpation from its native haunts. It can, however, be cultivated without much difficulty, and can be seen in many collections of Alpine Plants (q.v.).

Eden (Heb., 'delight'), the name of the district in which the garden of Paradise was situated. It lay 'in the East,' in the highlands of Central Asia (Gen. ii. 8). The name-word *paradeisos* (Gr., 'a park'), by which the Greek translators rendered the Hebrew *gan* ('garden') in Gen. ii. 8, &c., came originally from the old Persian *pairidaêza* ('a walled garden'). In the later books of the Old Testament it occurs in the Hebrew form *pardes*. Many futile attempts have been made to reconcile with modern knowledge the mythical geography of Gen. ii. 10–14. Two of the writer's rivers, Hiddekel (Tigris) and Phrat (Euphrates), are well known. Havilah is the general designation of South Arabia, Abyssinia, and perhaps India; Cush is the name for Ethiopia and the southern lands of Africa and Asia generally. Schrader, following the early tradition, which goes back as far as Josephus, identifies Gihon with the Nile, and Pishon with one of the great rivers of India; Ewald and Dillmann find the two rivers in the Ganges and Indus; Lassen, Knobel, Renan, and Spiegel think Pishon stands for the Indus, and Gihon for the Oxus. It is clear that the writer himself had no exact knowledge of the position of Eden, but combined as he found them the special Hebrew legend with the general Asiatic tradition. Aryans and Semites alike believed the cradle of

the human race to have been among the mountains of Central Asia, from which the great rivers of the earth proceed. The Indians held that the great streams flowed into all quarters of the world from the holy mount Meru in the Himalayas. According to the ancient Iranian tradition, the fertility of the whole earth depends upon the fountain Ardvî-çûra, which comes forth from the heaven-scaling mountain Hukairya, in the far north, and there are two wonderful trees. One of these, called 'the painless,' or 'all-seed,' produces all the seeds of the world's flora, and stands in the lake Vouru-Kasha, south of the holy mountain; the other, the white Haoma or Gaokarena, whose sap gives immortality, and will awake the dead, grows in the water of Ardvî-çûra. From Ezek. xxviii. 13, 14, it is clear that the Hebrews had a tradition of a 'holy mountain of Elohim,' on the sides of which lay the Paradise of Eden (cf. also Isa. xiv. 13). The idea of the tree of life appears in a still earlier form in the *Vedas*, in which the first man, Yamas, is represented as leading men to the garden of immortality on the summit of the mountain where he lives in fellowship with the gods. It may be also traced in the Babylonian and Assyrian monuments, but nowhere do we find such a deeply ethical and religious view of the primeval state of man as in the biblical account of Paradise. The tree of the knowledge of good and evil is a peculiarly Hebrew conception, and lifts the whole narrative from the physical into the moral sphere. See ADAM AND EVE, and ATLANTIS; also the commentaries on Genesis; Bertheau, *Beschreibung der Lage des Paradies* (1848); and Delitzsch, *Wo lag das Paradies?* (1881).

Eden, a river rising in the east of Westmoreland, in the Pennine chain. It runs north-northwest through the east of Westmoreland and Cumberland, past Appleby and Carlisle, and ends in a fine estuary at the upper part of the Solway Firth, after a course of 65 miles. There is another Eden in Sussex and Kent, a third in Fifeshire, and a fourth in Berwickshire.

Eden, WILLIAM. See AUCKLAND.

Edenhall, the ancient seat of the Musgraves in Cumberland, 4 miles NE. of Penrith. Here is still preserved the famous 'Luck of Edenhall,' an old painted glass goblet said to have been snatched from the fairies, on the safety of which the welfare of the house depends. It is supposed to have been a chalice, and its leathern case bears the sacred monogram. Uhland's well-known ballad, *Das Glück von Edenhall*, has carried its fame beyond the British Islands.

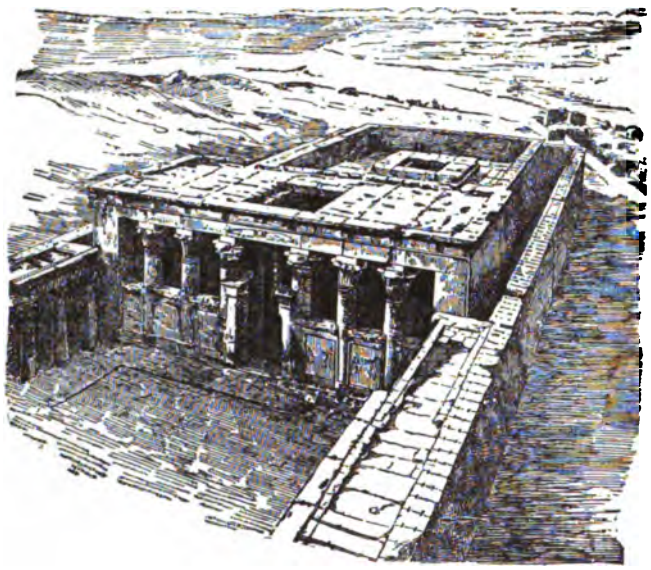
Edenkoben, a town of the Bavarian Palatinate, 6 miles N. of Landau. Pop. 5008.

Edentata (Lat., 'toothless'), one of the lowest orders of placental mammals, including sloths, anteaters, armadillos, pangolins, aardvarks, and extinct forms like Megatherium. The order is a very varied one, and few general characters can be given. The teeth are either absent or very imperfect. If present they are uniform in type, all of one set, without roots or enamel, and never situated in the front of the mouth. A superficial distinction into (1) leaf-eaters (Phyllophaga or Tardigrada) or sloths proper, and (2) insect-eaters (Entomophaga or Vermilingua), including all the others, is often drawn. It is better, however, to group the order in the five families of (1) Sloths (q.v.) or Bradypodidæ; (2) Ant-eaters (q.v.) or Myrmecophagidæ; (3) Armadillos (q.v.) or Dasypodidæ; (4) Pangolins (q.v.) or Manidæ; (5) Aardvarks (q.v.) or Orycteropodidæ. To these the extinct Megatheriidæ (see MEGATHERIUM) have to be added.

Edessa (Arabic *Er-Ruha*, called by travellers *Orfa*), a very ancient city, fabled to have been founded by Nimrod, in the north of Mesopotamia, between Aleppo and Diarbekir, 78 miles SW. of the latter town. Of its early history we know little, but with the conquest of Persia by the Greeks the history becomes less obscure. Seleucus, in particular, is said to have done much for the improvement of the city. Christianity was introduced into Edessa at an early period. In the reign of Trajan, the city was made tributary to Rome, and in 216 A.D. became a Roman military colony, under the name of *Colonia Marcia Edessenorum*. During this period, its importance in the history of the Christian church continued to increase. More than 300 monasteries are said to have been included within its walls; it was the seat of Ephraem Syrus (q.v.) and his school, and played an important part in the Arian and other controversies. Here, moreover, the famous portrait of Christ, supposed to have been painted by St Luke, and sent by the Saviour himself, with a letter, to Abgar (q.v.), king of Edessa, was preserved, till it was carried in 944 to Constantinople, and thence to the church of St Bartolommeo in Rome. Edessa was conquered by the Moslems in the seventeenth year of the Hegira, 638 A.D. Christianity declined, and wars at home and abroad during the califate destroyed much of its temporal splendour and prosperity. It was long held by the Arab tribes of Hamdân and 'Okeyl. The Byzantine emperors succeeded in recovering Edessa for a time in 1031, but the Seljuk Sultan, Melik Shah, retook it in 1086. There was always a strong Christian element in the population, and it was due to this that the city opened its gates to Baldwin, the brother of Godfrey of Bouillon in 1097, who made it the capital of a Latin principality and the bulwark of the kingdom of Jerusalem. Under the Frankish princes, Edessa held out valiantly against the Mussulmans, till at length 'Imâd-ed-dîn Zengi, ruler (*atabeg*) of Mosul, succeeded after a siege of a month, and several unsuccessful assaults, in taking the town and citadel in the year 1144, when the conqueror was so struck with the beauty and magnificence of the city that he withheld his men from sacking it. An attempt, however, of the Christian section of the inhabitants to betray the place to Joscelin in 1147 brought about the ruin of Edessa; the Christians were defeated by Nûr-ed-dîn; the city was laid waste; and all who were not massacred were sold as slaves. In 1182 Saladin added Edessa to his already extensive empire, and it was passed on to his kinsmen. After many vicissitudes, in the course of which Edessa fell successively into the hands of sultans of Egypt, Mongol emperors, Turkomans of the White Sheep, and Persian shahs, the city was finally conquered by the Ottoman Sultan, Selîm I., in 1515, and has ever since formed a portion of the Turkish dominions. It now contains above 40,000 inhabitants, of whom 2000 are Armenian Christians; the rest are Turks, Arabians, Kurds, and Jews. Edessa has numerous mosques and bazaars; manufactures of cotton goods, goldsmiths' wares, and morocco leather, commerce in British manufactures obtained by way of Aleppo, and a large trade in corn, &c. with Syria. Easterns, to whom it is the residence of Abraham, regard it as a sacred city.

Edfu (Coptic *Atbô*, Egypt. *Teb*, Gr. *Apollinopolis Magna*), a town of Upper Egypt, is situated on the left bank of the Nile, in 25° N. lat., and 32° 45′ E. long. It contains the remains of two temples, the larger of which is the best preserved monument of its kind in Egypt. It was founded by Ptolemy IV Philopator rather more than two centuries before Christ, and added to by his successors down to Ptolemy XIII Dionysus, a period of 170 years. The general plan of the temple resembles that of Dendera (q.v.). Its length is 451 feet, the breadth of its façade is 250 feet. Its

entrance is by a gateway 50 feet high, between two immense truncated pylons, 37 feet wide at the base, and 115 feet high, the whole surface covered with sculptures and inscriptions in low relief. This splendid façade is visible from a great distance, and is one of the most commanding sights in the Nile valley. Passing through this entrance, a court is reached; it is 161 feet long, and 140 feet wide, inclosed by a splendid colonnade of 32 columns of every variety of capital, and surrounded by walls, between which and the pillars there is a stone roof, forming a covered portico. The interior of this



View of the Temple at Edfu, from the top of the pylon.

court was to a great extent filled up with rubbish, and occupied by wretched dwellings, many of which also were built upon the roof of the temple; but these were all cleared away by Mariette in the khediviate of Ismail, and now the effect of the whole is grand and imposing, impressing the mind with the harmony and beauty of the design. From this court opens a hypostyle hall of 18 columns, joined by an intercolumnal screen, through which access is obtained to an inner hall of 12 columns, leading to the sanctuary, where a great monolith of gray granite was evidently intended to encage the hawk, the sacred emblem of Hor-Hud, the local Horus (q.v.), to whom the temple was dedicated. The sanctuary and surrounding chambers, together with the outer and inner halls, are separated by an open corridor from the outer wall of the temple, and both sides of this passage are covered with elaborate but monotonous reliefs and numerous inscriptions which present a sort of encyclopædia of ancient Egyptian geography, ritual, and ecclesiastical topography, with calendars of feasts, lists of divinities in the various names and cities, and even a species of church directory, including the names of singers and other temple officials. The smaller temple, erected by Ptolemy Physcon and Lathyrus, consists only of two chambers. Edfu has at present a population of about 2000. Its manufactures are blue cotton cloths, and earthenware similar to the ancient Egyptian pottery.—Wilkinson, *Ancient Egyptians;* Brugsch, *Reiseberichte,* and *Hist. Egypt.;* Lepsius, *Egypt and Ethiopia,* Mariette, *Monuments of Upper Egypt.*

Edgar, or EADGAR, king of the English from 959 to 975, was born in 944, the younger son of Edmund the Magnificent. After his elder brother's accession to the throne, Edgar in 957 was made ruler over Northumbria and Mercia, and two years later, on his brother Eadwig's death, became king of Wessex in addition. His reign, the policy of which was largely shaped by Dunstan (q.v.), was one of almost unbroken peace and prosperity; the Danes were conciliated, the monastic system was reformed, and the laws were strictly administered. Thus the epoch of Edgar the Peaceful was one which greatly favoured the work of national consolidation, the fusing together of the Danish, Saxon, and Mercian elements existent in the country.

Edgar the Atheling, grandson of Edmund Ironside, was born probably about 1057 in Hungary. His life may be epitomised as a series of abortive attempts. Selected by Edward the Confessor as his prospective heir, he was kept out of the throne by William the Conqueror (1066); having twice engaged in the northern revolts against the Norman, he was twice compelled to take refuge in Scotland, with Malcolm Canmore, who married Edgar's sister Margaret; then, embracing the cause of Robert, Duke of Normandy, against William Rufus, he was driven away (1091) from the duchy to Scotland; then he embarked (1099) in a bootless crusading expedition to the East; and finally was taken prisoner at Tenchebrai (1106) fighting for Duke Robert against his brother Henry I. Almost the only successful achievement of his life seems to have been that of reseating his nephew Edgar on the throne of Scotland (1097), which had been usurped by Donald Bane. His last days were spent in obscurity; the date of his death is not precisely known.

Edgehill, a hill-ridge on the border of Warwick and Oxford shires, 14 miles SSE. of Warwick. A tower, erected in 1760, marks the scene of the first great battle of the Civil War, which was fought on Sunday, 23d October 1642, between 12,000 royalists under Charles I. and 10,000 parliamentarians under the Earl of Essex. It was the intention of Charles, who had been lying at Shrewsbury, to march upon London; and Essex, who had thrown himself into Worcester, marched forward to intercept him, and entered the Warwickshire village of Kineton on the evening of the 22d. Next morning, the royalist army was discovered a little in advance, and drawn up in order of battle on the elevation of Edgehill, 3 miles to the south-east. The king's forces had the advantage in numbers and in cavalry, as well as in position; Essex, however, had the more formidable train of artillery. The royalists began to descend the hill about two o'clock, and Prince Rupert, who led the right wing, charged with his cavalry the left wing of the parliamentarians, broke it, and pursued it to Kineton. This was the fatal movement of the day. The right wing of the parliamentarians had charged and recharged with the greatest success, until, after some stubborn fighting around the royal standard, the royalist infantry broke and retreated toward the hill, and Rupert's cavalry were not available. The result was indecisive, the royalist loss being heaviest, but the advantage on the whole was with the king's forces.

Edgewater, a village of Staten Island, on New York Bay, adjoining Stapleton, with a number of small manufacturing concerns. Pop. (1890) 14,265.

Edgeworth, HENRY ESSEX, the 'Abbé Edgeworth,' was born in 1745. His father then was the Protestant rector of Edgeworthstown, but three years later turned Catholic, and, quitting Ireland, settled at Toulouse. There and at the Sorbonne young Edgeworth was trained for the priesthood; at his ordination he assumed the surname De Firmont from Firmount, the family property. Having declined an Irish bishopric that he might continue to minister to his countrymen in Paris, in 1791 he became confessor to the Princess Elizabeth, in 1793 to her brother, Louis XVI., just sentenced to death. He bravely attended him to the very foot of the scaffold; but the 'Son of St Louis, ascend to heaven,' was an invention, it seems, of the journalist Lacretelle. After many escapes he got safely to England (1796), and presently became chaplain to Louis XVIII. at Mittau, where he died of a fever, caught attending French prisoners, 22d May 1807. See his Memoirs by C. Sneyd Edgeworth (1815), and his Letters (1818).

Edgeworth, RICHARD LOVELL, Miss Edgeworth's father, was born at Bath, 31st May 1744. He came of a family that for 160 years had been settled in Ireland, at Edgeworthstown, County Longford. After nine years' schooling at Warwick, Drogheda, and Longford, then five months of dissipation at Trinity College, Dublin, in 1761 he was removed to Oxford, where, as a gentleman-commoner of Corpus, he passed two 'delightful, profitable' years. At Blackbourton, 14 miles distant, lived a friend of his father's, Paul Elers, a squire whose quiver was fuller than his purse: with one of his daughters Edgeworth eloped to Scotland (1763). The young couple spent a twelvemonth at Edgeworthstown, and finally settled at Hare Hatch, near Reading, Edgeworth meanwhile keeping terms in the Temple, till his father's death (1769) allowed him to give up all thought of the bar. As a boy of seven he had become 'irrecoverably a mechanic' through the sight of an electrical machine; and his whole life long he was always inventing something —a semaphore, a velocipede, a pedometer, and so forth. One of his inventions brought him across Dr Darwin; and at Lichfield, the Christmas-tide of 1770, he conceived a passion for lovely Honora Sneyd. His wife was away in Berkshire ('she was not of a cheerful temper'); but Thomas Day (q.v.) was with him, and urged him to flight. So with Day and his eldest boy, whom he was educating on Rousseau's system, he did fly to France, and at Lyons diverted himself and the course of the Rhone. Then his wife died, and four months afterwards he wedded Honora (July 1773), to lose her in 1780, and the same year marry her sister Elizabeth. She too died of consumption (1797); but the next wife, Miss Beaufort (1798), survived him by many years. In all he had nineteen children. 'I am not,' he observed, 'a man of prejudices. I have had four wives. The second and third were sisters, and I was in love with the second in the lifetime of the first.' Of his life besides not much more need be told. He advocated parliamentary reform and Catholic emancipation; his house was spared by the rebels (1798); and in the last Irish parliament (1798–99) he spoke for the Union, but voted against it, as a measure 'forced down the throats of the Irish, though five-sixths of the nation were against it.' He died 13th June 1817. Masterful, versatile, brilliant, enlightened, he stands as a type of the Superior Being; 'cocksureness' his principal foible. He was the idol of his own womankind, the friend too of Watt and Wedgwood and many more better and greater than himself.

MARIA EDGEWORTH, novelist, was born at Blackbourton, on New-year's Day 1767, and in 1775 was sent to a school at Derby, in 1780 to a fashionable establishment in London. As quite a child she was famed for her story-telling powers, and at thirteen wrote a tale on Generosity. 'Excellent,' said her father, 'and extremely well written; but where's the generosity?' She accompanied him to Ireland in 1782, and thenceforth till his death the two were never separate. For his sake and that of her other dear friends and her country she sacrificed her one romance—refused the Swedish count, M. Edelcrantz, not without much suffering then and long afterwards. This was in 1802 at Paris, where, as again in 1820, and during frequent visits to London, she was greatly lionised. She was at Bowood (Lord Lansdowne's) in 1818, and at Abbotsford in 1823, Scott two years later returning the visit at Edgeworthstown. For the rest, her home life was busy and beneficent, if uneventful. Her eyesight often troubled her; but at seventy she began to learn Spanish, at eighty-two could thoroughly enjoy Macaulay's History, and even mount a ladder to take the top off the clock. She died in her stepmother's arms, 22d May 1849.

To the literary partnership between Mr and Miss Edgeworth we are directly indebted for *Practical Education* (2 vols. 1798), and the *Essay on Irish Bulls* (1802). But most of her other works, though they do not bear the joint names, were inspired by her father, and gained or (it may be) lost by his revision. Published between 1795 and 1847, they filled upwards of 20 volumes. Besides the *Tales from Fashionable Life* and *Harrington* (an apology for the Jews), there are her three Irish masterpieces, *Castle Rackrent* (1800), *The Absentee* (1812), and *Ormond* (1817). These, Scott says, 'have gone so far to make the English familiar with the character of their gay and kind-hearted neighbours of Ireland, that she may be truly said to have done more towards completing the Union than perhaps all the legislative enactments by which it has been followed up. Without being so presumptuous as to hope to emulate the rich humour, pathetic tenderness, and admirable taste which pervade the works of my accomplished friend, I felt that something might be attempted for my own country of the same kind with that which she has so fortunately achieved for Ireland.' The praise from Scott is extravagant; but Turgenief, too, has recorded how he 'was an unconscious disciple of Miss Edgeworth in setting out on his literary career. . . . It is possible, nay probable, that if Maria Edgeworth had not written about the poor Irish of County Longford and the squires and squireens that it would not have occurred to me to give a literary form to my impressions about the classes parallel to them in Russia.' Yes, her novels are too didactic; the plots may be poor, the *dramatis personæ* sometimes wooden; the whole may have too much the tone of a moral Lord Chesterfield; but for wit and pathos, for lively dialogue and simple directness, for bright vivacity and healthy realism, as a mirror, moreover, of the age when they were written, and of that 'most distressful country' in which their best scenes are laid, they still deserve to be read, by subscribers even to Mudie's. And her children's stories—'Lazy Laurence,' and 'Simple Susan,' and the other delightful old friends—are worth all the unchildish books about children which a mawkish sentimentality has brought into recent vogue.

The *Memoirs of Richard Lovell Edgeworth* (1820; 3d ed. 1844) are autobiographical up to 1782; the completion, less interesting, is by Miss Edgeworth. Of herself there is a Memoir (privately printed, 3 vols. 1867), on which are founded the Life by Helen Zimmern ('Eminent Women' series, 1883), and the exquisite sketch by Miss Thackeray in her *Book of Sibyls* (1883).

Edgings are indispensable to neatness in gardening, except where parterres are cut out of a lawn,

but more especially to separate gravel-walks from cultivated ground. They are sometimes made of stone, or of deal, of ornamental wire and cast-iron work, and very frequently now of terra-cotta tiles in elegant patterns. Living edgings are, however, always to be preferred where they can be adopted, because they are almost invariably most pleasing and characteristic of gardening. For this purpose many low-growing evergreen shrubs are used in Britain, such as dwarf box, Cotoneaster, Pernettya, Erica, ivy, and latterly some remarkably neat and pretty dwarf Veronicas from New Zealand. Among herbaceous plants commonly used for edgings may be noted double-flowered daisies, thrift or sea-pink, gentianella, saxifrages, and many others which when in flower are highly beautiful. The only drawback in connection with these is that they require frequent, almost annual renewal. Turf-edgings are sometimes employed for wide flower-borders.

Edgware, a village of Middlesex, 11¼ miles NW. of King's Cross station, stretching for about a mile along the highway. In a forge here, where he had taken refuge from the rain, Handel conceived his 'Harmonious Blacksmith.' Pop. 816.

Edible Birds'-nest, a nest chiefly composed of the salivary secretion of several species of Swiftlet (Collocalia), which are almost wholly restricted to oriental regions—Java, Borneo, Ceylon, &c. The nests are made into soup and much prized as luxuries by the Chinese; both on this account and because of their unique origin they have been subjects of not a little inquiry. The nest, when clean and of the best quality, has a white colour and a somewhat fibrous texture. It is small, shallow, and bluntly conical. Mr E. L. Layard has vividly described those of the Ceylon species (*C. nidifica*), noting the vast numbers which hang close together on the sides of dim caves, the varying quality at different seasons, and also the nonsense that has been talked about them. 'The white nests,' he says, 'are supplied entirely by the inspissated saliva of the bird, and are the first produced. They are taken and sold for their weight in silver. The next made by the birds are mixed with rootlets, grasses, &c., and often show traces of blood from the efforts of the birds to produce the saliva. These are esteemed second quality. The third nest is composed of extraneous substances cemented together to the rock with a little saliva—these are generally left for the bird to breed in, and are destroyed at the end of the season to compel the birds to build fresh white ones after their powers are recruited by a year's rest and stimulated by the breeding impulses.' Mr Pryer, a naturalist of Yokohama, gives a graphic account of a visit to the Borneo caves, but it is quite impossible to credit all his results. He describes the myriads of birds which return home as myriads of bats emerge, the birds of prey which make victims of both, the unexhausted supply which is known to have persisted for seven generations, the yield of three crops of nests in the year, and so on. But he proceeds to give the bats (!) some share in the credit of nest-making, and refers the main constituent of the edible morsel to a fungoid growth on the walls of the cave.

There is no doubt that Layard's account is correct. At the breeding season, the sub-lingual salivary glands in these swiftlets become enlarged and very active. They pour forth a viscid secretion, which soon hardens in the air. This is the chief constituent of the white nests. The first supposition was that of Horne, who supposed the secretion to be gastric; Bernstein, however, showed that it was salivary, and this is without doubt true in spite of more than one assertion as to the vegetable character of the nest. It is probable that the discrepancy is explained in the existence of the three qualities noted by Layard. Mr J. R. Green analysed the product, which was one of the curiosities of the Health Exhibition in London (1884), and found that the main constituent is closely akin to mucin, a not uncommon secretion of

The Edible Nest of the Salangane of South Java.

many animals. It is for instance with a similar substance, derived from a very different source, that the male stickleback weaves his nest together.

There are some ten species of swiftlet, which all exhibit this profuse salivary secretion, though in different degrees. Thus one of the Javanese species (*C. fuciphaga*) builds a similar nest, which is not edible because so much mixed up with plant-fibres and the like. The birds are sometimes called *Salangane*, from one of the islands which they frequent. The luxury is a very costly one; the nests are but small, and worth 'their weight in silver.' To Canton alone about 25 million nests are sent annually, and the price of a million has been estimated at about £35,000. The taste for the costly soup is said to require cultivation.

See J. R. Green, *Nature*, xxxi. (1884), xxxiv. (1886); *Jour. of Physiol.* vi. (1885); E. L. Layard, *Nature*, xxxi. (1884); Report of Pryer in *Nature*, xxx. (1884).

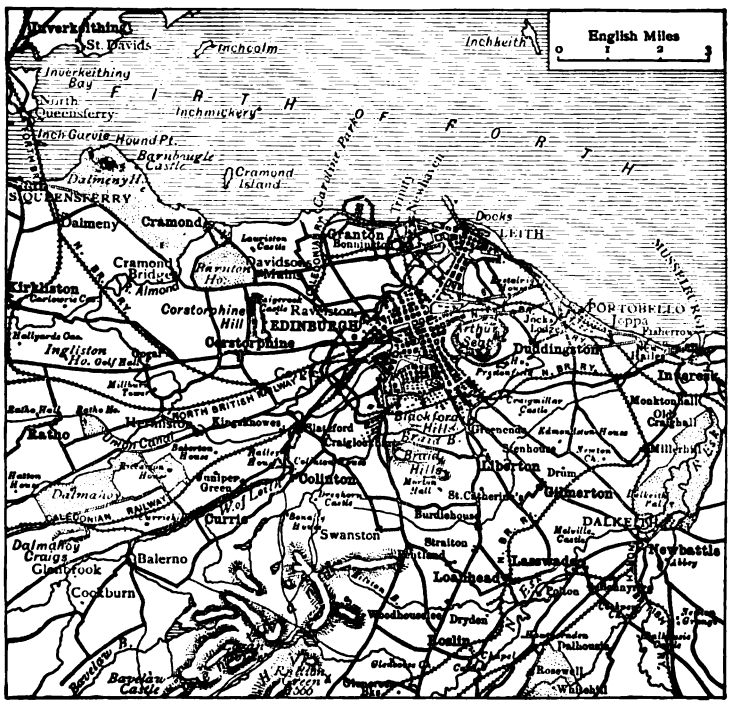
Edict (Lat. *edictum*). The power of making edicts (*jus edicendi*) belonged generally to the higher magistrates at Rome; but it was specially exercised by the curule ædiles, and more extensively still by two Prætors (q.v.). Even in Cicero's time, the study of the edicts had become a regular branch of the study of the law. The object of the edict, according to the Roman jurists, was to aid, supplement, and correct the civil law; it was, in short, an indirect form of legislation, which public opinion had sanctioned for the public convenience; and there can be no doubt that it contributed what was ultimately the most valuable part of the Roman law. There were many commentators on the edicts under the emperors; and in the time of Hadrian, Salvianus Julianus is supposed to have collected and arranged the edicts, and given to them a systematic form called Edictum Perpetuum. See Lenel, *Das Edictum Perpetuum* (Leip. 1883).

Edictal Citation, or INTIMATION, the form of citation or notice by which a party amenable to the courts of Scotland, but out of the country, is summoned to make appearance in court in answer to a civil suit. The older forms of edictal citation were complicated, but were gradually simplified by recent legislation. Edictal citation is now made by delivering a copy of the citation at the office of the keeper of edictal citations in Edinburgh who records and publishes it. In criminal cases edictal citation was till recently made by proclamation at the cross of Edinburgh and the pier and shore of Leith. This

form was abolished by the Criminal Procedure (Scotland) Act, 1887, which enacts that when any person accused has absconded, the indictment may be served at his last known residence.

Edict of Nantes. See HUGUENOTS, NANTES.

Edinburgh, the capital of Scotland, and county town of the shire of Midlothian, is situated in 55° 57′ N. lat., and 3° 11′ W. long. By rail it is 393 miles NNW. of London, and 47½ E. of Glasgow. Edinburgh occupies a peculiarly high place in the regard of the civilised world, and draws to herself the devoted attachment of Scotsmen, partly on account of the charm of her situation, but even more by reason of the many tragic events of Scottish history enacted within her walls, which have been made of world-wide interest by the genius of her great townsman Sir Walter Scott. To the cultured is added the attraction of the memory of the many eminent literary and scientific men who have been among her citizens. The town stands about 2 miles from the sea, on a series of ridges, and is overlooked by Arthur's Seat (q.v.) and other hills, to the foot of which it has now extended. Those hills are noticed in the article EDINBURGHSHIRE; of hills within the city itself the highest are the Castle Rock (437 feet) and the Calton (349). Although the Castle Rock, which for centuries was considered an almost impregnable fortress, must have been a place of refuge and of arms from the earliest times, Edinburgh is not noticed in history until the beginning of the 7th century, when it is mentioned as the capital of the kingdom of Northumbria, from whose king Edwin it is said to derive its name. Four centuries later, in the end of the 11th century, its castle figures in the story of St Margaret, queen of Malcolm Canmore, and the little Norman chapel on the summit of the rock, dedicated to her memory, is the oldest building connected with the city. In 1128 David I. founded the abbey of Holyrood, about a mile east of the castle, and round it grew up the little burgh of the Canongate, which maintained its separate municipality until 1856, when it was incorporated with Edinburgh. The Canongate for centuries retained an ecclesiastical flavour.



Environs of Edinburgh.

To the east of the castle, where the ground slopes down from the rock in a narrow 'hog's-back' (see the article CRAG AND TAIL, and the cut there), there grew up the town of Edinburgh. In 1329 it was made a burgh by Robert the Bruce, by a charter which also granted the town the right of establishing a port at Leith, 2 miles distant; thus began the vassalage of the port to the capital town, which continued until 1833, when Leith was by Act of Parliament made a burgh. It was, however, during the 15th century, under the Stewart dynasty, that Edinburgh began to be recognised as the capital, and parliament regularly met here; at first within the great hall of the castle, and afterwards in the City Tolbooth, until in 1631 the Parliament House, which still stands, was erected. James V. further confirmed its choice as the capital by building a palace within the abbey of Holyrood; and by establishing in it, in 1532, the Court of Session, as a supreme court of justice for Scotland. In 1450 the first wall was built; and in 1513, after the defeat at Flodden, an extended wall was erected to include the suburb of the Cowgate, which had meantime arisen in the valley to the south. For two centuries and a half the town remained stationary in size, consisting of two long streets, the High Street (which was continued without the walls by the Canongate) and the Cowgate; while from these branched off numerous narrow lanes, called 'wynds,' which were also lined with houses. The town was defended on the west by the castle; on the north by a morass, called the 'Nor' Loch;' and on the east and south by the city wall. As the population increased, the houses rose higher and higher, being built of the splendid freestone of the surrounding country, until the town abounded in great 'lands' of houses, which, being erected on the steep sides of the 'hog's back,' had entrances from two levels, and rose to ten, twelve, and even fourteen stories in height. This is the historic city; and it entered on the most remarkable period of its history with the birth of Queen Mary. In 1544 it was burned to the ground by the English under Hertford, scarcely a building outside the castle, save St Giles' Kirk, escaping. In 1560 the drama of the Reformation began in Edinburgh, and John Knox became the city minister; in 1561 Queen Mary returned a widow from France, and there was acted, chiefly in Edinburgh, the striking tragedy of her short reign, which has given subject-matter to historian, poet, dramatist, and novelist. It was at Holyrood Palace that Rizzio was murdered, and in the castle James VI. was born; in the Kirk-of-Field, where the university now stands, Darnley was killed, and in the Chapel Royal of Holyrood Mary was married to

Bothwell. In 1583 the university was founded, and the town which George Buchanan had already made known to the learned began its intellectual life. In 1603 James I. left Scotland to ascend the English throne, and although parliament still continued to meet in it, the town was shorn of much of its importance. It was the scene of many of the fiercest episodes in the long ecclesiastical struggle of the 17th century; and its Cross witnessed the execution of Montrose in 1650, and of Argyll and his brother Covenanters after the Restoration.

The Union of 1707, which emptied the Parliament House of its legislators, and drew away the Scottish nobility from their Edinburgh mansions, was very unpopular, and the citizens long remained discontented. The Porteous mob, which Scott has made famous in the *Heart of Midlothian*, showed the spirit abroad, and so the town was ready to welcome the Pretender, and to rejoice for a brief season in the glories of the court which he held at Holyrood Palace, in 1745. But the Rebellion was followed by the inroads of modern enterprise. Shortly after the middle of the century, the Town Wall was broken down in every direction, until but little now is left, save one of the towers built into the west boundary wall of Heriot's Hospital; the Nor' Loch was drained; and when the North Bridge was erected, in 1763, access was given to the country which slopes down to the Firth of Forth, on which arose the New Town. In 1785 the valley to the south, in which lies the Cowgate, was bridged, and the town spread southwards. In 1815–19 another bridge was thrown over a deep hollow on the north-east, and the Calton Hill was connected with the city; while a few years later a bridge was built across the Cowgate parallel to the one already erected. Thus the city connected the country on north and south with the narrow ridge topped by the castle, on which she had stood for centuries. Meanwhile a greater intellectual revolution had awakened the deadness of the early 18th century. There spread northwards the wave of scientific research which rose in England in Charles II.'s reign, and resulted in the establishment of the Scottish school of medicine, of which Alexander Monro was the founder; he was a man worthy to head even its long roll of fame. In this important movement the town assisted materially by the foundation, in 1738, of the Edinburgh Royal Infirmary, the joint work of Monro and Lord Provost Drummond. Closely following the scientific came the great literary revival which has made the town known over the world. Early in the 18th century lived Allan Ramsay and Robert Fergusson, the forerunners of Robert Burns, and then followed Robertson the historian, David Hume and Adam Smith, Professors Dugald Stewart and John Playfair, Sir Henry Raeburn, and many lesser celebrities, such as Henry Mackenzie and Tytler, Lord Hailes and Hugh Blair. But her greatest literary period was reached when Walter Scott was writing his novels, and when the *Edinburgh Review* was started by Jeffrey, Sydney Smith, Brougham, and Horner, and *Blackwood's Magazine* by the brilliant coterie led by John Gibson Lockhart and John Wilson (Christopher North).

The modern city now spreads on every side round the steep ridge to which for centuries she was confined. Northwards she has spread to the sea, eastwards she touches the basaltic cliffs of Salisbury Crags (see ARTHUR'S SEAT), southwards and westwards she is creeping round the base and up the slopes of the picturesque hills which try to shut her in. But her most remarkable feature is the line formed by the

View from Edinburgh Castle, looking eastward.

mass of the Castle Rock, continued by the great houses and spires of the ridge of the Old Town, looking across the valley, in which was once the Nor' Loch, to the noble modern terrace of Princes Street. The old historic houses of the Old Town have been largely cleared away by much-needed City Improvement Acts. The New Town is regularly laid out; it contains many handsome streets and squares, ornamented with gardens; and its houses are mostly lofty and built of fine freestone. The suburbs, especially the southern, contain a great extent of villa-houses, so that the town covers a wide space for its population. It is also especially fortunate in its open spaces and public parks. The Princes Street gardens occupy the site of the old Nor' Loch, at the foot of the

Castle Rock; the range of the Meadows and Links—the remains of the once extensive Burgh Muir—divides the town proper from the southern suburbs; the old royal hunting-ground attached to Holyrood—the Queen's Park and Arthur's Seat—is open to the citizens; while on the north the Arboretum has been acquired, and on the south Blackford Hill and the Braids have been added to the town property devoted to recreation. The view obtained from the top of either Arthur's Seat or Blackford Hill is a very noble and extensive one; that from the latter eminence is finely described in Scott's well-known verses in *Marmion*.

Edinburgh is still in some measure the capital of Scotland: it is the seat of the Supreme Courts and of some of the departments of government; in it are held the General Assemblies of the Scottish churches; and the military headquarters for Scotland are also stationed in it. It contains the head-offices of the principal Scottish banks; of some of the largest of the Scottish insurance companies, which are among the greatest institutions of their kind; and of many other financial companies trading in Scotland and even more largely in the colonies. It is the centre of much of the intellectual life of Scotland, being the home of the Royal Society of Edinburgh, of the Royal Scottish Academy of Fine Arts, of the Scottish Society of Antiquaries, and of many other literary and scientific societies. Its leisured class, which is a large one, is partly composed of Scottish landed proprietors, but much more extensively recruited from those who have returned from abroad after acquiring affluence; while the tone of its society is in great measure given by the legal bodies which practise before its Supreme Courts, and by the staff connected with the university. At the head of its legal bodies is the Faculty of Advocates or barristers, which has always included many of the most distinguished Scottish writers and politicians; then come the Society of Writers to the Signet, and the Solicitors before the Supreme Court. There are also important societies of Accountants and Actuaries. Since the middle of the 18th century it has been celebrated for its physicians and surgeons, many of whom have been known for strong character as well as scientific knowledge. These and other circumstances tend to make Edinburgh very much a place of residence, with a large well-to-do population, a fact shown by its returns to the imperial revenue for house duty levied on houses above £20 rental, which are, after London, probably the largest in the kingdom.

It has been long known for its educational institutions, and these draw many inhabitants to the city for the benefits they offer. At the head of these is, of course, the university, and there are besides theological halls connected with the Free, United Presbyterian, and other churches, and normal schools for training teachers. The High School and Academy, and many of its private schools, have also attained a high reputation; but the most noteworthy feature perhaps is the exceptionally large sum which is annually derived for educational purposes from bequests left by citizens. These endowments have been largely diverted for secondary education during the last twenty years. Among the principal is the trust founded by George Heriot in Charles I.'s time, which now yields £26,000 per annum, applied by the Act of 1885 to the Heriot-Watt Technical College, and to the maintenance of a Science and Technical School; the trusts under the charge of the Merchant Company of Edinburgh, with an annual income of £40,000, applied principally to middle-class education; and the Fettes endowment, applied to higher-class education on the English model. In Libraries (q.v.) Edinburgh is rich, having besides the University Library, the magnificent collection of over 300,000 volumes belonging to the Faculty of Advocates, and the valuable library of the Society of Writers to the Signet, amounting to nearly 90,000 volumes; a free public library was also erected in 1887–89, the building being a gift of Mr Andrew Carnegie of Pittsburg, U.S. The city is known for its many religious, charitable, and philanthropic societies. Perhaps the greatest of these is the Royal Infirmary, 'open to the sick and hurt of all countries.' During the year ending October 1888 it relieved over 8800 patients, with an annual expenditure of over £34,000. It has received within the last generation great sums from gifts and legacies, and may be almost said to be the *ultima hæres* of all connected with the city who die without immediate heirs. It is a necessary adjunct to the great medical school, and is considered one of the most admirably appointed hospitals in Europe.

The city ranks as a county in itself, and is under the management of a corporation of forty-one members, who elect from their number a Lord Provost and six magistrates, called bailies. The Lord Provost, who serves for three years, takes the title of 'Right Honourable,' is Lord-lieutenant of the city and Admiral of the Firth of Forth, and nominates deputy-lieutenants and justices for the city.

Edinburgh, as a residential town, is probably the most important shopkeeping centre out of London; it is not in any great measure a manufacturing town, its most important industries being brewing and publishing. It has long been famous for its ale, and the trade has extended greatly of late years. Of 1,392,416 barrels of beer brewed in Scotland in the year ending 31st March 1888, 910,509 were produced in Edinburgh; an ever-increasing proportion of this is sent abroad. It has been known for its printers since the early years of the 16th century, when Walter Chepman, under the patronage of James IV., set up the first Scottish printing-press. The publishing of books, with the subsidiary businesses of printing, bookbinding, and typefounding, is now a most important industry; the publications of Messrs Black, Blackwood, Chambers, Nelson, and numerous other firms are well known; and the book-factories are exceptionally large and well appointed. It is also a centre for the paper trade, as there are many important paper-mills in the immediate neighbourhood. See BOOK-TRADE. There are also very important distilleries, and large india-rubber manufactories, tanneries, and extensive nurseries for trees and shrubs. Edinburgh is a great railway centre, and, besides a suburban railway, has both a horse and cable system of tramways.

Edinburgh has many buildings famous in history, or important from their architectural merit. The Palace and Abbey of Holyrood (q.v.) are a memorial of the old Scottish monarchy; of the castle, the earliest portion, the old Parliament Hall, was restored (1888–89) by the late Mr William Nelson, publisher, while the Queen Mary portion contains the Scottish regalia; St Giles' Church, the old parish church of Edinburgh, dating most of it from the 15th century, was restored by the late Dr William Chambers (q.v.), the work being completed in 1883; the Parliament House, erected in 1633 for the Scottish parliament, is now used as the 'Outer House' of the Supreme Courts, and adorned with many fine portraits and statues belonging to the Faculty of Advocates; John Knox's House is the 'manse' used by the great Reformer while minister of the town; the beautiful 17th-century building of Heriot's Hospital is now used as a technical school. Many of the modern buildings are fine. The Episcopal Cathedral of St Mary's, opened in 1879, is one of the largest

churches built in Britain since the Reformation; and many of the other churches are handsome buildings. The new Medical Schools and the Infirmary occupy a noble range of buildings; while many of the museums and galleries, banks, insurance-offices, clubs, and public schools are fine buildings, and occupy sites made remarkable by the broken nature of the ground on which the city is built. Among its many monuments stands out the graceful Gothic spire in memory of Sir Walter Scott.

Edinburgh had a population in 1831 of 136,548, which rose in 1881 to 234,402, and in 1891 to 261,261. It contained in the latter year 51,079 inhabited houses. It is divided, for municipal purposes, into thirteen wards, with a total constituency in 1888–89 of 42,971, embracing a large proportion of female householders. It is divided into four divisions for parliamentary representation, and returns four members to parliament.

See Histories by Maitland (1753) and Arnot (1779); Wilson's *Memorials* (1848) and *Reminiscences* (1878); Chambers's *Traditions* (1825); Drummond's *Old Edinburgh* (1879); R. L. Stevenson's *Edinburgh: Picturesque Notes* (1878); Grant's *Old and New Edinburgh* (1880–82); and Lees' *St Giles'* (1889).

THE UNIVERSITY OF EDINBURGH, the youngest of the Scottish universities, is in a very special manner the child of the Reformation. It took its origin from the zeal of the Reformers for education, inspiring the citizens of Edinburgh to seek after a college for their town. In 1561 the town-council began to move in the matter, and a few years after it obtained from Queen Mary a grant of the ruins of the Kirk-of-Field, an old collegiate church; this holding it afterwards extended by buying out several of those who had taken possession of parts of the grounds of the church. The long civil war retarded the project, but in 1582 the town-council obtained a charter from King James authorising it to establish a college; it was at the same time empowered to recover a sum of 6000 merks Scots, which had been left as far back as 1558 by Robert Reid, Bishop of Orkney and Abbot of Kinloss, for the purpose of founding a college in Edinburgh, according to lines laid down by the testator. The college was opened in 1583 in very humble buildings, and on a very small scale, its staff consisting of one regent, Robert Rollock, a young scholar brought from the college of St Andrews, with one assistant. In 1587 the staff was increased, Rollock becoming principal and professor of Divinity, with four regents, who each taught all the subjects of the curriculum, and conducted students through their four years' course. Such the college continued, without much material change, until the beginning of the 18th century; it was principally a school for training the Scottish Presbyterian clergy, although many of the Scottish nobility also attended its classes. In 1708, however, under the enlightened guidance of the principal, William Carstares, the regents became professors, teaching but one subject, and a possibility was opened up for a great extension of the scope of the college. In 1724 a beginning was made of a medical faculty, when Alexander Monro became professor of Anatomy; other chairs in the same faculty rapidly followed, and with such teachers as Monro, Cullen, and Gregory, the fame of the school soon rose. The reputation of the university was extended when, towards the close of the 18th century, Robertson, the distinguished historian, became principal, and Dugald Stewart and John Playfair drew students in crowds to its arts classes. During the 19th century the number of students has gone on increasing, and has been greatly augmented of late years; the number matriculating for the year 1888–89 being 3561, of whom 1967 entered in medicine, 1014 in arts, 471 in law, and 109 in divinity.

The great influx of students during Principal Robertson's time rendered an increase of college accommodation absolutely necessary, the growth of numbers having been met up to this time by buildings erected from time to time by the town-council from city funds, or by the generosity of private donors. In 1789 the foundation of the present university buildings on the South Bridge was laid, being begun partly by subscription, but mainly on promise of aid from government; these buildings were not completed till 1827, the grants from the national treasury being withdrawn during the French war. A classical edifice, from designs by the elder Adam, it was completed only in 1887 by the addition of a dome. Some years ago the greatly augmented numbers, especially of the medical classes, called for a further increase of buildings, and a separate medical school was opened in 1884, erected at a cost of £250,000, of which £80,000 was supplied by government, the rest by private subscription. In 1887–89 a students' union was built; and in 1889 a college hall was erected at the expense of Mr M'Ewan, M.P. for one of the divisions of the city.

From its foundation in 1583 down to 1858 the university was entirely controlled by the town-council, which in its early days was much guided in its choice of teachers by the city clergy. It was felt, however, that it had outgrown its original constitution, and after a Royal Commission had reported, the Universities (Scotland) Act, 1858, made the university of Edinburgh a corporation 'consisting of chancellor, rector, principal, professors, registered graduates and alumni, and matriculated students.' Its government was vested in a Senatus Academicus, subject to the review of a University Court consisting of eight members, appointed partly by the university authorities and partly by the town-council of Edinburgh. The patronage of the chairs, which, with the exception of a small number vested in the crown, had remained up to this date with the town-council, was transferred to seven curators, four appointed by the town-council and three by the University Court. The lord rector is elected by under-graduates. A Students' Representative Council was founded in 1884 as a means of expressing the opinion of the body of students on university matters. Since 1868 the chancellor, professors, and members of the University Courts and General Councils of Edinburgh and St Andrews Universities conjointly elect a member of parliament.

Among the alumni of the university are numbered Goldsmith, Scott, Carlyle, Darwin, and John Leyden; while of its famous principals and professors may be mentioned the names of Carstares and Robertson, of M'Laurin, Leslie, Forbes, and Charles Bell, of Dugald Stewart, John Playfair, Sir William Hamilton, John Wilson, and Thomas Chalmers, of the Monros, Gregory, and Cullen, and of Christison, Syme, and Simpson.

Faculties, Degrees.—The university comprises the Faculties of Arts, Divinity, Law, and Medicine, with 41 chairs, of which 4 belong to the Faculty of Divinity, 6 to that of Law, 13 to that of Medicine, and 18 to that of Arts. Attendance is compulsory at all classes in the first three faculties, but candidates for the degree of M.A. are only required to attend the lectures of the professors of Humanity (Latin), Greek, Mathematics, Logic and Metaphysics, Moral Philosophy, Natural Philosophy, and Rhetoric and English Literature, the first six of which chairs, along with that of Divinity, were founded in 1583; the chair of Celtic Languages and Literature, the most recent, was instituted in 1882.

The university recognises as qualifying for its degrees the lectures of a large body of distinguished

extra-mural lecturers; distinct degrees are granted by the Royal Colleges of Physicians (q.v.) and Surgeons (q.v.).

Libraries, Museum, Societies.—The University Library originated in a bequest of books made in 1580 by Clement Little to the town and church of Edinburgh. This little library, consisting of about 300 volumes, was transferred by the town-council to the college on its opening. It has gradually increased. From 1709 it enjoyed the right of receiving every book entered in Stationers' Hall, but a composition of £575 per annum in lieu of the privilege was accepted in 1837. The University Library contains about 150,000 printed volumes, and 2000 volumes of MSS. The university also contains subsidiary libraries, such as the Theological Library, the Humanity Class Library, &c. The Natural History Museum was established in 1812, and received a government grant of £200 per annum. It was in 1854 transferred to the new Museum of Science and Art, where it forms a Natural History Department, of which the professor of Natural History is the regius keeper. The Anatomical Museum, now exhibited in a fine hall in the new Medical School, was founded by the town-council and the Senatus Academicus in 1826. The Botanical Museum is stationed in the Botanic Garden, which is in connection with the university. The numerous societies for literary or scientific discussion play an important part in the training of the students. The Speculative Society was founded in 1764, and the Royal Medical in 1737. The Scots Law, the Dialectic, the Diagnostic, and the Philosophical constitute the Associated Societies of the university. Some 100 bursaries or exhibitions are awarded to students, and about 80 scholarships, some of them worth over £100 a year; while for graduates there are ten fellowships, worth from £100 to £160 a year.

Edinburgh Review, the great Whig 'buff and blue' quarterly, was started in October 1802 by a knot of young men living in the northern capital, the principal of whom were Jeffrey, Sydney Smith, Horner, and Brougham. So much was secrecy felt or believed to be necessary to the success of the undertaking, that, according to the account which Lord Jeffrey gave to Mr Robert Chambers in 1846, 'the dark divans' of the reviewers were held for some time 'in a dingy room of Willison's printing-office in Craig's Close,' to which each repaired alone, and 'by back approaches or different lanes.' Of the first number, 750 copies were printed: the demand exceeded this limited supply; 750 more were thrown off, and successive editions followed. In 1808 the circulation had risen to about 9000, and it is believed to have reached its maximum—from which it has declined—in 1813, when 12,000 or 13,000 copies were printed. The pay of contributors was at first ten guineas a sheet, but shortly after 'the *minimum*,' says Jeffrey, 'was raised to sixteen guineas, at which it remained during my reign. Two-thirds of the articles were, however, paid much higher, averaging, I should think, from twenty to twenty-five guineas a sheet on the whole number.' The original publisher was the well-known Constable, whilst Sydney Smith was editor of the first three numbers, his successors having been Jeffrey (1803–29), Macvey Napier (1829–47), Professor William Empson (1847–52), Sir George Cornewall Lewis (1852–53), and Henry Reeve, C.B. The influence of the *Edinburgh Review* in developing and strengthening the political convictions of the Whig party cannot be overestimated; but its power was even more visible, certainly more immediately palpable, in literature. Amid the feeble and effete periodicals of the day it burst like a bombshell. The keenness of criticism, the sharpness of wit, the brilliancy of style, the vigour of mind and comprehensiveness of knowledge exhibited by the writers excited amazement and fear in the world of letters; and although, in the case of Wordsworth, Southey, and other writers of a certain school, unfairness of a flagrant kind was undoubtedly exhibited and persevered in, yet impartial justice was, on the whole, administered. Since Jeffrey's day the most brilliant contributor was Lord Macaulay. The *Edinburgh Review* is now published in London. See *Correspondence of Macvey Napier* (1879).

Edinburghshire, or MIDLOTHIAN, a Scottish county, extending 12 miles along the low southern shore of the Firth of Forth. The greatest length from east to west is 36 miles; its greatest breadth, 24; and its area, 367 sq. m. The surface has a general southward rise to the Pentlands, culminating in Scald Law (1898 feet), and the Moorfoot Hills, whose highest point is Blackhope Scar (2136). Intermediate eminences are Arthur's Seat (822), Blackford Hill (500), Corstorphine Hill (520), Craiglockhart (550), the Braid Hills (698), and the Dalmahoy Crags (800). The streams—Esk, Water of Leith, and Almond—all flow to the Forth, with the exception of Gala Water, which runs to the Tweed. The geology is most interesting, the rocks of the Moorfoots being Lower Silurian; of the Pentlands, Upper Silurian and Lower Old Red Sandstone, the latter consisting chiefly of volcanic rocks; and of the plains, Carboniferous, with contemporaneous and subsequent or intrusive igneous rocks. Coal has been largely mined for nearly three centuries; and ironstone, oil-shale, and fireclay are also raised. There are large quarries of sandstone at Craigleith (q.v.) and elsewhere. Agriculture is highly advanced, though only 57 per cent. of the entire area is in cultivation. Near Edinburgh are large market-gardens and sewage-meadows; and on the Esk and the Water of Leith there are paper-mills. The county returns one member to parliament, and contains the parliamentary burghs of Edinburgh, Leith, Portobello, and Musselburgh, besides the police-burghs of Dalkeith, Bonnyrigg, Loanhead, and Penicuik. Pop. (1801) 122,597; (1841) 225,454; (1891) 444,055. Edinburghshire possesses four battlefields, Roslin, Pinkie, Carberry Hill, and Rullion Green. Among its antiquities are the Catstane, the Roman remains of Inveresk and Cramond, Roslin Chapel, and the castles of Borthwick (q.v.), Crichton, Craigmillar, &c. It is rich, too, in fine and interesting mansions, described in Small's *Castles and Mansions of the Lothians* (2 vols. 1883).

Edison, THOMAS ALVA, a notable American inventor, was born in Milan, Ohio, 11th February 1847, but his early years were spent at Port Huron, Michigan. His father was of Dutch, and his mother of Scotch descent; the latter, having been a teacher, gave him what schooling he received. Edison was a great reader in his youth, and at the age of twelve he became a newsboy on the Grand Trunk Line running into Detroit, and began to experiment in chemistry. Gaining the exclusive right of selling newspapers on this line, and purchasing some old type, with the aid of four assistants he printed and issued the *Grand Trunk Herald*, the first newspaper printed in a railway train. A station-master, in gratitude for his having saved his child from the front of an advancing train, taught him telegraphy, in which he had previously been greatly interested; and thenceforward he concentrated the energies of a very versatile mind chiefly upon electrical studies. He invented an automatic repeater, by means of which messages could be sent from one wire to another without the intervention of the operator. His system of duplex telegraphy was perfected while a telegraph operator in Boston, but was not entirely successful until 1872. In 1871 he became superin-

tendent of the New York Gold and Stock Company, and here invented the printing-telegraph for gold and stock quotations, for the manufacture of which he established a workshop at Newark, N.J., continuing there till his removal to Menlo Park, N.J., in 1876. His inventive faculties now getting full play, he took out over fifty patents in connection with improvements in telegraphy, including the duplex, quadruplex, and sextuplex system; the carbon telephone transmitter; microtasmeter; aerophone, for amplifying sound; the megaphone, for magnifying sound. From thence also emanated his inventions of the phonograph, and of a form of telephone, and the practical adaptation of the electric light for purposes of illumination. In December 1879 he gave an exhibition of a very complete system of electric lighting at Menlo Park, when the electric light was successfully subdivided for the first time. In 1882 he came to New York to superintend its adoption. The 'Edison Electric Light Company' was started there in 1878. In 1888 he brought out a greatly improved Phonograph (q.v.). He has received the degree of Ph.D. from Union College, and is a chevalier of the Legion of Honour.

Edmonton, a large suburban village of Middlesex, 10½ miles NNE. of Liverpool Street Station, London. Lamb spent his last years here, and is buried in the churchyard; and here, too, is the 'Bell,' where Gilpin did not dine. Pop. of parish 23,463; of village (1881) 15,174; (1891) 25,380.

Edmonton, a town on the North Saskatchewan River (navigable thither from Lake Winnipeg), district of Alberta, North-west Territories of Canada. Seams of lignite coal outcrop here, and have been utilised. There is communication by means of traders' carts with Calgary on the Canadian Pacific Railway. The projected Saskatchewan branch railway would tap this district.

Edmund, for his bravery surnamed IRONSIDE, king of the English for seven months of 1016, was son of Ethelred the Unready, and half-brother of Edward the Confessor, and is said to have been born in 981. He was chosen king by the Londoners on his father's death (April 1016), while Canute was chosen king at Southampton by the Witan generally. Edmund threw himself into the struggle with characteristic energy, hastily levied an army in the western shires, and defeated Canute, first at Pen (Selwood), in Somersetshire, and again at Sherston, in Wiltshire, after a desperately fought battle, which the king's gigantic strength and courage did much to win. He next raised the siege of London, crossed the Thames at Brentford, and again routed the Danes. Levying a fresh army, he followed them into Kent, and defeated them at Otford —his last victory. At Assandûn (Ashington, in Essex), after a desperate battle that raged all day, he was defeated, and, says the Chronicle, 'all the flower of the English race' perished. This disaster compelled him to a compromise with his adversaries. An arrangement was entered into in a conference held on Olney, an island in the Severn, by which England was divided between the two kings, Canute obtaining possession of Mercia and Northumbria, while all the south and the headship fell to the share of Edmund. It was also agreed that on the death of either, the survivor was to succeed him. A few weeks after this agreement Edmund died, November 30, 1016, it has often been asserted through foul play, but Mr Freeman's conclusion is that this was not the case.

Edmund, ST, the last king of the East Angles, was born in 841, and reigned from 855 to 870. The son of King Alkmund of Saxony, he was adopted by Offa, king of the East Angles, as his heir. Scarcely anything is recorded of his reign until the Danish invasion of 866–870. The accounts of these years in the chroniclers are discrepant; but it would seem that, after his men had been defeated by the Danes, he conceived that the welfare of his people would be best furthered if he sacrificed himself to his enemies. At all events, he was seized by the Danes, and slain because he refused to abjure his faith. Thirty-three years after his death his remains were translated from Hoxne to the church of Bury St Edmunds.

Edmund, ST. Edmund Rich, Archbishop of Canterbury, was born at Abingdon in the end of the 12th century. Whilst still a child he devoted himself to the service of the Virgin, and all his life long practised with unaffected devotion the austerities of the ascetic spirit in which his mother had early trained him. His time was spent between Oxford and Paris, at first as a student, and afterwards as a teacher. He also acquired fame as a preacher, and was commissioned by the pope to preach the sixth crusade throughout England, about the year 1227. Six years later, at the instance of Pope Gregory IX., he was appointed Archbishop of Canterbury, and received consecration on 2d April 1234. He attached himself closely to the national party, whose spokesman he became in their remonstrances with the king (Henry III.), even threatening him with excommunication if he did not dismiss his foreign favourites and exclude foreigners from positions of trust in the realm. But he was by no means a prelate of the bold, aggressive type; on the contrary, his gentleness and kindness of disposition, together with his self-denying generosity and personal purity, would seem to have put him out of joint with his age and time. At anyrate, Henry III. adroitly managed to nullify Edmund's power and authority by a resident papal legate; and against their combined influence the saintly archbishop was unable to stand. Accordingly he retired, in 1240, to the abbey of Pontigny, in France, where Stephen Langton and Thomas Becket before him had likewise found refuge. He died in the same year, on 16th November, at Soisy.

Edmund THE MAGNIFICENT, king of the English from 940 to 946, was born probably about 922. The early years of his reign were spent in an attempt to subdue the north of England to his rule, which occasioned a revolt; this, however, he succeeded in putting down, and then he proceeded to conquer Mercia and the five towns of the Danish confederacy, in 941 or 944, and also Cumbria, which he intrusted to Malcolm of Scotland, on condition that he should be 'his fellow-worker by sea and land.' Edmund was slain by an outlaw at Pucklechurch, Gloucestershire, on 26th May 946.

Edmunds, GEORGE FRANKLIN, senator, born in Richmond, Vermont, in 1828, sat in the state legislature in 1854–59, in the state senate in 1861–62, and in the United States senate 1866–91, of which he was president *pro tempore* after Mr Arthur became president of the United States. Here he took an active part in the prosecution of President Johnson, served on many important committees, and was author of the 'Edmunds Act' (1882) for the suppression of polygamy in Utah, as well as of a similar act passed in 1887.

Edom (Heb., 'red') is given in Genesis as the surname of Esau (q.v.), who, after leaving his father's house, went with his family to 'Mount Seir,' which he took from its earlier inhabitants, the troglodyte Horites. The name Seir or Edom was applied to the whole country extending from the Dead Sea southwards to the Gulf of Akabah, and bounded on the W. by the wilderness of Paran, and on the N. and NE. by the wilderness of Sin and the land of Moab. It was about 100 miles long from north to south. The mountains of Edom are steep, bare masses of chalk and

porphyry, 'far from the fat places of the earth and from the dew of heaven above,' where men could only 'live by the sword'—i.e. by robbery and the chase (Gen. xxvii. 39, 40); but from the mountains (now called Esh-shera) lying east of the Arabah (Wady Mousa), and their northern continuation Jebal, stretched a plateau favourable to vine-growing and tillage. On this side of the country lay the chief town, Sela, on the eastern slope of Mount Hor (4320 feet), the highest peak of Mount Seir, and also the other towns Maon (now Maan), Bozrah (now Buseirah), Punon, and the seaports Elath and Ezion-geber on the Gulf of Akabah. The road taken by pilgrims from Damascus to Mecca passes through Maan, and doubtless the same route was taken in ancient times by the caravans from the Gulf of Akabah and Central Arabia to Damascus and the Euphrates, which developed the trade of Elath, Selah, and Bozrah. The Edomites were recognised by the Israelites as a closely-connected race, who had attained to settled life and independence before them. Their religion was polytheism. Josephus's reference to an Edomite idol, *Koze*, is confirmed by the discovery of the name of an Edomite king, Kaus-malaka ('Kaus is king'), on an inscription of Tiglathpileser. The Book of Numbers relates that the refusal of the Edomites to allow the Israelites to cross their land obliged the latter to make a toilsome journey round the whole country to the Promised Land. The Edomites were conquered by Saul and subdued by David, and were subject to Judah till the reign of Joram. Again conquered by Amaziah and Uzziah, they regained their independence under Ahaz. After the fall of the kingdom of Judah, they became masters of Hebron and southern Palestine; but, after being defeated by Judas Maccabæus about 165–164 B.C., they were completely subdued by John Hyrcanus about 126, and compelled to be circumcised. From about 300 B.C. the eastern part, with the capital Selah (Petra), had been in the hands of the Nabatheans, and from the time of John Hyrcanus the western part (Idumæa) was held by Jewish governors, one of whom, Antipater, through the favour of the Roman emperor, became procurator of all Judæa in 47 B.C. His son, Herod the Great (q.v.), founded the last Jewish dynasty. After the destruction of Jerusalem (70 A.D.) the country was merged in Arabia Petræa, and the name of Idumæa disappears from history. See PETRA.

See Laborde and Linant, *Voyage de l'Arabie Pétrée* (Paris, 1830); vol. ii. of Lord Lindsay's *Letters on Egypt, Edom, and the Holy Land* (3d ed. Lond. 1839); vol. iii. of D. Roberts and G. Croly's *The Holy Land, Syria, Idumæa, &c.* (Lond. 1849); Palmer, *The Desert of the Exodus* (Lond. 1871); vol. i. of De Luynes's *Voyage d'Exploration à la Mer Morte, à Petra, &c.* (Paris, 1874).

Edriophthalmata (Gr., 'sessile-eyed'), a section of higher crustaceans, including the simpler and more primitive forms, in which the eyes are sessile, not stalked. The title includes the Amphipods (e.g. sandhopper), the Isopods (e.g. woodlouse), and is equivalent to Arthrostraca. See CRUSTACEA.

Edrîsî (whose full name is ABÛ-'ABDALLAH MOHAMMED ESH-SHERÎF EL-EDRÎSÎ), one of the most eminent Arabic geographers, was born at Ceuta in 1100. He belonged to the princely family of the Hammûdîs of Malaga, and traced his pedigree up to Fatima, the daughter of the Prophet Mohammed. Tradition avers that he studied at Cordova, and in youth he certainly travelled in Spain, Barbary, and Asia Minor. He then settled at the court of the enlightened king of Sicily, Roger II., who covered him with honour. Edrîsî made the king a silver map of the world and a celestial sphere, and Roger invited him to write a description of the earth founded upon direct observation. For this purpose travellers were sent on journeys of exploration to many parts, and were directed to assist him by sending their itineraries, their measurements of longitudes and latitudes, their observations and adventures—in short, all they had seen or heard on their journeys. The collection of this material occupied many years, and Edrîsî's Description of the World (*Nuzhat-el-Mushtâk*), or 'Book of Roger,' as it was also called, was not completed till 1154. Unequal in its execution, and better for Western than for Eastern lands, it is nevertheless a work of the highest value and authority, and stands in the very first rank of medieval geographies. A mere abstract of it was first edited in Arabic, very inaccurately, at Rome in 1592, under the mistaken title of *Nubian Geography*, and reprinted in the monastery of Khesruan, in the Lebanon, with Syriac characters, in 1597. The first published translation was a Latin one, made in Paris (1619) by Gabriel Sionita and Johannes Esronita, a work teeming with the most absurd blunders; and Domenico Macri translated this Latin translation into Italian. Rosario Gregorio's Latin version of the portion referring to Sicily was published with the text in 1790. Portions of the Arabic text, with comments, have been separately published; the chapters relating to Africa and to Spain by Hartmann (Göttingen, 1796); those concerning Syria by Rosenmüller (1828); and those on Africa and Spain again (admirably) by Dozy and De Goeje (Arab. and French, Leyden, 1866). The whole work was done into French, not very satisfactorily, from two MSS. in the Bibliothèque Nationale, by Amédée Jaubert (Paris, 1836–40), but the entire Arabic text has never been edited. Edrîsî was also the author of a larger geographical work, which has apparently been lost, and of a treatise on herbs. He died about 1180.

Education. The word education, though etymologically distinguishable from instruction, is generally held to signify the teaching, training, and discipline by means of which the young are prepared for the business and the duties of life. The French word *enseignement*, and the German *die Erziehung*, are commonly used with a similarly comprehensive meaning, and are understood to extend to the entire school-system, and to include primary, secondary, technical, professional, and university education. Under the heads PUBLIC SCHOOLS, TECHNICAL EDUCATION, and UNIVERSITIES specific information will be found relating to several branches of this large subject.

To trace the history of education and of educational theories and ideas in past ages would be impossible in this article. The student who would do this would find in the *Republic* of Plato, and the *Cyropædia* and *Memorabilia* of Xenophon, and in the Socratic dialogues generally, a representation of the ideal of education which prevailed among the Greeks, of the importance attached to music and dialectic in the training of the æsthetic and the logical faculties, and to gymnastics and the exercises of the palæstra in the development of beauty and strength in the human body. The value of oratory as one of the means by which the Roman youth might be trained and become qualified to rule is insisted on by Cicero and Quintilian. The *trivium* and the *quadrivium*—the seven studies of the monastic schools in the middle ages: grammar, dialectic, rhetoric, music, arithmetic, geometry, and astronomy—are mainly interesting to a modern student as proofs that the Fathers of the church and the schoolmen of the Alexandrian and Latin schools were more concerned to secure intellectual gymnastic, and formative or disciplinal studies, than those arts and accomplish-

ments which had a more obviously practical use. For the churchman the discipline of the seven liberal arts just enumerated constituted his main professional equipment. For the knight and the squire it was deemed necessary to add to some knowledge of these arts the discipline of hunting, riding, swimming, boxing, hawking, and shooting with the bow. But for both, the ideal education of the middle ages was rather that of a training which should develop the best powers and faculties of the individual, than of discipline consciously directed towards material ends, or towards industrial or professional success. The Revival of learning and the Reformation (see RENAISSANCE) had the effect of enlarging, though not of materially modifying, the conception of a liberal education which had prevailed from the 4th to the 15th century. A reference under their several titles to the great names which have been associated with speculation or with practical experiment in the domain of education will enable a reader to trace the growth of the ideas by which successive generations have been dominated, and out of which modern conceptions of the aim and work of the schoolmaster have been slowly formed. The names of Erasmus, Colet, Ascham, Luther, Melanchthon, De Feltre, Sturm, Ratich, Bauer, Comenius, Montaigne, Locke, Milton, the Port-Royalists, Rousseau, Jacotot, Basedow, Rosmini, J. P. Richter, Pestalozzi, and Fröbel furnish a *catena* of authorities, each of whom represents vividly some one phase of thought, or some one form of fruitful experiment in regard to the art or science of education. For historical and critical memoirs of this branch of the subject, and for careful discussions on the relative value of the principles with which these eminent names are severally identified, the reader must be referred to the list of books at the conclusion of this article.

UNITED STATES.—In modern times, those countries in both the Old and the New World which are governed by constitutions of comparatively recent date possess systems of public instruction more symmetrical and capable of easier description than the educational systems which prevail in Great Britain. In the United States of America there is no national system, no centralised control over public education; each state having its own system, making its own specific appropriation of money to schools and colleges, and appointing its own officers. Yet from the early colonisation in New England and in the southern states each state has recognised the duty of making public provision for the education of its youth. Except in seventeen of the older states the Federal law requires the appropriation of one-sixteenth part of the land for purposes of education. In the case of many of the new states the property thus provided has been sold to defray the cost of erecting school-buildings; and in none does the provision suffice to render taxation unnecessary. In all the states education in the primary schools (from six years to ten) and the 'grammar-schools' (from ten to fourteen) is gratuitous, and in some, though not in all, education in high schools, including a course adapted to scholars from fourteen to eighteen, is also gratuitously provided. Compulsory attendance is enjoined by the law in many of the states, but is not uniformly enforced. The great cities, and many of the counties or subdivisions of the states form district administrative units for educational purposes, make their own regulations and appropriations of money, and appoint their own officers independently of the state bureau. There is no general system of training or recognised national standard of qualification for teachers; each state, city, or educational body grants its own diplomas; and in some cases, though not in all, furnishes a normal school for the training of teachers. Such special training, however, is not generally regarded as indispensable, and whatever normal preparation is afforded is chiefly offered to women, who form the staple of the teaching staff in the primary and grammar schools. The head-masters of such schools, and the teachers and professors in high schools, have not generally been in normal seminaries, but have acquired their qualifications in colleges and universities. The lack of a complete normal system is partly supplied by teachers' 'institutes,' or special gatherings for the discussion of principles and methods, held under the supervision of the school superintendent or principal officials. The periods during which schools are required to be open vary in different states; but in many cases the state law is satisfied with the provision of instruction for six months, and even for three or four months, in the year. In all the great cities, school-houses, handsomely built and amply provided with educational appliances, are to be found; and a keen popular interest in the efficiency of the schools is everywhere exhibited. The course of instruction does not materially differ, age for age, from that prescribed in England, but it accentuates the importance of drawing, of what may be called 'oral composition' and other exercises in the free use of language, and of the history and constitution of the United States. Infant schools for children under seven are very rare. The 'kindergarten' system for the younger children in the primary schools, and manual instruction for older scholars, have recently been introduced into the general school-system of Boston, Philadelphia, and a few large towns, but form no necessary part of the course of instruction in the states generally, and are notably absent in the schools of New York city, Chicago, and many places of importance. The curriculum of instruction in the high schools, though not omitting the studies of Latin and Greek, gives greater prominence to modern languages and physical science than the course of study in corresponding schools in England.

CANADA.—The relation of the provinces of Canada to the Dominion parliament is very nearly analogous to that of the states of the American Union to the Federal government. Each province has its own educational laws and its own department of public instruction. The schools of Nova Scotia, British Columbia, Manitoba, New Brunswick, and Ontario are free; but in Quebec there is a school-tax levied on parents for all children of school age. Throughout the whole continent of North America there are many schools maintained by religious bodies or by private enterprise and receiving no aid from the state. There is no general law which affects the freedom of teaching, or requires any proof of educational qualification for persons who act as school-teachers.

AUSTRALASIA.—In each of the Australian colonies and in New Zealand, liberal provision is made for public education. The universities of Melbourne and Adelaide have received large private gifts as well as public subsidies; and colleges belonging to the various religious denominations have been affiliated to them. An effective system of public elementary schools has also been established. Dr R. W. Dale, who in 1888 visited those colonies, reports that in New South Wales regulations are in force providing that a public school may be established wherever a regular attendance of twenty children between the ages of six and fourteen can be guaranteed. Free railway passes are granted to children living in country districts to enable them to reach the school nearest to their homes. The administration of the public schools and training-colleges, and the appointment and dismissal of teachers, are in the hands of the Department of Education, presided over by a responsible minister.

Local Authorities, called in New South Wales Public School Boards, and in Victoria, South Australia, and Tasmania, Boards of Advice share in the management of schools, but have considerably less influence than the school boards of Great Britain. No aid is given to private or denominational schools. Elementary education is free in Victoria; but fees are paid by parents for instruction in such 'extra subjects' as book-keeping, French, mensuration, drawing, and history. In New South Wales and in South Australia fees are generally paid. The colony of New Zealand is divided into educational districts, over each of which there is a presiding board, elected annually by the ratepayers, and possessing considerable powers both in regard to the establishment and the control of schools. The Colonial Treasury grants to each board £3, 15s. for each child in daily average attendance, and a further sum for scholarships. In the boards are also vested the rents and profits from property or endowments for education, all donations and subscriptions given for the same purpose, and all fees paid for higher education. Ordinary elementary education is free. In all the Australian colonies, with the exception of Western Australia, the teachers are employed by the state, not by local managers. In Victoria, and to a slight extent in South Australia, the principle of 'payment by results' is recognised, but generally the salaries of teachers are regulated by the grade in which they are placed. Very liberal provision is made by way of scholarships for encouraging scholars of promise to enter higher schools.

British India.—Education in this great dependency is carried on by means of two classes of institutions—private and public. A public institution is defined to be 'a school or college in which the course of study conforms to the standard prescribed by the Department of Public Instruction or by the university, and which is either inspected by the department, or regularly presents pupils at the public examinations held by the department or by the university.' Schools or colleges not falling within this definition are called private. The returns for 1893 show that the educational institutions of all kinds numbered 144,983, and the pupils in them 3,981,002. Though these numbers represent a considerable increase on those of the previous decade, it is officially computed that only one child in ten of school age is actually under instruction. The explanation of this fact is to be found in the extreme backwardness of girls' education; for while less than two per cent. of female children of school age are to be found in the schools, nearly one-fifth of the whole number of boys of that age are under instruction in some form or other. The public provision consists of institutions of three classes—*primary schools*, which are designed to meet the wants of 94 per cent. of the population; *secondary schools*, in which advanced instruction is given in English as well as in the vernacular, and which are supposed to be suited for little more than 5 per cent. of the community; and *colleges*, which give a liberal or professional education, available for about ½ per cent. of the population. The attendance in the primary schools amounted in 1893 to 2,895,066. Of these, about one-seventh were in private schools, and scarcely one-twenty-fourth were girls. In attendance at the 4994 secondary schools were 456,486 boys and 35,747 girls, the proportion here being about 16 to 1. There are 148 colleges in India, attended by 16,982 students. There are 632 training and other special schools. Of the total number of educational institutions, 21,608 are public, 58,968 are aided, and 60,932 are private and unaided. All schools receiving aid are inspected by government officers. Hitherto these officers have been Englishmen of the same rank as the professors of colleges and the heads of secondary schools, but the government proposes for the future to avail itself more largely of native officers in the ordinary inspection of primary schools. Technical and manual training will, for the future, be more directly encouraged in these schools. The rule on which the Indian government has always been guided is to avoid entering into competition with private enterprise, to retire from the field of direct instruction wherever that field could otherwise be well occupied, and to help as far as possible, by reasonable subventions, the operations of independent institutions. It has been the avowed intention also of the government to restrict gradually its own direct official action to the maintenance of a few schools in which the system of instruction and discipline shall afford a standard for the emulation of private or aided schools in the neighbourhood. In a community such as India, untrained to self-help, it will probably be long ere this ideal policy is carried into full effect. There, even more than in Europe, state-aid, though stimulating local effort in certain favoured conditions, is accepted in too many places as a substitute for such effort, and serves to discourage private enterprise and initiative.

France.—In France there is now a very completely organised system of instruction, *supérieure, secondaire, et primaire*, under the supervision of the Minister of Public Instruction, the schools being all visited and examined by state officers. The professors in the universities are remunerated by the state. The *Lycées* or secondary schools also receive large subventions from the state, those of Paris and Versailles being considered rather higher in rank, and having a better paid staff of professors and teachers, than those of the provinces. *Colléges* are establishments for intermediate education, maintained at the charge of the local municipalities, but without any aid from the central government, except the occasional endowment of special chairs and the partial payment of a few professors. *Primary instruction* is everywhere throughout France gratuitous. The provision consists of *écoles normales, écoles primaires, supérieures et élementaires, classes enfantines*, and *écoles maternelles*. Except the normal schools, which are mainly supported by the central government, all the primary schools are dependent for the principal part of their support on local bodies. By the law of 1881 each commune is bound to furnish (1) one-fifth part of the net revenue; (2) the sum derived from a special school-tax. In case of the insufficiency of the amount, the department in which the commune is situated adds to its resources a further sum derived from a departmental tax of four centimes; and when, as it often happens, these resources prove to be inadequate, the state adds a *subvention complémentaire* in the form of augmentation to the salaries of teachers, proportioned partly to the rank of the diplomas of qualification which they severally hold. In 1886 there were in France 3,453,071 children in public schools thus supported, and 1,067,857 in schools under the private management of religious bodies or voluntary teachers and societies. It was the opinion of Mr Matthew Arnold (see his report on 'Schools and Universities on the Continent') that the superiority of France over England was in regard to secondary instruction very marked; but that the primary schools were not so good, and the scholars, age for age, not so advanced as in Great Britain.

Germany.—The organisation of German elementary education in its present form may be said to have commenced with the Prussian Code of Regulations of October 1854. Mr C. C. Perry, who made a report to the English Education Department and to the Royal Commission in 1887, is one of the

best English authorities on this subject, and he points out in detail the manner in which this code has been subsequently modified and enlarged by the Falk Laws of 1872. He explains further that the elementary schools are divided into (1) those with three or more classes; (2) schools with two teachers; and (3) schools with one teacher, either with one class or half-day schools. Eighty is recognised as the maximum number of scholars under one teacher, even under the most unfavourable conditions. In Prussia, Würtemberg, and Oldenburg the classification of the scholars is mainly by age. The hours of instruction are in the lowest division 22 per week, in the middle division 28, and in the upper from 30 to 32. The middle school, which was created by Falk's regulations, is specially adapted to commercial requirements. Its syllabus of instruction includes the elements of science and at least one modern language, and its course of instruction may extend to agriculture, manufactures, mining, or navigation, to suit the industrial requirements of different districts. Teachers in such schools must have received a diploma of special qualification for this higher work. All the schools are under the supervision of the thirty-six government districts of Prussia. In Saxony, elementary schools are divided into primary, middle, and higher. They also include *Fortbildungsschulen*, which are held in the evenings or on Sundays, and are designed to take up and carry forward the work of the elementary school. Throughout Germany these 'continuation schools,' the need of which is so seriously felt in England, form an important element in the national provision for instruction. The compulsory laws as to ordinary school attendance are enforced from the age of six to that of fourteen, but generally, if a child at fourteen fails to reach the proper standard, he may be compelled to attend either another year at the day-school, or at a supplementary school in the evening or on Sunday. Among so disciplinable a people as the Germans, who have now been for several generations accustomed to regard the legal obligation of school attendance as a settled principle, the enforcement of the law creates little or no difficulty. Fines, however, are imposed, and the agency of the police is called into requisition to force the child of a negligent parent to attend school. In Prussia, Saxony, and Bavaria the payment of school-fees is the rule; free schools are the exception. The popular school in these countries is a municipal affair; it is maintained, so far as it is not self-supporting, out of municipal resources and municipal taxes. The proportion of scholars in schools of different classes may be judged of from the fact that of 158,412 scholars in the public schools of Berlin, 8627 were in *gymnasien* or classical schools; 5552 in *real-gymnasien*, or first-class modern schools; about 10,000 in other middle schools of various kinds; and 132,889 in *gemeindeschulen*, or communal schools. In the kingdom of Saxony 5481 were in attendance at *gymnasien*, 2788 in *real-gymnasien*, and 3057 in *real-schulen*; about 600,000 in the popular schools, and 1892 in continuation schools. Mr M. Arnold, in his interesting parliamentary paper 'On Certain Points connected with Elementary Education in Germany, Switzerland, and France' (1886), speaks strongly in favour of the German schools, and contrasts them and their work favourably with those of England. Training schools and colleges are more numerous than in Great Britain. The course lasts either two or three years; but students are received at seventeen in Prussia, and at sixteen in Bavaria, Baden, and Hesse-Darmstadt. Although the necessary examination for professional certificates is not always limited in Germany to those who have been students in training-colleges, there is probably no country in Europe, except Switzerland, in which so large a proportion of the public teachers have been trained with a view to their special employment.

HOLLAND AND BELGIUM.—In both Holland and Belgium there is also a generous state provision for primary education, although there is no enforced attendance; but in the former country, out of half a million of scholars, 134,172, or rather less than one-third, are in schools under private management which receive no aid from public funds. In Belgium the communal schools provided by law are attended by 429,724 scholars, while in other schools—chiefly those maintained by the church, and instructed by the members of religious orders—no less than 170,725 are to be found. The communes are empowered under certain regulations to recognise and to aid the Catholic schools.

Throughout Germany, Italy, and Switzerland the proportion of scholars in the public schools is much larger since religious instruction is in different degrees recognised, and the co-operation of the clergy, both Catholic and Protestant, is under certain conditions invited in the management of the schools.

Fees and Gratuitous Education in Europe.—The Royal Commissioners of Education, whose Report (1888) contains a large number of details respecting the systems and educational resources of foreign countries, thus summarise the general evidence respecting fees and gratuitous education: 'In France, Norway, Sweden, Geneva, Neuchâtel, Vaud, Ticino, and Zurich education is free. In Austria it is free, except in Bohemia, Moravia, and Silesia. In Italy it is free, but in some communes an entrance-fee is charged of from 2s. 8d. to 8s. 4d. In Bavaria education is generally free; some communes charge 2s. 6d. per head per year. In Belgium, 499,699 scholars are free; 89,105 pay fees. In Hungary, parents pay 3s. 8d. a year. In Prussia, by the constitution the schools should be free, but the practice varies. When fees are charged they cover 12 per cent. of the cost. In Berne the schools are generally free, but 1s. 8d. a year may be charged. In Holland there is a mixed system; some schools are free, in some fees are charged. In Würtemberg the schools are rarely free. In the country the fees are 2s. a year; in the larger towns they go up to 3s. 6d. a year. In Saxony there are fees ranging in the country districts from ¾d. to 1¾d. per week; in towns from 12s. to 25s. or 36s. a year, according to place or grade of school. In Dresden the elementary school-fees are 2½d. to 3¾d. a week.'

ENGLAND AND WALES.—In marked contrast to the symmetrical and comparatively recent and complete schemes of public instruction in force in other countries, is the system—if so it may be called—by which provision is made for education in England. It is very characteristic of the country, of its genius, its traditions, its history, and the idiosyncracies of its people, that many of its most cherished institutions are the result of growth rather than of manufacture, have not been consciously predetermined by legislators or by theorists, but have shaped themselves by a process of slow evolution to suit the changed circumstances and needs of successive generations. This fact renders a summary description of English primary and secondary education difficult, if not impossible, and obliges the student of the subject to make a further glance backward into history than would be necessary in the pursuit of similar researches in any other country in Europe.

Before the Reformation, there were, with the exception of the universities, very few institutions which could be called public, for the advancement of learning. The monasteries had been for centuries the only seminaries in which the sons of gentlemen

were able to obtain instruction. But here and there, grammar-schools had been founded as chantries or choristers' schools, or were otherwise connected with ecclesiastical establishments. Before the time of Henry VII., sixteen such schools had been founded, the most notable of which were Carlisle (*temp.* William II.), Salisbury (1319), Winchester (1387), Sevenoaks (1432), Eton (1441), Magdalen School, Oxford (1480), and Rotherham (*temp.* Edward IV.). The Tudor period witnessed a very large increase in the number. The revival of learning, and the increased mental activity of which the Reformation was the expression, produced a widely spread demand for the means of instruction; and the dissolution of the monasteries furnished in many cases the resources by which the new grammar-schools were erected and permanently endowed. During Henry VII.'s reign, sixteen new foundations were added to the list, including Hull, Reading, Lancaster, Macclesfield, Enfield, and Plymouth; but all of these were rather slenderly endowed. His successor's reign (1509–1547) witnessed the establishment of no less than sixty-three new foundation schools, of which Wimborne (1509), St Paul's, London (1510), Pocklington (1514), Burton (1519), Taunton (1522), Manchester (1525), Bosworth (1539), Gloucester (1540), Canterbury (1541), Durham (1541), Warwick (1545), Hemsworth and York (1546), and Ipswich are among the most important. In the short six years' reign of Edward VI., fifty new schools were added to the list, and among them the well-known foundations of Norwich (1547), Skipton (1548), Ilminster (1549), Sherborne (1550), Shrewsbury (1551), Louth (1551), Sedbergh (1551), King Edward's School at Birmingham (1552), Leeds (1552), Stratford (1553), Giggleswick (1553), Christ's Hospital (1553), and Tonbridge in the same year. Even in Mary's time nineteen new grammar-schools were founded, including Boston (1555), Ripon (1555), Hampton (1556), Repton (1556), Oundle (1556), St Peter's, York (1557), and Brentwood (1558). During the long reign of Elizabeth, one hundred and thirty-eight further additions were made to the number, and among them are comprised Westminster (1560), Bristol (1561), Merchant Taylors, London (1561), Felstead (1564), Highgate (1565), Harpur's great foundation at Bedford (1566), Richmond, Yorkshire (1567), Rugby (1567), Harrow (1571), Faversham (1576), St Bees (1583), Colchester (1584), Halifax (1585), Cheltenham (1586), Uppingham (1587), Wakefield (1592), and Aldenham (1599). Eighty-three other endowed schools were founded in the reign of James I., and fifty-nine in the time of Charles I. A few of these, such as Sheffield (1604), the Charterhouse (1611), Monmouth (1615), Dulwich (1619), Chigwell (1629), Exeter (1629), and Tavistock (1649), are still prominent; but otherwise it may be said that in the 17th century, the grammar-schools were poorly endowed and historically insignificant. One uniform purpose, however, is manifest in the testaments, the deeds of gift, the statutes and ordinances by which the character and subsequent career of these schools were intended by their founders to be fashioned. It is to encourage the pursuit of a liberal education, founded on the ancient languages of Greece and Rome—then the only studies which had been so far formulated and systematised as to possess a disciplinal character. It is generally stipulated in the instrument of foundation that the master shall be a learned man, apt and godly, qualified to instruct in good letters and good manners, and that he shall receive as his pupils children of all ranks.

The period of the Civil War was unfavourable to educational enterprise; and when that period ended, new facts, thoughts, and experiences had come into prominence, and new views as to the purpose of education, and as to the mode by which that object was to be attained. The Act of Uniformity and the secession of the Nonconformist clergy brought home to men's minds the conviction that all attempts to incorporate Puritanism into the organic life of the English Church must be abandoned as hopeless, and the Toleration Act which followed soon after compelled English churchmen to recognise for the first time the unwelcome truth that dissent must be reckoned with as a fact. To the earnest churchmen of the beginning of the 18th century, to men like Edward Colston, the founder of the great hospital school at Bristol, and Robert Nelson, the author of the *Fasts and Festivals*, it seemed that the true remedy for the social and moral evils which they dreaded, was to be found in the multiplication of schools of a new type for the poor, schools in which the instruction should be specially designed both to fit them for the humbler duties of life and to attach them to the Church of England. It was feared that the prevalence of dissent would imperil the social order. A dread lest the poor should be encouraged by it to forget the duties of their station, and to encroach upon the privileges of the rich, is very manifest in much of the literature and some of the legislation of the age. There is a very significant passage in the sermon of Bishop Butler which he delivered at one of the earliest of the annual festivals of the charity children at St Paul's:

'The design' of these institutions, the bishop said, 'was not in any sort to remove poor children out of the rank in which they were born, but keeping them in it, to give them the assistance which their circumstances plainly called for, by educating them in the principles of religion as well as of civil life; and likewise making some sort of provision for their maintenance, under which last I include clothing them, giving them such learning—if it is to be called by that name—as may qualify them for some common employment, and placing them out to it as they grow up.'

There is indeed no more striking token of the changed feeling with which the rich had come to regard the problem of education, and its relation to the needs of the poor, than the simple fact that whereas in the 16th century men founded Grammar-schools, in the 18th they ceased to add to the number of such schools, and founded Charity schools instead. These institutions rapidly multiplied during the whole of the 18th century and in the beginning of the 19th. They are founded on a conception of education partly religious and partly feudal, but almost wholly ignoble and humiliating, and many of them have lasted down to our own day in striking contrast to the grammar-school foundations of earlier generations. The charity-school children were to be taught the church catechism, reading and writing, and in a few cases arithmetic, but were to be sedulously discouraged from attempting to learn more. They were to be clothed in a distinctive dress, so as to show that they were objects of public benevolence, and to 'remind them of their rank.' But the scholars in the grammar-schools were, whether the sons of gentlemen or not, to be treated as if they were. They were to be brought within reach of the highest educational advantages which the nation could afford; they were to be encouraged to proceed from school to the universities; and special provision was always made to tempt into this higher region of learning and of 'gentilesse' the child of the yeoman and the peasant, in order that, if diligent and apt in learning, he too might be so trained as to 'serve God in church and state.'

It is to be observed that while schools of the charity class were open to girls, the whole of the grammar-school education was provided for boys

only. There is scarcely a record in all the voluminous reports of later charity commissions, of any school whose founder deliberately contemplated a *liberal* education for girls; certainly not one which fulfilled such a purpose, whether it was contemplated by the founder or not. A girl was not expected to 'serve God in church or state,' and was therefore not invited to the university or the grammar-school; but she might, if poor, be needed to contribute to the comfort of her 'betters,' as an apprentice or a servant, and therefore the charity schools were open to her.

Elementary Education.—Such were the only educational resources of a public or quasi-public kind which existed in England at the end of the 18th century. They were at best available for only a very small section of the community. All other teaching was in private hands. A statute in 1779 relieved schoolmasters from the obligation which had been imposed on them by the Toleration Act, of signing the Thirty-nine Articles, and thus gave greater freedom, especially to Nonconformists, in regard to the establishment and conduct of private adventure schools. In 1781 Robert Raikes of Gloucester established the first Sunday school, and was thus the pioneer of the long succession of philanthropists who, during the next fifty years, sought by their own voluntary exertions to supply to some extent the lack of all public or legislative provision for the instruction of the poor. In these Sunday schools secular as well as religious teaching was at first often given. In 1802 Joseph Lancaster, a young Quaker, the son of a Chelsea pensioner, published his first pamphlet. In it he describes the wretched character of the only schools which were then frequented by the children of artisans. They were kept by persons of the lowest qualifications and of the lowest character, the refuse of mechanical trades. He told with simple pathos the story of his first experiment made four years before. He had hired a large room in the Borough Road, Southwark, and had gathered round him nearly a thousand children. Having no adult assistants or money to pay them, he organised a corps of the elder boys, to take charge of the rest and instruct them under his supervision. He possessed a gift for organisation, and a remarkable power of securing the loyalty and affection of his scholars. The school was divided into classes under monitors and superintending monitors, and was a very striking spectacle of order and mental activity; the pride, not to say the self-confidence of the elder scholars, as they exercised their monitorial functions, being very remarkable.

Meanwhile, Dr Andrew Bell, who was at first a military chaplain in India, had been trying experiments at the asylum for boys in Madras, and had been led by the difficulty of procuring adult assistance to the adoption of the same device of employing the pupils to instruct one another. His first pamphlet was published three or four years before Lancaster's, and Lancaster always acknowledged his obligations to it. Both men were enthusiasts, and both believed that a wonderful discovery had been made, which would have the effect of extending, at a small cost, the blessings of education to large numbers who had hitherto been without the means of instruction. And they were not wholly wrong. They overestimated, no doubt, the value of the teaching which children who were themselves little older than their scholars could give; but it cannot be denied that under the system some humble rudiments of learning were really imparted, and the method of 'mutual instruction' was found to be not without its moral value in encouraging scholars to put forth their best powers and to find a pleasure in helping each other. Educationally, there was little or no difference between the 'systems' of Lancaster and Bell. But the connection of the one with Nonconformists and of the other with the Church of England, had the effect of separating the friends of popular education into two camps, and provoking much acrimonious controversy. The church catechism and liturgy formed a substantial part of the education given in the schools provided under Bell's method, and while the Lancasterian schools were essentially religious institutions, the Bible being from the first a staple subject of instruction, no doctrinal teaching distinctive of any particular section of the Christian church was permitted to be introduced. Bishops, clergy, and churchmen generally, constituted themselves into a society for the patronage and perfection of Bell's system. The main supporters of the efforts of Lancaster were Liberal churchmen, Nonconformists, and the powerful body of Whig noblemen, statesmen, and *littérateurs* who founded the *Edinburgh Review*, the *Penny Magazine*, and the Society for the Diffusion of Useful Knowledge.

In 1808 the Royal Lancasterian Society, afterwards better known as the British and Foreign School Society, was founded; and in 1811 the National Society for the Education of the Poor in the principles of the Established Church. It may be added that neither of the two great societies had much reason to be proud of its founder. Lancaster's enthusiasm was little controlled by prudence. He was thriftless, unmethodical, headstrong, and fatally incapable of working well under the advice even of his most generous friends. He quitted in anger the Society which for a time bore his name, and died in poverty in America. Bell was vain, self-seeking, not very scrupulous, and filled with an extravagant sense of the value of his own invention, and of the worthlessness of all learning of other kinds. He received several valuable pieces of ecclesiastical preferment, and died rich. (See Professor Meiklejohn's Life of Bell, 1881.) Not till they were comparatively free from some of the personal associations connected with the founders of the 'monitorial system,' did the National and the British and Foreign School Societies enter fairly upon that long career of honour and of public usefulness which they have pursued to this day. The former society was far the more powerful. It received larger support, and 'National' schools were to be found in remote and thinly peopled districts, where no 'British' school would have had any chance of success. In all the great towns, however, and in many small ones, the unsectarian schools were large and flourishing, and shared with the church schools the task of supplying the educational needs of the labouring classes. The schools of both classes were mainly taught by young monitors. Fees were charged varying with the industrial and social condition of the places in which the schools were situated. A useful though humble standard of elementary instruction was reached, and in 'British' more often than in 'National' schools a successful effort was made to raise the standard by the introduction of geography and history, and by lessons on objects and on common things.

Public Measures for Elementary Education.—Practically, it may be said that the first sign of interest in public instruction evinced by parliament was the appointment in 1816 of a select committee of the House of Commons on the education of the lower classes of the metropolis. It was presided over by Henry Brougham, and it reported 'there was reason to conclude that a very large number of poor children are wholly without the means of instruction, although their parents appeared to be very desirous of obtaining that advantage for them.' The committee enforced strongly the necessity for some measures whereby the deficiency in the means

of instruction might be supplied. But no immediate action was taken on this report. In 1832 Lord Althorp procured the assent of the House of Commons to a vote of £20,000 for the erection of school-buildings in England, and this sum was distributed through the hands of the National Society and the British and Foreign School Society. But the grant did not contemplate the maintenance of schools, or any provision for instruction or inspection. The administration of this sum was intrusted to the Treasury. In 1835 Lord Brougham brought before the House of Lords his celebrated series of resolutions, declaring that it was incumbent upon parliament further to encourage the establishment of schools, and to provide seminaries for the training of teachers. A more effective step was taken in 1838, when another committee of the House of Commons, under the chairmanship of Mr Slaney, reported still more strongly to the same effect, and appended to its report ample statistics and testimony respecting the educational destitution, especially in large towns. The establishment in 1839 of a committee of Council on Education, at the instance of the Marquis of Lansdowne and Lord John Russell, was the first step towards the foundation of the present system of public elementary education, and the administration of a parliamentary grant in aid. The committee was to be composed of the Lord President of the Council and four other of Her Majesty's ministers; and to the board thus constituted was intrusted the application of any sums which might be voted by parliament for the purpose of education in England and Wales. The first secretary and chief adviser of the committee was Dr J. Philips Kay (afterwards Sir James Kay-Shuttleworth), a man of singular energy, who entered on his work in a spirit of hopeful enthusiasm, which had been largely stimulated and guided by his study of the state of education in foreign lands, particularly in Switzerland, Prussia, and Holland. To his mind the first task to be performed was the establishment of a normal school for the training of teachers, and pending the realisation of this project, one of the earliest grants made by the new committee of Council was one of £10,000, in equal proportions to the two great societies, each of which, however, had before this time been accustomed to receive intending teachers for three months' attendance at its model schools at Westminster and at the Borough Road, to 'learn the system.'

Second only in importance to the training of teachers was, in the judgment of the first committee of Council and its secretary, the inspection of all aided schools by a skilled agency. In the Minutes of Council presented to parliament in 1840, it was expressly provided that the right of inspection would be insisted on in all cases in which a grant was made. Nevertheless, with a view to conciliate the religious bodies with whom from the first the committee proposed to work, it was agreed that all schools connected with the Church of England should be visited by clergymen approved by the Archbishop of Canterbury, and that the British and Foreign School Society, which did not invite inspection in religious knowledge, should have its work examined by laymen whose names had been previously approved by the committee of that body. The project of establishing a state training-school was most distasteful to the bishops and other authorities of the English Church, and was owing to their opposition most reluctantly abandoned. But the energy of Dr Kay, seconded by that of his friend Mr E. Carleton Tufnell, was not to be daunted, and by their joint personal efforts a training-school was established at Battersea, in which some of the earliest experiments were tried in England to systematise the professional training of teachers. Two years afterwards, in 1842, the government consented to make grants to the institution, both for maintenance and for the extension of the buildings. In the following year the National Society took over the whole establishment, which has existed ever since as one of the most successful of the training institutions for schoolmasters in connection with the Church of England. Nearly at the same time the British and Foreign School Society enlarged and adapted Joseph Lancaster's old premises in the Borough Road, and established in connection with the well-known model school a residential institution for training teachers, both male and female. In 1842, under the administration of Sir Robert Peel, Sir James Graham made proposals in the educational clauses of the Factory Regulation Act, which, had they been carried out, would have had the effect of providing schools for the poor at the cost of local rates, and enforcing in them the attendance of all children partially employed. But the incidental provision in this bill, that the religious instruction in the proposed factory schools should be in accordance with the principles of the Church of England, although dissenting parents were to be allowed to claim exemption for their children from such instruction, alarmed the Nonconformists throughout the kingdom. It gave them an opportunity to hinder this new step in advance, fearing it might give an unfair advantage to the Establishment, even as the ecclesiastical dignitaries had already objected to the provision of national and unsectarian training-colleges through a fear lest the interests of the church and of religion should suffer.

Experience of this kind of failure served to narrow the field of possible useful action on the part of the government, and in 1846 new Minutes of Council were issued, which proceeded frankly on the principle that the existing religious agencies should be utilised and aided, and that no independent state system should be attempted. The parliamentary grant for school building and inspection had already risen to £100,000; and it was now proposed to make further grants in aid, with a view to render existing schools efficient. The primary object of these proposals was to improve the qualifications of teachers. This object was to be attained (1) by granting certificates of merit to schoolmasters and mistresses who, after examination, proved to be fit for the work; (2) by aiding training institutions (nine of which had by this time been reared by the two great societies), and supplying students in them with scholarships to defray the cost of their training; (3) by creating a body of pupil-teachers, who at the age of thirteen should be regularly apprenticed, and afterwards should take part in the instruction of scholars, and be themselves annually examined, with a view to their systematic preparation for ultimate employment in charge of schools. This was in fact the main feature of Sir James Kay-Shuttleworth's scheme. He had been much impressed with the successful working of school apprenticeship in Holland, and he had been equally impressed with the failure of the monitorial system of Bell and Lancaster, which still provided the staple of the teaching power in the schools of the National and the British and Foreign School Societies. The Minutes of 1846 provided that graduated personal payments of from £10 to £20 should be made to each pupil-teacher during the years of his apprenticeship, on condition of his passing an examination suitable to his age. At the end of his or her term of service, the way was open to further training by means of a scholarship in a normal college, and thus provision was made for recruiting the ranks of the teacher's profession with suitable candidates. By the same minutes

head-teachers possessing certificates were entitled to receive grants of from £15 to £30 a year from the Treasury in augmentation of their salaries.

It is very characteristic of the spirit in which the whole enterprise originated, that Shuttleworth tried at this time several experiments which it soon became necessary to abandon, but which were not without their value in determining the future course of the department, and of guarding his successors against mistakes. He formed, very naturally and honourably, a conception of his office as one for the direction and control of *methods* of education, as well as for the aid of local and denominational effort. Accordingly the committee of Council invited various teachers and professors, of whom Mr Hullah and Mr Butler Williams were the most distinguished, to give public lectures, first at Exeter Hall, and afterwards in various provincial centres, on the best methods of teaching singing, drawing, phonic reading, writing, arithmetic, and the like. Text-books on these subjects were published under the express sanction of the committee of Council; and subsequently official lists of approved school-books and manuals were issued under the same authority. Experience, however, soon rendered it necessary to retreat from the position thus tentatively occupied. Not only the interests of publishers, but the larger educational interests of the ablest school-managers and the most original and earnest of the teachers, were found to be inconsistent with the prescription by authority of particular books, machinery, and methods. Soon it became apparent that in administering grants in aid, it was the duty of the central government to recognise every form of good work, and to leave the largest possible freedom to the producers of books, the inventors of methods, and the managers and teachers of schools. Herein the action of the state in England and Scotland has always differed materially, alike from the bureaucratic systems of national education which prevail on the continent of Europe, and from the organisation of public instruction in the various states of the American Union; for in all of these public authority extends to methods, text-books, organisation, machinery, time-tables, and the like, and leaves less liberty of choice to teachers. The principle which, by gradual evolution since 1846, has established itself in England, and is not now likely to be departed from, is one essentially suited to the genius and traditions of the English race. The department of the state intrusted with the duty of administering the parliamentary grant does not exist for the purposes of imposing on the nation its own educational theories, or of prescribing in all cases what shall be learned and how it shall be taught. It simply distributes a sum of public money in aid of local effort, leaving to the managers the fullest freedom of administration and initiative in the choice of teachers and of processes of teaching. At the same time it reserves to itself the power to lay down the conditions under which the grant shall be obtained, and to proportion the amount of that grant to the number of the scholars and to the actual efficiency of the school.

How effectual was the stimulus given to local effort by the Minutes of 1846 may be judged from the simple fact that by 1849 there were in England 681 certificated teachers and 3580 pupil-teachers. In two years more there were 1100 certificated teachers and 6000 pupil-teachers, and twenty-five training-colleges; and by 1859 the number of certificated teachers had risen to 6878, and the number of pupil-teachers to 15,224. The state had contributed upwards of £1,000,000 towards the erection of new schoolrooms, and the annual grant had risen to £836,920. Two important steps in advance had meanwhile been taken. Under the name of capitation grants, additional sums had been granted to school-managers in aid of the general expenses of the school over and above the special grants already made to teachers and pupil-teachers in augmentation of their salaries. An act of parliament in 1856 had established the office of Vice-president of the Privy-council on Education, and thus provided that a minister should be responsible to the House of Commons for dispensing the grant hitherto distributed on the responsibility of a departmental committee.

In 1858 a Royal Commission, under the presidency of the Duke of Newcastle, was appointed to inquire into the present state of popular education. The public reasons assigned for instituting such an investigation were the rapid increase in the annual grant demanded from parliament—from £100,000 in 1846 to £663,435 in 1858—and the misgivings entertained by many persons as to the worth of the results attained by the nation in return for its outlay. The Commission reported in 1861. Among the general conclusions arrived at, the most important were that the existing system had already reached one-eighth part of the population, but that the attendance of even this number was often irregular; that the aided schools were far more efficient than the unaided and private adventure schools; but that even in the best schools only a small proportion of the scholars, not exceeding one-fourth, were successfully educated; and that the system provided no check on the tendency of many teachers to neglect the rudimentary subjects and the younger classes. The commissioners pointed out that some evils had arisen, and were likely to increase, owing to the practice of making direct personal payments to teachers and pupil-teachers; and they recommended that all grants should in future be paid directly to the managers, who should be left to make their own contracts with teachers. They further recommended that one part of the grant paid to a school should be made by the committee of Council out of funds annually provided by parliament, and that another part should be furnished by means of a county rate. But the principle on which public subsidies were to be made in aid of schools was insisted on with great distinctness—the one way of securing the efficiency of a school was declared to be 'to institute a searching examination of every child in all the schools to which grants were to be paid, and to make the prospects and position of the teacher dependent on the results of this examination.'

The Revised Code of 1862.—Mr Lowe (afterwards Lord Sherbrooke) was in 1861 the Vice-president of the Council, and Mr Lingen (afterwards Lord Lingen) was the permanent secretary, and it fell to them to devise means for giving effect to the recommendations of the Commission. Both were greatly impressed with the growing inconvenience to the state of the system of personal payment to teachers whom the government had no power to appoint or to dismiss. They saw with alarm the creation of a body of vested interests which it would every year become more difficult to deal with or to destroy. The Revised Code of 1862 supplied a very drastic and summary remedy for the evils to which the commissioners had directed attention. It abolished once for all the personal relation between the department and the teachers, and proposed to make the grant to each school, in one sum, to the local managers. It did not adopt the suggestion of the commissioners so far as the aid to schools by means of a county rate was concerned; but it proposed that the whole of the grant should come from the Consolidated Fund, and that in determining its amount the results of examination in reading, writing, and arithmetic should alone be considered. It is very

characteristic of the spirit in which this measure was adopted, that Mr Lowe, in recommending it to the House of Commons, said in effect: 'I do not promise that the system shall be economical, or that it will prove efficient. But if it is not efficient it will be economical; and if it is not economical it will certainly be efficient.'

The measure became law, but not without experiencing vehement opposition. Part of this opposition arose from what was felt by many as a breach of faith on the part of the government towards the large army of teachers whose stipends had been directly augmented by grants, and part of it was based on educational considerations. The government, it was said, was abandoning a position of much usefulness in ceasing to make grants of books, and to encourage by means of higher allowances the attainment of superior qualifications by teachers. The new code recognised no other results than proficiency in reading, writing, and arithmetic. It provided only a meagre course of instruction up to the age of twelve, and it was thus certain to lead teachers to take a narrow and mechanical view of their work. One effect of the new arrangement was that during the first five years after 1862 the amount of the grant steadily declined from £813,441 to £649,307. Another was that increased attention was certainly paid to the accurate teaching of elementary subjects, and that any temptation which may heretofore have led teachers to neglect the rank and file of their scholars, especially in the lower classes, was effectually removed. In 1867 the Vice-president, Mr Corry, so far modified the rigidity and narrowness of the code of 1862, as to provide additional grants on condition that there should be a larger staff than the minimum heretofore required, and that some one additional subject—grammar, history, or geography—should be taught.

The Education Act of 1870.—The memorable parliament of 1868, under the administration of Mr Gladstone, was in many respects the most important parliament, from an educational point of view, which ever sat in England. It not only saw the enactment of the great measure for the reform of endowed schools, for which see the section *infra* on secondary education, but Mr Forster, the Vice-president of the Council, succeeded in 1870 and 1871 in carrying through parliament the Education Acts for England and Scotland, which will always be associated with his name. Before preparing his great measure, he caused a special inquiry to be made by two parliamentary commissioners into the condition of elementary education in the four largest towns next to the metropolis; and the revelations of those commissioners, corroborated by testimony from all parts of England, proved that there was large educational destitution, which the voluntary system had not met and was not likely to meet. Hitherto the only initiative had been taken by voluntary bodies chiefly connected with the churches; the government had simply aided existing schools, but had taken no steps to provide new ones. The Act of 1870 provided that whenever the voluntary supply was insufficient, school boards should be created with power to levy rates for the establishment and maintenance of schools, and at the same time to exercise by means of local bylaws the power to compel the attendance of children at school. The main provisions of this important act, which may be regarded as forming the corner-stone of the English system of primary education, are as follows:

(1) That either by voluntary effort, or failing that, by the compulsory establishment of school boards, there should be a sufficient supply of public elementary schools for every district in the kingdom. The basis of the calculation was that accommodation was to be provided for one-sixth of the population.

(2) That every such public elementary school should be taught by a properly qualified teacher, should be open to the inspection of Her Majesty's inspectors, and should conform to regulations to be prescribed from time to time in the code.

(3) That in all public elementary schools, whatever religious instruction was given should be imparted at the beginning or end of the school meeting, and that an unbroken period of two hours in each meeting should be devoted to secular instruction.

(4) That a time-table setting forth in detail the hours to be devoted to religious and secular instruction should be publicly displayed in each schoolroom; and that parents should have the right to withdraw their children from any religious instruction or observance which they disapproved.

(5) That in schools provided or managed by school boards, no catechism or religious formulary distinctive of any particular denomination should be taught.

(6) That the understanding hitherto existing between the department and the religious bodies with regard to inspection should cease. No cognisance was to be taken by the department of the religious instruction in any elementary school; and the inspector, whether lay or clerical, was to visit and report on all schools receiving government aid in his district. Since the passing of the act no clergyman has been appointed to the office of inspector.

Advantage was taken of this period of change to enlarge in the departmental regulations of the code the scope of instruction in the schools. By making the first of the six standards appropriate to children of seven instead of six, and raising the requirements, the scheme of elementary instruction was so altered as to contemplate the age of thirteen instead of twelve as the limit of school-life; and by permitting two additional subjects instead of one, encouragement was offered to greater variety and intelligence in the teaching. Subsequent modifications of the code in 1873, 1874, and 1875 still further helped to enlarge the curriculum by the introduction of a list of specific or additional subjects beyond the class subjects, and by allowing grants on behalf of older children who were examined and passed in them. Lord Sandon's Act in 1876 gave to school attendance committees in places where no school boards existed the power to enforce attendance; and reciting and embodying former factory acts, made clearer the duty of parents to provide education for their children from six to fourteen, unless before that age they should have succeeded in passing the standard for exemption prescribed by the local authority.

The period of Mr Mundella's administration of the department, during the parliament of 1880, witnessed several significant changes. The act passed in that year superseded the optional compulsion provided by Mr Forster's Act and the indirect compulsion of Lord Sandon's Act, by a new enactment enforcing on the school authority in every district the obligation to make bylaws to compel attendance. More important were the educational changes made in the code which was sanctioned by parliament in 1882. One of its chief provisions affected the infant schools. Hitherto almost the only test applied to the efficiency of these departments was the ability of the little scholars to read, write, and count. Now, for the first time, the code required that besides a knowledge of these elements provision should be made for a regular course of object lessons on the phenomena of nature and of common life, and also for those manual and other employments which are commonly known as the

kindergarten games and occupations. The effect of this first official recognition of the principles of Frŏbel and Pestalozzi in their application to infant training has been very marked. The best English infant schools are now almost unrivalled for their excellence. The change effected by the code of 1882 has not only increased the cheerfulness and attractiveness of the infant schools to the little ones, but has had the incidental result of securing more effective, because more intelligent progress in the rudiments of ordinary instruction.

One of the most substantial changes in the code was to substitute graduated grants for the fixed sums which had heretofore been paid for instruction in such subjects as English grammar and composition, geography, history, and elementary science, and thus to recognise differences in the quality of the teaching. Another change of importance was embodied in the provision that scholars who were deficient in health or mental power might be exempted from examination without entailing on the managers any loss of grant. And with a view to avoid too mechanical an estimate of the results of instruction, by mere counting of passes, a substantial portion of the sum awarded to each school was to take the form of a 'merit grant' to be awarded on the inspector's general estimate of the intelligence of the teaching, the tone and discipline, and the value and public usefulness of the school as a whole. Another object secured at the time of the reconstruction of the code in 1882 was the more complete organisation of the inspectorate. Powers of supervision over the work of district inspectors were for the first time intrusted to the eight divisional chiefs, and arrangements were made for annual conferences in each division, and for an annual conference of the chiefs with the heads of the department in London, with a view to the attainment of greater uniformity of judgment and of practice in the work of inspector. At the same time a new class of officers was created under the name of sub-inspectors, to be recruited from the ranks of the assistants, all of whom had been distinguished elementary teachers.

The Royal Commission of 1886.—The Conservative government of 1885 being much pressed by many of its own supporters to reconsider the position in which the voluntary schools were placed by the rapid multiplication of board schools, and by the steady increase in the local rates, nominated in the next year a new Royal Commission to inquire into the working of the Education Acts. It was urged that some changes in the mode of distributing the parliamentary grant were yet to be desired, and in particular, that the managers of voluntary schools experienced increasing difficulty in maintaining them, owing to the unwillingness of many of the supporters of those schools to continue making voluntary subscriptions in addition to their enforced contributions as ratepayers. A very strong Commission, including in itself representatives of all shades of educational opinion and all the leading sections in religion and politics, was constituted under the presidency of Lord Cross, and devoted two years to a laborious investigation, and to the hearing of multitudinous evidence on the whole subject.

The final Report of this Commission, published in 1888, was not unanimous. The majority desired and strongly recommended that school boards should be empowered to subsidise voluntary schools at the cost of the local rates; but an influential minority presented an alternative report earnestly deprecating such a course. In regard to the more distinctly educational problems, the majority and minority were practically agreed on some weighty recommendations. They were unable to advise any departure from the principle first insisted on by Mr Lowe, of assessing the share of the public grant to managers in proportion to the efficiency of the schools as determined by examination; but they suggested several modifications in the application of that principle; and in particular they desired to substitute a more general *qualitative* test of the results of instruction, for the method of computing any part of the grant by the percentage of passes; and thus to advance a step further in the direction already indicated by Mr Mundella's reforms of 1882. The commissioners say on this point: 'After weighing carefully all the evidence laid before us, we are convinced that the distribution of the parliamentary grant cannot be wholly freed from its present dependence on the results of examination, without the risk of incurring greater evils than those which it is sought to cure. Nor can we believe that parliament will long continue to make so large an annual grant as that which now appears in the education estimates without in some way satisfying itself that the quality of the education given justifies the expenditure.' Other recommendations on many points of detail—e.g. on moral training and discipline, on inspection, on drawing and manual exercises, and on the exceptional help required in small rural schools—were made by the commissioners, and in the code of 1889 some of those recommendations were practically embodied; but the government of the day promptly disavowed any intention of introducing such measures of relief to voluntary schools as would legalise the appropriation of money from the local rates for their maintenance.

It is fitting to close this narrative of legislative and administrative measures by placing on record the figures representing the present statistics of educational provision, as compared with those of the year 1870, before the passing of the Education Act. At that time the number of schools in England and Wales receiving government aid and inspection was 9563, the number of scholars 1,152,389, the staff of certificated teachers was 12,467, and the amount of the government grant was £464,943. The report of the Education Department for 1888 shows the number of schools to be 19,267, containing 29,098 separate departments under head-teachers. The number of scholars was 4,660,301, and of certificated teachers 43,628, while the annual vote for education submitted to parliament in 1888 amounted to £3,071,547. The progress made in the metropolis alone places the influence of the Education Act in a yet more striking light. In 1870 the sole provision for elementary education made by National, British, Wesleyan, Catholic, and other voluntary schools extended to a quarter of a million scholars. During the eighteen years following, the School Board for London erected upwards of 400 new schools, each in three departments, for boys, girls, and infants, and with accommodation for 407,638 additional children, while the accommodation in the voluntary schools amounts to 262,022, and remains substantially unchanged since 1870. Thus the total school attendance in the metropolis had risen in 1888 to 669,658.

Evening-schools.—During the year 1888, 917 evening-schools in England and Wales received aid from the parliamentary grant, and were attended by 37,369 scholars. The number and relative importance of night-schools considered as factors in the system of elementary education have necessarily diminished, and are likely still further to diminish as day-school attendance becomes more universal and more effective. Hitherto public aid has been offered only in respect to those scholars who desired to supply the deficiencies in their early education, and to pass the examination in one of the seven standards. But the friends of night-schools urge that aid should also be given to those who aim at

higher instruction, and to employment of a more recreative kind. At present this desired concession has not been made. Whether young men who have passed successfully through the ordinary elementary course, and are presumably getting their own living, and are engaged in efforts after self-improvement, are the proper objects of aid from the education grant, is a question of public policy on which parliament has not yet decided.

It may thus be seen that the history of elementary education in England presents a somewhat incoherent record of experiments and failures, of compromises, of measures adopted to meet the varying necessities and experience of different periods, and often of a lack of clear purpose or appreciation of the ultimate ends to be attained. Nevertheless the nation has undoubtedly arrived, by paths however circuitous, at a system which has covered the country with good elementary schools, which has provided adequate accommodation for the children of school age throughout the kingdom, and which has brought the influence of the central government, and the ideal of public education which has been sanctioned by parliament, to bear upon the remotest village in the land. It is true that elementary education is not wholly gratuitous, for the fees paid by parents of the scholars amounted in 1888 to £1,774,626, and the fees paid on behalf of indigent children by the poor-law guardians reached a total of £59,358. But under the provisions of the Acts of 1870 and 1876, no child need be excluded from school on the ground of poverty, and practically the rudiments of instruction are now accessible to every boy and girl in the kingdom.

Secondary Education in England.—The history of secondary education in England is no less confused and difficult to trace, while it cannot be said to have yet arrived at so definite a conclusion. It has been shown that the main provision for such education has for centuries been supplied by endowed grammar-schools. Each of these has, however, been controlled exclusively by its own body of trustees; it has been regarded as a purely local and separate institution rather than as part of any general system of public education, and has been absolutely free from any central control. The elaborate inquiry into endowed charities, begun in 1818 and concluded in 1837, resulted in the accumulation of a mass of facts respecting the history, origin, constitution, and resources of endowed schools; but it did not attempt to furnish any information respecting the educational character and present public usefulness of those schools. The first step towards the acquirement of such information was, in accordance with many precedents, the establishment of a special Royal Commission of Inquiry in 1865. Already the state of the universities had been investigated by royal commissions, and legislation had followed the recommendations of the commissioners. In 1858, as we have seen, the Duke of Newcastle's Commission had been appointed to report on the condition and resources of the education of the labouring classes, and in 1862 Lord Clarendon's Commission had investigated the state of the nine great public schools—Eton, Harrow, Rugby, Winchester, Westminster, Shrewsbury, Charterhouse, St Paul's, and Merchant Taylors. Legislation, except so far as the two last-named schools were concerned, had followed the recommendations of both Commissions.

The Schools Inquiry Commission.—But between the elementary schools for the poor and the public schools, which stood in the closest relations to the universities, there was a large and comparatively unexplored field, and the task of inquiring into the endowed grammar-schools, and into secondary education generally, was intrusted in 1865 to the Schools Inquiry Commission, under the presidency of Lord Taunton, who had for his colleagues an unusually powerful body of public authorities, academic and political. Their inquiry covered the whole of the endowed grammar-schools; but by means of specimen districts, very full investigations were also made into the condition and resources of secondary instruction generally. The commissioners reported in 1867. They showed that of the 3000 endowed schools in the country 782 had been designated by the instruments of their foundation 'grammar'-schools, while the rest belonged mainly to the second class, which has already been described, of 'non-classical' or charity schools. Beside these there were many proprietary or joint-stock schools, established voluntarily either by religious bodies or to meet special local wants. The rest of the secondary instruction was in the hands of private teachers.

On each of these three classes the commissioners reported fully. So far as the ancient grammar-schools were concerned the results of the inquiry were lamentable. A small number were found to be vigorous, well attended, and useful; but in the enormous majority of cases the schools were languishing and inefficient. The present writer, as one of the assistant-commissioners, visited and examined nearly one hundred of them in the north of England, and reported that about five or six were flourishing and doing excellent work; some twenty were, though small and comparatively feeble, very fairly taught; and the remaining three-fourths less efficient than ordinary elementary schools under inspection. Similar testimony came in great abundance from other parts of the country, and the conclusions of the Commission, in reference to the decadence of the ancient grammar-school system, and its failure either to fulfil its original purpose or to meet modern needs, were very emphatic. They attributed this failure partly (1) to the constitution of the governing bodies, many of which were exclusive cliques renewed by perpetual co-optation, and completely out of sympathy with the communities for whose benefit the schools had been designed; (2) to the obsolete and unworkable character of the ancient statutes, and to the difficulty experienced by trustees either in carrying them out or in disregarding them; (3) to the fixed or freehold tenure of the head-masters, and to the conditions under which other teachers were appointed; (4) to the general unsuitableness of the instruction given; (5) to the absence of all publicity and supervision; and (6) to the capricious distribution of the endowments, the richest often being situated in places in which there was least need, and large and important centres of industry and population being often wholly without endowments.

Of proprietary schools, which were of a more modern type, and which had come into existence to meet actual needs, the Commission was able to give a somewhat better account, but few of them were financially stable or prosperous; the supply of such schools was reported to be very small, and was often practically available only for scholars of particular denominations. The largest number of scholars receiving instruction not purely elementary were in private establishments; and the assistant-commissioners visited and examined a great number of these, but were unable, except in a small number of cases, to give a satisfactory report. The teachers were generally very ill qualified for their work, the methods in use were unskilful and ineffective, the scholars were subject to no external test, and there was in the routine of the schools a remarkable monotony and an absence of intellectual life. On the whole,

the voluminous Reports of the Schools Inquiry Commission contain some of the most disheartening chapters in English educational history; and the commissioners recommended some drastic and comprehensive remedies. They concluded that improved secondary instruction might be largely secured by the adoption of public measures which should be partly obligatory and partly permissive. They proposed to begin with endowed schools, which should be suitably graded, to modernise the schemes of instruction, to repeal obsolete and useless statutes, to abolish the freehold tenure of masterships, to impose fees corresponding to the character of the education imparted, and to reserve a substantial part of each endowment for encouraging special merit by means of exhibitions or free places tenable in the school, and scholarships to enable the best pupils to proceed to the university or other place of higher education.

At the same time the Commission proposed to abolish many of the local privileges and rights of founder's kin, and in particular to take out of the hands of the trustees all personal patronage. The governing bodies were to be re-constituted on a more popular basis, and provision was to be made for the periodical inspection and examination of the schools. With a view to the attainment of these objects, the commissioners devised and recommended a highly elaborate machinery, consisting of (1) a provincial authority to prepare schemes for the reorganisation of the endowed schools, and to bring into the educational fund other charities, such as apprenticeship premiums, doles, and other charities which had become obsolete or useless; (2) a central authority to receive and revise all such schemes and to submit them to parliament; (3) a second central authority, to be composed partly of representatives of the universities, and to be charged with the duty of awarding certificates of competency to teachers, preparing an official list of persons so qualified, examining schools both endowed and private, and making periodical public reports as to their numbers and efficiency.

The Endowed Schools Act.—This Report, and especially that portion of it which disclosed the pitiable condition of the endowed schools, and the mischief of attempting a half-hearted and imperfect compliance with ordinances unsuited to modern educational needs, made a great impression on the public. Fortunately its appearance happened to coincide with the accession to power of one of the strongest governments of modern times—the administration of Mr Gladstone in 1868. The Vice-president of the Council was Mr W. E. Forster, who had himself served on the Schools Inquiry Commission, and to whose bold and vigorous initiative the nation owed, two years later, the Elementary Education Act. Feeling the need of preventing without delay the creation of new vested interests, he carried through the parliament of 1868 a short 'act for annexing conditions to the appointment of persons to offices in certain schools;' and in accordance with the provisions of this statute every schoolmaster who accepted office was bound to do so subject to any future scheme which might be made for the regulation of the school. In 1869 Mr Forster brought forward his Endowed Schools Bill in two parts. The first part proposed the erection of a special executive commission, with power to frame schemes for the reorganisation of all endowed educational charities, and also, with the consent of the local trustees, to apply certain non-educational endowments to educational purposes. The second proposed the formation of an educational council, to be composed of representatives of the three universities of Oxford, Cambridge, and London, and of six persons to be nominated by the crown, with power (1) to examine persons deserving recognition as teachers, and to confer upon them professional diplomas; (2) to examine and report on the condition of all endowed schools; (3) to keep a register of all private schools under qualified teachers; (4) to admit such schools as might apply for recognition to the same examination as that provided for endowed schools; and (5) to allow the scholars of such private or unendowed schools to compete for exhibitions.

It will be observed that the bill contemplated a somewhat simpler machinery than that devised by the Schools Inquiry Commission, and in particular, that the proposal for provincial councils disappeared from Mr Forster's scheme. But of the two portions of this bold measure Mr Forster was able to carry the first only, which served to reform the schemes of endowed schools. The second, which would have taken a substantial step towards the general reorganisation of secondary education in England, was reluctantly dropped. Nevertheless, the Endowed Schools Act, though confessedly an imperfect measure, effected great results. Considerable friction arose in connection with the earliest efforts of the commissioners to administer the act, and it was found, especially by some of the older and richer corporations and trustees, to touch the traditions and local interests connected with many schools more rudely than had been expected. In particular, all proposals for amalgamating neighbouring charities, and for removing a grammar-school to another place in which it might be more needed, were found to be so distasteful, and to encounter such strong local opposition, that they were necessarily abandoned. But under the provisions of the act nearly every educational foundation in England has in time been subjected to a beneficent, though in some respects a drastic reform, has been placed on a more popular basis, and has largely extended its usefulness.

In connection with the general reorganisation of secondary education, of which the reform of the endowed schools forms only a part, though a conspicuous part, it is to be observed that both in the new schemes framed by commissioners and those adopted by private and proprietary bodies, there is a fuller recognition than existed before of the claims of modern languages, and especially of modern science, as integral parts of a liberal education. Latin and Greek and literary culture alone are found to afford but a one-sided intellectual training. Having regard to the present state of knowledge, and to the essentially disciplinal character of physical science when rightly taught, the best of modern educational authorities seek to broaden the curriculum of secondary and higher schools, and while including in it Latin and a critical knowledge of English, to make the systematic study of one branch of inductive and experimental science at least an indispensable element in that curriculum.

A select committee of the House of Commons in 1886, under the chairmanship of Sir Lyon Playfair, inquired into the operation of the Endowed Schools Act, and reported strongly in favour of the policy which had been pursued in administering it, at first by the Endowed Schools Commission, and afterwards by the Charity Commissioners (q.v.), to whom the duty had in 1874 been transferred. The committee made some minor suggestions in detail as to the conditions which should be observed in the framing of future schemes, and they pointed out the need of some authority by which, after schemes had once been legalised, the efficient working of those schemes should be periodically tested and reported on. The committee also expressed an opinion favourable to the appointment of a responsible minister of education, who, besides the supervision of the elementary schools which are aided

by the parliamentary grant, should also be charged with a general supervision of all endowed schools.

[Sir Lyon Playfair in 1879, and Sir John Lubbock in 1880, drafted and introduced, without result, measures which provided for the due registration of teachers, and for the establishment of an educational council. Meanwhile, since this article was written, public elementary education in Great Britain has been made free. The devotion of part of the Probate Duties to the remission of fees gave Scotland free education in 1890; England secured the same privilege under the provisions of the budget of 1891.]

SCOTLAND.—The history of public education in Scotland, though extending over three centuries, is simpler and less eventful. Two or three conditions exist in North Britain which have largely differentiated its educational annals from those of England. A stronger and more general appreciation of the value of learning, and especially of the 'humanities' or Latin literature, has generally been found to exist than in the south of the island. There are no sharp lines of theological division analogous to that of church and dissent in England. The social distinction which practically preserves the English universities as the heritage of the rich, and makes the difference between primary and secondary instruction correspond very nearly to the division between the wage-earning and the middle classes, does not exist. The educational problem, too, has not been encumbered, as in England, by the claims of wealthy grammar-schools, enriched by the spoils and preserving the traditions of ancient monasteries, nor by the unmanageable ordinances and mismanaged estates of 'pious founders.' And most important of all, the duty of providing the means of instruction has been recognised as a national obligation, or rather as an obligation on the church, even from the time of John Knox. The Church Assembly of 1560 promulgated a decree that every parish kirk in a town should have a Latin school, and that in the country districts provision should be made for elementary teaching, while in large towns colleges should be established for 'logic, rhetoric, and the tongues.' Legislative effect was given to these intentions by an Act of 1633, and still more definitely by the Statute of 1696, which put the parochial schools on a secure footing, charged the heritors or landowners with a tax for their support, and placed the supervision in the hands of the presbyteries or church courts of each district. These enactments, though carried out in the Lowlands, did not effectually supply the wants of Highland parishes in remote districts, and a further act in 1803 made the provision of a small stipend and of a house and garden for the schoolmaster a duty incumbent upon every parish. Besides the parochial schools, burgh schools or academies had been established in most of the towns, and were controlled by the municipal authorities. These occupy an intermediate position between the parish school and the universities, although they are often so constituted as to encroach on the province of both.

But even these public provisions left room for much voluntary effort. In 1816 David Stow, the Scottish Joseph Lancaster, but a man of finer insight into the nature of true teaching than his English prototype, had been struck with the mass of neglected ignorance and vice among the poorer inhabitants of Glasgow, had gathered many of the children together in a Sunday school; and after ten years of experiment, established in 1826 his Normal Seminary in Glasgow. This was the first systematic attempt in Great Britain to train teachers in the art of communicating knowledge, and of conducting a school. Stow did not rely on monitors. He believed strongly in what he called the sympathy of numbers, and was prepared to intrust very large classes to teachers who were rightly trained in the art of simultaneous instruction and in the true principles of moral discipline. The first public grant made by the central government in aid of Scotch education in 1833 took the form of subsidies to the training-schools. Six years later, the system of inspection and of annual grants to schools was established both in England and Scotland, and the Minutes of Council of 1846 extended to both countries.

The disruption of the church in 1843 had somewhat altered the conditions of the problem. To the new Free churches schools were for the most part attached. Both in Edinburgh and in Glasgow a Free Church training-college existed side by side with the training-college of the Established Church. An act of parliament in 1861 withdrew from the presbyteries the duty of examining teachers, and transferred it to the universities, and substituted for the Confession of Faith a simple declaration on the part of a schoolmaster that he was a member of a Presbyterian church. All subsequent legislation has in like manner recognised the practical equality of the various denominations, although, since no serious theological differences divide the Presbyterian churches, the difficulties which in England have attended the enforcement of a conscience clause have been absent in Scotland. The revised code of Mr Lowe in 1862 was made in many of its essential features applicable to Scotland, although it encountered serious opposition. The narrow view of the aims of an elementary school which sought to restrict the examinations to reading, writing, and arithmetic was essentially out of harmony with all the traditions of a liberal education which prevailed in Scotland. And the attempt to restrict the grants to the children of the labouring class was especially resented in a country whose pride it had long been to see on the same humble benches in the parish school the children of the tradesman and the heritor side by side with those of the shepherd and the artisan. Accordingly, the revised code, in the form in which its author presented it to parliament, was never imposed absolutely upon Scotland, although its two main principles—that the scholars should be individually examined, and that the grants should be proportioned to the proved efficiency of the schools—were accepted with little question.

When, after Mr Forster's English Education Act of 1870, the government of the day undertook in 1872 to supplement that act by one for Scotland, it became necessary to recognise the social and historical *differentiæ* of the two peoples, and to introduce into that act some special provisions. The first of these is indicated by the title of the act. It was not for elementary education only, but included within its scope the parish school and the burgh school. It contemplated a wider range of instruction, and in particular gave encouragement to the study of Latin and of those subjects by means of which a scholar might be helped to proceed to the university. It did not, like the English Act of 1870, leave the establishment of school boards to the voluntary initiative of the inhabitants, but made the provision of such boards universal, and vested in those bodies the property and the control of the existing burgh and parish schools, and of all endowments belonging to them. And whereas in England the enactment of local bylaws for the enforcement of children's attendance was not rendered obligatory until ten years later, the Scottish Act of 1872 (the Lord Advocate Young's) laid down once for all the obligation of every parent to send his child to school from the age of five to thirteen, and gave to the school boards authority to enforce this obligation. Even this provision required

the aid of subsequent legislation in 1878 and 1883 to make it effective. In 1885 a separation was made of the administrative functions of the Scotch and the English Education Departments; and the former has since had its own committee of Council and its own secretary. The educational effects of this series of public measures will be understood by the reader who consults Mr Fearon's Report on the Burgh Schools of Scotland presented to the Schools Inquiry Commission of 1867; James Grant's *History of the Burgh Schools of Scotland* (1876); Matthew Arnold's chapter on 'Scottish Education' in Ward's *Reign of Queen Victoria;* and Mr H. Craik's admirable summary, *Education and the State* (1883). It should be added that the Local Government Act for Scotland (1889) allotted the sum of £201,000 per annum derived from the Probate Duties, so that £30,000 should go to the relief of local taxation in the Highlands (including the education rate), and the remainder, £171,000, to the reduction of school-fees in state-aided schools throughout the rest of Scotland. The result will be to make elementary education in Scotland free.

In 1867 a Commission of Inquiry reported that of 500,000 children about 400,000 were in attendance at school, of whom about half were to be found in schools under government inspection. In the report for 1888 it appears that the number of scholars on the rolls of inspected schools was 631,865, that the average attendance was 491,735, and that of this number 231,670 were examined in the higher standards (III. to VI.), of whom 58,131 having reached the fifth standard were presented in some 'specific' subject such as Latin, French, mathematics, or some branch of science. In a population scarcely reaching four millions, these figures represent a standard both of attendance and attainment which compares favourably with that of the best instructed nations of Europe. Recent measures of the Scotch Education Department for the more systematic inspection of higher schools, and for awarding 'leaving certificates' to their pupils, have greatly enlarged the influence of that department, and are giving to the whole system of primary, secondary, and university education in Scotland a unity and comprehensiveness which are still lacking in the south.

IRELAND.—Up to 1831, when Lord Derby (then Mr Stanley) established the national system, parliamentary grants for education had been made through the agency of private societies. In that year a Board of Commissioners was established, with very large powers of administration, including the power to aid in the erection of schools, to appoint inspectors and other officers, to award gratuities to teachers, to establish a model and training school, and to edit and publish suitable school-books. It will thus be seen that the powers intrusted to the Irish commissioners were greatly in excess of those ever exercised by the committee of Council in England or in Scotland. From the first it was determined that the rights of the Catholic population should be duly regarded, and when, in 1861, the whole system was consolidated by the grant of a royal charter to the commissioners, it was specially provided that of the twenty members of the board, one-half should be Catholics and one-half Protestants. There is a Catholic secretary as well as a Protestant secretary, and one-half of the inspectors are Catholic. In 1887 the number of schools under the supervision of the board was 8024, the number of scholars 1,071,797, and the annual grant £852,000. In the same year, the total income from all local sources was £190,000, of which £106,000 was derived from the school-fees. The commissioners proposed to defray two-thirds of the cost of erecting new schools. They pay the teachers partly by fixed salaries and partly on a scale determined by the results of examination. Each subject of instruction is separately assessed, and the 'results fees' are not, as in England and Scotland, paid to managers, but direct to the teachers. The inspectors are appointed by the board after competitive examination, one important part of such examination being in school management and organisation. Uniformity of judgment is largely secured by frequent conferences, central or in districts, of inspectors under the direction of the board. Hygiene and manual training have of late been introduced as subjects of instruction, on which 'resnlts grants' may be claimed. The monitorial system still prevails to a much larger extent in the schools of Ireland than in those of Great Britain. The provision for training teachers consists of one normal college maintained and controlled by the board, two Roman Catholic training-colleges, and one under the supervision of the Protestant Archbishop of Dublin. Grants are made to these institutions, and their pupils are subject to the government examination for certificates of competency to take charge of schools. Religious instruction is provided in all the schools, but a stringent conscience clause protects the interests of parents who do not approve of that given in the school. The general principle on which the whole state system is founded has been described as 'united literary and separate religious teaching;' but in practice, not more than half the schools illustrate this theory. In 3168 schools under Catholic teachers, there were 475,364 Catholic pupils, and no Protestants. In 809 schools under Protestant teachers, there were 86,469 pupils, of whom none were Catholics. The remaining scholars were in mixed schools, of which 2714 were under the care of Catholic, and 1228 under Protestant teachers, while 77 were taught by Protestant and Catholic instructors conjointly.

Local Examinations and Recent Development.—In England, meanwhile, subsidiary efforts, for the most part tentative, voluntary, and unsystematic, have been made towards a fuller development of our educational resources. In this connection, the place of honour is due to the ancient universities, which have of late put forth considerable energy in fields outside the recognised domain of academic work. The Local examinations of the universities, instituted in 1858, have had enormous influence in elevating and defining the aims, and in encouraging the efforts of teachers in secondary schools, both private and public; and by the operations of the joint board of the two universities, a large number of the foremost classical and other schools have been subjected to annual inspection and examination, and a *rapport* between those schools and the universities has been established, by the award to the best scholars of a leaving certificate—*abiturienten examen*—which is accepted as equivalent to matriculation in nearly every college in Oxford and Cambridge. In 1867 the first steps were taken by Cambridge towards the establishment in provincial towns of courses of lectures of a higher and more systematic character than the miscellaneous lectures familiar to the members of literary and mechanics' institutes. The authorities of Oxford soon took a share in this missionary enterprise, and, under the name of 'University Extension Lectures,' teaching by highly qualified professors is now being largely appreciated in many local centres, and is followed up in many cases by regular reading and examination. Proposals for the formation of reading circles for home-study, on a plan which has since 1879 proved very successful in America (cf. CHAUTAUQUA), have been formulated by the universities, and are probably destined to exercise considerable influence on the home-reading and the intellectual life of large classes of the community

who have had few opportunities of higher instruction, and are engaged in efforts after self-improvement.

A more difficult enterprise has been attempted at Cambridge by the establishment of a special syndicate for the training of teachers. In the sphere of elementary education, experience has conclusively shown the enormous importance of special preparation for the teacher's work, and the marked superiority of trained over untrained teachers. In England and Scotland there are no less than fifty training or normal colleges receiving large subsidies from the parliamentary grant, and providing for the systematic professional instruction of nearly 4000 students, male and female, who remain in them for a period of two years, with a view to become masters and mistresses in elementary schools. But for the technical training of secondary and higher teachers in their craft no similar provision has been made. In the universities of Edinburgh and St Andrews, professorships of Education have been established; but the value of a theoretical acquaintance with the art, science, and history of teaching is at present very imperfectly recognised in the higher schools of either England or Scotland. The Cambridge syndicate sought to supply this deficiency (1) by providing various courses of lectures on these subjects under the sanction of the university, and (2) by the establishment of a special examination, and the award of a teacher's diploma to successful candidates. Of the other agencies at work in England with the same object, the most important is that of the *College of Preceptors*, a body which, having been incorporated in 1849, and having during many years limited its action mainly to the promotion of the professional interests of private teachers, has of late years exhibited much honourable activity, and by means of courses of lectures on professional topics, and by awarding the degrees of associate and licentiate after examination, has done much to raise the standard of qualification among the teachers of intermediate schools. Two training-institutions for secondary teachers, the Maria Grey College in Fitzroy Street, London, and an institution with a similar object in Cambridge, have been started with excellent prospects of success. They are for women students only, and already the demand for teachers who have undergone due probation in these institutions is considerable, and is constantly increasing.

The creation of the *Girls' Public Day School Company* in 1874 was one of the most memorable facts in the recent history of education in England. It offered to parents for the first time schools with a high standard of instruction, with qualified teachers, and with the supervision of a responsible public body. By the end of 1888 thirty-three schools had been established by the company in different towns in England and Wales, and with scarcely an exception had achieved considerable educational success. The number of pupils amounted to 6618, but these figures furnish a very imperfect measure of the influence of this enterprise, since, in many cases, local bodies not actually associated with the company have established schools on a similar basis, and have thus helped to create among parents the demand for education of a high and liberal type for their daughters, and at the same time to satisfy that demand. See the article WOMEN'S RIGHTS.

One other factor of educational improvement, none the less potent because it has operated indirectly, deserves to be noticed. The great experiment tried at the instance of Lord Macaulay in opening to intellectual competition the principal offices of the Indian civil service, was found after trial to have succeeded in three important respects. It relieved statesmen and persons in authority of a very onerous responsibility, and of much solicitation for personal patronage; it has given to the nation a highly capable body of public servants; and it has greatly stimulated higher education by offering lucrative posts as the rewards of intellectual merit. The success of this experiment led to the promulgation in 1870 of an order in council, throwing open a large number of clerkships and other honourable employments in the civil service to competition. The purification of the permanent service of the country from all taint of favouritism and of political or family influence, is of itself an object of high national concern; but incidentally, the effect of such a measure in raising the standard of intelligence among civil servants, and in encouraging and rewarding intellectual merit, is sufficiently important to deserve special notice in any estimate of our present educational condition and prospects. See CIVIL SERVICE.

Educational Literature.—Lastly, one of the most hopeful auguries for the education of the future is to be found in the recent and steady growth of a valuable educational literature. Teaching is no longer regarded as an empirical profession, but as a practical science based on laws and principles, on a right knowledge of the constitution of human nature, on a true psychology and physiology, on philosophy, history, and experience. The difference between the skilled and the unskilled practitioner in the art of teaching depends partly on personal gifts and natural aptitudes, but also largely on a knowledge of the best methods of disciplining the scholar and communicating knowledge. Other things being equal, the best teachers are those who have studied with most care the speculations, the doings, the failures, and successes of the past, and the reasons by which they may be explained. At present this truth, though sufficiently obvious to Englishmen in regard to every other profession, is very imperfectly recognised by them in regard to teaching. But it has long been recognised in other countries, notably in Switzerland, in Germany, in France, in Belgium, and in the states of the American Union.

For the general history of education, and for criticisms upon the various systems, the reader will do well to consult Professor Mahaffy's *Old Greek Education*, Professor Laurie's *Life of Comenius*, Compayré's *History of Pedagogy*, Oscar Browning's *Educational Theories*, R. H. Quick's *Educational Reformers*, Henry Barnard's *English Pedagogy*, and *German Teachers and Educators*, Leitch's *Practical Educationists*, Kiddle and Schem's (American) *Cyclopædia of Education*, and Sonnenschein's *Cyclopædia of Education*.

Those who desire to trace the history of English popular education in fuller detail will find materials for doing so in Sir James Shuttleworth's *Four Periods of Public Education*, in Dr J. H. Rigg's *National Education and Public Elementary Schools*, in Henry Craik's *Education and the State*, in the introductory chapter of the Report of the Royal Commission (1888), and in the chapter on 'Schools,' contributed by Matthew Arnold to Humphrey Ward's volumes on *The Reign of Queen Victoria*.

In order to trace the history both of the facts relating to secondary instruction in England, and of the controversies and projects which have arisen on the subject, it will be well to refer (1) to the voluminous Report of the Schools Inquiry Commission of 1867; (2) to Matthew Arnold's Report on Secondary Instruction in France, Germany, and Switzerland, and to his Essays *passim*; (3) to the papers and discussions recorded in the second volume of the Report of the International Educational Conference in connection with the Health Exhibition of 1884; and (4) to the Report of the

select committee presented to the House of Commons, April 1887.

In the German language, the *Levana* of Jean Paul Richter, the *Geschichte der Pädagogik* of Schmidt, the *Pädagogische Schriften* and other writings of Herbart, and the works of Diesterweg, Dettes, Sturm, Fichte, Herder, Wiese, Grübe, and Rosencranz, the accounts of the life and system of Pestalozzi by Von Raumer and De Guimps, the Baroness Bülow's exposition of the Fröbelian principles, and the Encyclopædia of Schmid, are among the principal authorities. In the French language, some of the most notable contributions to pedagogic science and history, besides those already named, are Buisson's *Dictionnaire de Pédagogie*, Jacotot's *Enseignement Universel*, Rousseau's *Émile*, Michel Breal's *Words on Public Instruction*, Charbonneau's *Cours Théorique*, Forneron's *Guide des Instituteurs*, and Th. Braun's *Manuel de Pédagogie*. Of the American writers on education, the foremost are Henry Barnard, Professor W. H. Payne, Horace Mann, Miss Peabody, Miss Youmans, Miss Anna Brackett, D. P. Page, and Colonel Parker; while in England, Stanley's biography of Dr Arnold, and Biber's Life of Pestalozzi, have been followed by many books expository in various ways of the history and philosophy of education, among which the most valuable are the works of Herbert Spencer, Alexander Bain, Professor S. Laurie, Professor Meiklejohn, Joseph Payne, Matthew Arnold, Dr E. A. Abbott, Edward Thring, R. H. Quick, Professor Sully, and the series of books and monographs published by the Cambridge Press, and containing various lectures which have been given before the university since 1879, under the sanction of the Teachers' Training Syndicate. The first of these courses of lectures was intrusted to the present writer in 1880. His book is entitled *Lectures on Teaching*, by F. G. Fitch. The *Bibliography of Education*, by President Stanley Hall of the Clark University in Massachusetts, may also be consulted with advantage.

Unsolved Problems.—This general review of some of the more salient features of our educational history and present condition may be fitly concluded with a brief reference to some problems which yet remain unsolved, and which in the near future will challenge the serious attention of statesmen, of parents, and of teachers. Of these, the political problem is not the least complex and difficult. There is a general agreement that a minister of public instruction is needed in England, but there is far less of clear understanding respecting the right status of the proposed minister, and the functions he should discharge. The questions are often asked—What should be the rank of such a minister? How can the necessary *rapport* with the government of the day be made compatible with the need for ripe special knowledge, with the maintenance of definite principles, and with a steady pursuance of an organised system? Can these ends, e.g., be best attained by following the precedent of the India Office, and establishing a small permanent council to advise the minister of the day, and under his responsible supervision, to divide between them different departments of administrative work? And when a ministry of public instruction shall have been constituted, what should be the precise scope of its work, its relations to the universities, the nature of its authority over endowed schools, and of its less direct influence over other schools, and over their teachers?

Other questions—e.g. How far is the action of the central government, in a community of free men, to be desired in such a matter as education? and how can such action be reconciled with the freedom of teachers, the variety of methods, the scope for philanthropic initiative, and the due encouragement of new educational ideals and experiments?—are of special interest to Englishmen, and have not yet been satisfactorily answered. The due provision of a suitable supply, both of intermediate and higher education, so that parents who desire such instruction shall have no greater difficulty in finding it than the labouring-man now has in obtaining access to a good elementary school, is not free from difficulty. Experience has shown that the capricious distribution of endowed foundations cannot be remedied by legislation, and that the nation cannot rely on endowments for an efficient supply of secondary schools. In these circumstances, should municipalities and county councils be compelled, or if not compelled, at least permitted to tax their constituents for the due provision of public secondary schools where they are wanting? And if such schools are once supplied, how are they to be maintained and governed? With regard to the improved status and qualification of teachers, the question arises whether these objects are most likely to be attained through those voluntary efforts which will result spontaneously from the growth of a healthier and more intelligent demand on the part of the public; or is it on the other hand needful that legal restraints shall be put in the scholastic, as in the medical profession, upon the incompetent and unauthorised practitioner? And what after all is the truest and highest kind of qualification for the public teacher? Should it be sought in special seminaries, or in the ordinary places of liberal education? In what proportions should the *technique* of school-management on the one hand, and speculative discussion on the philosophy of teaching and with the nature of mind on the other, be combined in a true system of professional training with practical work, and the sort of general study and mental cultivation which is common to the needs of all professions alike?

Finally, there is room for larger and truer conceptions than any we have yet formed of the objects and aims of education itself. Most of our present methods and ideals are survivals from a time when the range of available knowledge was narrower, and when the duties and responsibilities of life were less complex. In view of the new intellectual and social conditions of our time, and of the experience we have gained, this age has now to inquire what kind of knowledge is best worth having, and what sort of formative and moral discipline is best fitted to equip a man for the duties of citizenship, for the work of active life, and for the enjoyment of an intelligent home. What are the relative educational values of the traditional discipline of classical study and of more modern studies? What larger share, if any, of the time and efforts of teachers should be given to the training of the hand and of the senses, as distinguished from the acquisition of the sort of knowledge and of mental cultivation which are derivable from books? What other and better means of communicating knowledge, and of making it attractive, can yet be devised?

On no one of these topics has the last word yet been said. On all of them the best and most fruitful discoveries have still to be made.

Education, MILITARY. See ARMY SCHOOLS.

Educt, as opposed to *product*, is a body obtained by the decomposition of another in which it already existed *as such*; the *product* being a compound not previously existing, but formed during the composition.

Edward, surnamed the CONFESSOR, the last Anglo-Saxon king of the old royal line, was born at Islip in Oxfordshire, the elder son of Ethelred the Unready, by his marriage in 1002 with Emma,

daughter of Richard the Fearless, duke of the Normans. On the death of Ethelred in 1016, Canute obtained possession of the throne, and next year married the widowed Queen Emma, by whom he had two sons, Harold and Hardicanute. Until the death of Canute in 1035, Edward lived in Normandy, but was invited to his court by his half-brother Hardicanute in 1041, and next year succeeded him as king. This was brought about mainly by the great Earl Godwin, whose only daughter, Edith, Edward married in 1045, to treat her, however, throughout his life rather like a father than a husband. He was perpetually influenced by his favourites, who were usually worthless foreigners, and the history of his reign is merely the record of the struggle of the Norman or court party with the national or Anglo-Saxon party, which was led by Godwin and his son Harold. Wars with the Welsh, and an unsuccessful revolt of the Northumbrians, were the chief events in the later years of his reign. Edward died 5th January 1066. He was a poor and spiritless king, who, for his monk-like virtues, was canonised by Pope Alexander III. in 1161. With him the old English monarchy perished, save only for its spasm of dying energy in the few months' reign of the heroic Harold. See Freeman, and the early lives of Edward edited by H. R. Luard ('Record' series, 1858).

Edward I., king of England, was the elder of the two sons of Henry III., by his queen, Eleanor, daughter of Count Raymond Berenger of Provence, and was born at Westminster, June 17, 1239. His name was given him by his father out of reverence for the memory of Edward the Confessor, and in its English sound, as well as in the honest English temper, no less than the yellow hair and stalwart figure with which the young prince grew up, Englishmen might well have read the promise, that once more after two hundred years England would be ruled by a native English king. Edward was brought up at Windsor, was given by his father in 1252 the government of Gascony, and in 1254 married, in the monastery of Las Huelgas, Eleanor, sister of Alfonso X. of Castile, receiving immediately thereafter from his father Gascony, Ireland, and the Welsh march betwixt the Conway and the Dee, where, in fighting with the turbulent Welshmen, he learned his first lessons in warfare. At the Parliament of Oxford (1258) he took part with his father in his contest with his troublesome nobles, but thereafter appears to have at first sided with the great Earl Simon de Montfort, the leader of the barons or national party, without, however, impairing his own personal loyalty and affection for his father, with whom ere long he was reconciled. It was his rash eagerness in pursuing an advantage gained over the Londoners, who were devoted to the party of Simon, that lost the battle of Lewes (1264), one immediate consequence of which was the prince's imprisonment as a hostage for his father's pledges. Conditions for his liberation, discussed at Simon's famous parliament of 1265, were frustrated through Edward's escape by a stratagem from Hereford Castle; and at the final battle at Evesham (August 4), where Simon recognised, in the skilful disposition of his enemy's forces a fatal lesson learned from himself, the struggle practically ended with the great popular champion's death on the battlefield. Edward gained much influence by the wise prudence and moderation with which he stamped out the last embers of rebellion.

In 1270 he started at the instigation of Louis IX. of France to join the last of the crusades, but when he reached Tunis, found that king dead, and the expedition already desperate of success. He went on to Acre, and won great renown as a knight, but failed to save the Frankish kingdom in the East from its inevitable fate. In June 1272, while sitting alone on his bed, his own strength and energy saved him from being murdered by one of the infamous sect of the Assassins. Hastily guarding himself with his arms, and receiving a desperate wound, from which he afterwards suffered much, he tore the knife from his assailant's hand, and buried it in his heart. The ancient story that his queen Eleanor, who had followed him in his pilgrimage, saved his life at the risk of her own by sucking the poison from the wound, unfortunately lacks historical support, but fits well with the romantic temper of the times, as well as with the deep affection that survived throughout life betwixt husband and wife. Two months later he started for home, and at Capua, in the January of 1273, heard of his father's death two months before. Meantime he had been quietly proclaimed king, and as things went well in England, he visited the pope, did homage at Paris for his French provinces, and did not return to his kingdom till the August of 1274. At his coronation he received the homage of Alexander III. of Scotland for his lands in England, but Prince Llewelyn of Wales neglected the summons to attend, and only did his homage in 1276, under the combined terrors of excommunication and the royal army. Edward at once commenced that wise and large policy of domestic consolidation and financial as well as legal reform that has shed such lustre upon the reign of the English Justinian, and made it almost the most important epoch in the constitutional history of England.

His first warfare was with the turbulent and disaffected Welshmen, who had profited by the intestine turmoil of the preceding reign, and intrigued perpetually with the rebellious nobles of Henry III. for their own ends. The forced peace of 1277, and the national dissatisfaction at the stringent terms granted by Edward, which was not abated by the personal favours he heaped upon the princes Llewelyn and his brother David, were but the preludes to the final struggle which commenced three years later, and ended in the complete suppression of Welsh nationalism, with the defeat and death of Llewelyn, near Builth in Brecknockshire, and the cruel execution of David at Shrewsbury, as a traitor, in 1284. By the famous Statute of Wales in the same year, the ancient principality was finally annexed to the English crown, while English laws and English institutions were forced upon the conquered people. Edward devoted the next year to legislation, then went abroad to mediate, without success, in the quarrel between France and Aragon. He had soon to return to quell fresh disturbances in Wales, and even in England, where the great Statute of Winchester, which had been passed in 1285 to place the defence of the country on a really national basis, had not yet had time to effect its end. Finding that most of his judges had been corrupting justice, he punished them with an iron hand, next banished in 1290 all the Jews to the number of over 16,000 from the kingdom on the plea of extortionate usury. Earlier in the reign he had hanged 280 for money-clipping and forgery.

Just at this time the death of the young Scottish queen, the Maid of Norway, whom Edward had caused to be betrothed to his eldest surviving son, Edward of Carnarvon, opened up a fatal contest for the Scottish crown, which gave Edward his opportunity to assert anew the old but somewhat shadowy claim of the English crown to the over-lordship of Scotland. The southern half of that composite kingdom was inhabited by people of English blood and English institutions; its south-eastern part, the Lothians, had undoubtedly once formed part of the Anglian kingdom of Northumbria; while its south-western, Strathclyde or Scottish Cumbria, the population of which

was in great part Celtic, had in 945 been given by the English king Edmund I. to Malcolm as a fief. The northern portion of the kingdom was purely Celtic in blood, and had at no time been subject to English influences, but though the reigning family was itself of Celtic origin, its authority hardly extended effectively beyond the region inhabited by men of English blood. Undoubtedly the Scottish king in 921 chose Edward the Elder 'to father and to lord,' and the right then acknowledged was claimed successively by William the Conqueror, Rufus, and other English kings. Moreover, from the 12th century it had been customary for the Scottish kings or their sons to receive English earldoms, and do homage for them, but it continued to remain somewhat vague, whether such homage was understood to be extended beyond these earldoms, so as to include the Lowland provinces and the whole Scottish kingdom. William the Lion, taken prisoner at Alnwick in 1174, for his freedom acknowledged the supremacy of Henry II. in the treaty concluded at Falaise on December 7, but on his return found his subjects ill disposed to accede to his cowardly submission; and fifteen years later the claim founded on this special act of submission was formally renounced for a sum of 10,000 merks by Richard I., who was eager to raise money for his crusade. Such was the ill-defined position of this ancient controversy, when fate seemed to fling into Edward's hands the opportunity of defining it anew with all the clearness dear to his legal mind. It was easy for him to secure a recognition of his superiority from the selfish and eager candidates for the crown, and meantime he secured the Scottish castles, and after a deliberate examination of the rival claims, decided in favour of John Baliol, who, on his accession, paid homage distinctly for the whole kingdom of Scotland. He soon found his position as a vassal-king intolerable, betwixt the unruly turbulence of his subjects and the imperious demands of his over-lord, who allowed appeals to be led from Baliol's subjects to himself. Meantime the ambitious projects of the new king of France, Philip IV., involved Edward in anxieties for the safety of Guienne and his other possessions in France. Ere long the high-handed conduct of the French king made war necessary, and Edward, with characteristic energy, at once began his preparations, and summoned in 1295 an assembly of the estates of the realm, which was practically the beginning of our modern parliaments. The ever-increasing exasperation of the Scots at length broke out into open warfare in 1296. Edward at once marched northwards, captured Berwick, and carried his victorious arms as far north as Aberdeen, Banff, and Elgin, taking the great castles on the way, formally accepted Baliol's surrender of the crown at Montrose, and returned to Berwick (August 22), carrying with him the famous coronation-stone from Scone, after having subdued the whole kingdom in about five months. Here, six days later, he received the fealty of the clergy, barons, and gentry of Scotland, whose names fill the thirty-five skins of parchment known as the Ragman Roll.

At length he was at liberty to turn to France, but the great cost of his late expenditure had already driven him to make such heavy demands upon the revenues of the church, that the clergy now refused fresh subsidies, headed by Archbishop Winchelsea and supported by the bull 'Clericis Laicos' of Pope Boniface VIII. The king retaliated by placing the clergy of the kingdom in outlawry. At the Salisbury parliament in February 1297, the great barons also refused to take part in foreign war, while the merchants were exasperated because their wool had been seized. A compromise was soon effected with the clergy, and a temporary illegal grant for the immediate purposes of the war was procured from the nobles and commons who were with him. Edward sailed for Flanders, and at Ghent confirmed the Charter with such supplementary clauses as were demanded by his refractory nobles, thus finally establishing the right of the people themselves to determine taxation. This is only second in importance to Magna Charta itself as a landmark in the history of England. The suspicious fears of his people compelled Edward to repeat the confirmation at London in 1300, and again at Lincoln in 1301—an insult to his honesty which the king never forgave, and to which his subsequent banishment of Winchelsea was due. In 1303, and again the year after, Edward, in desperate straits for money, levied, by agreement with the foreign merchants, some new customs—the beginning of our import duties, without consent of the estates, and collected a *tallage* from the royal demesne, and again, in 1305, he obtained from Clement V. a formal absolution from the obligations of 1297. It is true that the first two measures were contrary to the spirit rather than the letter of his promise, and that he never sought to avail himself of the dangerous power granted him by the papal absolution, yet these three facts, says Bishop Stubbs, 'remain on record as illustrations of Edward's chief weakness, the legal captiousness, which was the one drawback on his greatness.'

It was the dangerous aspect of affairs in Scotland that forced the king to submit so easily to the demands of his barons. Already, in the spring of 1297, Wallace, without any countenance from the Scottish nobility, had commenced a guerilla warfare, and his handful of desperate men soon increased into an army, which completely defeated Earl Warenne and Cressingham at Cambuskenneth (Stirling Bridge) in September 1297, and ravaged England, with the most atrocious cruelties, from Newcastle to Carlisle. Edward's expedition to Flanders had been a failure, but he hastened to conclude a truce, so as to find time to chastise the Scots, cementing it by his betrothal to Philip's sister Margaret. The good Queen Eleanor had been already dead nine years. Meantime, Wallace's success had merely earned him the bitter jealousy of the Scottish nobles, and his power was finally broken in the disastrous defeat by Edward's army at Falkirk in July 1298. The king had two of his ribs broken by a kick from his horse on the morning of the battle, but rode throughout the day as if unhurt. The struggle lingered on some years under various leaders, as Edward found his energy paralysed the while by the intrigues of Philip, and the constitutional struggles with his barons. Pope Boniface, in 1301, put forth a claim to the overlordship of Scotland, which was repudiated by the whole body of the estates at Lincoln. It was not till the June of 1303 that the king was able to resume his conquest. Accompanied by a fleet carrying his supplies, he penetrated again into the far north, tarried a while in Dunfermline, and settled the kingdom after the reduction of Stirling, the last place of strength that held out. In 1305 Wallace was betrayed into his hands, sent to London, and cruelly executed as a traitor. The fate of this noble-hearted patriot is a fatal blot upon his conqueror's memory, but it should not be forgotten that Edward was profoundly convinced of the legality of his own claims over Scotland, and that Wallace to him was merely a pestilent rebel, who had earned his doom by treason to his lord and by the cruelties he had inflicted upon Englishmen. The same year the king prepared a new constitution for the conquered kingdom, divided it into sheriffdoms like the English counties, and made arrangements for the representation of the Scots in

the English parliament—a measure which, had it been successful, might have anticipated by four centuries the benefits of the union. It might now have been expected that Scotland was effectively subdued, but ere long Robert Bruce, who had hitherto played a dubious game, raised a revolt in the beginning of 1306, got rid of the regent Comyn, his most serious rival, by a foul murder in Dumfries church, was crowned king at Scone, and kept up an incessant but varying struggle during the winter of 1306 and the spring of 1307. The treachery of those who had sworn fealty to him, and whom he had trusted implicitly, roused Edward to the pitch of exasperation, and at the knighting of Prince Edward at Westminster, he swore a solemn vow to be revenged upon Bruce. He at once despatched a force to Scotland, and though now old and infirm, began preparations for his fourth expedition; but he was attacked with dysentery on the march, and his malady increased so much upon him that he died on the 7th of July 1307, at Burgh-on-Sands, near Carlisle, within sight of Scotland, leaving for his son Edward the dying command not to bury his body till he had utterly subdued the Scots, but to carry his bones with the army until the victory was complete. Eleven days later the young prince reached Carlisle, but returned a few weeks after to London, and buried his father's body in Westminster, where it still rests under a slab, with the simple but truly descriptive inscription: 'Eduardus primus, Scotorum malleus, hic est.'

See *Life and Reign of Edward I.* (Seeley, 1871); vol. ii. (1876) of Bishop Stubbs's *Constitutional History of England*, his *Early Plantagenets* in 'Epochs of Modern History' (1876), and his prefaces to the *Chronicles of the Reigns of Edward I. and Edward II.* in the 'Rolls' series (2 vols. 1882–83).

Edward II., son of the preceding, was born at Carnarvon in Wales, 25th April 1284, and in 1301 was created Prince of Wales, being the first heir-apparent of the English throne who bore that title. In 1297 he was appointed regent in his father's absence, and as such signed the famous *Confirmatio Cartarum*. He accompanied his father on his various expeditions into Scotland, but was absent at his death in July 1307, and instead of carrying out his dying commands, returned to London to give himself to unworthy pleasures and the beloved companionship of his favourite the Gascon, Piers de Gaveston. A month later he created him Earl of Cornwall, and on his departure for France in the beginning of 1308 to marry Isabella, daughter of Philip IV., left him guardian of the kingdom. The indignant nobles demanded his banishment, and twice was the favourite forced to leave England, but as often was he recalled by the infatuated monarch, until at length they rose in arms, captured Gaveston, and executed him at Warwick in 1312. Two years later, Edward invaded Scotland at the head of an army of 100,000 men. At Bannockburn, on the 24th June 1314, he was defeated with immense slaughter by Bruce, whose heroism redeemed the dubious patriotism of his earlier years, secured his own crown, and the final independence of his kingdom. With the capture of Berwick in 1318, he had undone every trace of the conquest of Edward I. This great disaster in Scotland was followed by risings in Wales and Ireland, and two seasons of unexampled famine attended by still more fatal pestilence. From this time till 1321 the influence of Lancaster as the king's minister was supreme, but in that year, with the aid of his new favourites, Hugh le Despenser the elder, and his son, Hugh the younger, who had been already banished, but whom the king had recalled, Edward overthrew Lancaster, and put him to death. Immediately after, Edward invaded Scotland for the last time, but achieved no particular success, and in 1323 concluded a truce with that nation for thirteen years, and returned to England. A dispute now arose between him and Charles IV. of France, brother of his wife Isabella, in regard to the territories which he held in that country. Charles seized these, whereupon Edward sent over Isabella to remonstrate, and, if possible, to effect an amicable arrangement between them. Isabella already despised her husband, and hated the Despensers, and had contracted a guilty passion for Mortimer, one of the most unprincipled and powerful of the disaffected nobles. She now treacherously made common cause with many of the exiled nobles against her husband and the Despensers, and having obtained possession of the young Prince Edward, she embarked from Dort, in Holland, with a large body of malcontents, and landed on the coast of Suffolk on the 24th September 1326. Edward fled, but was taken prisoner in Glamorganshire. The Despensers, father and son, were executed, and the monarch himself compelled formally to resign the crown. His robust frame refusing to succumb to some months of the most inhuman treatment, he was murdered by a cruel death in Berkeley Castle, 21st September 1327.

Edward III., son of the preceding, was born at Windsor, 13th November 1312, and was crowned king 29th January 1327. During his minority the country was governed nominally by a council of regency, but really by Mortimer and his paramour Isabella. Early in 1328 the young king married Philippa of Hainault, and two years later seized Mortimer and put him to death, banishing his unworthy mother, Isabella, to her remaining twenty-seven years of privacy in Risings Castle. He next invaded Scotland to assist Edward Baliol, son of John Baliol, who, in the confusion that ensued on the death of the great Bruce, had made a descent on the country, and got himself crowned at Scone. In a bloody battle fought at Halidon Hill, near Berwick, 19th July 1333, the Scots were completely defeated, whereupon Baliol assumed the authority of a king, and did homage to Edward for his possessions, but a few months later had to flee from the kingdom. In the course of three years Edward thrice invaded Scotland, but though he frightfully wasted the country, and brought armies such as could not be met in the field, he could not break the invincible spirit of the people, who, after each invasion had rolled over them like a flood, rallied anew with a still more stubborn resolution to be free. But the scene of Edward's great exploits was France. Charles IV. having died without a son, Philip of Valois, the nearest heir by the male line, ascended the throne, under the title of Philip VI. Edward claimed the crown in right of his mother Isabella, sister of Charles; but as the law of France expressly excluded females from enjoying sovereign rights, it is needless to say that his claim was utterly groundless. The English king admitted that his mother, being a female, could not inherit the crown of France, but affirmed that he, as her son, might. But it is clear that he could not receive from his mother rights to which she herself had no claim. Yet never was a bad cause redeemed from baseness with more splendid triumphs. Edward declared war against Philip in 1337, raising money unsparingly by tallages, forced loans, and seizing wool for which it is true he promised to pay in the course of two years. Spite of the brilliant sea-victory at Sluys in 1340, the war was at first singularly unsuccessful, and Edward soon found himself at issue with his nobles, and especially the princes of the church, and was compelled to purchase the grants of money necessary for the war with concessions of privileges, which he occasionally endeavoured to evade by subterfuges that his

grandfather would have scorned. At length in 1346, accompanied by his eldest son, known as the Black Prince, he again invaded France, conquered a great part of Normandy, marched to the very gates of Paris, and on the 26th August 1346, inflicted a terrible defeat on the French at the famous field of Crécy. Here the Black Prince, though but sixteen years old, exhibited the most heroic courage. After some further successes, and the fall of Calais after a twelvemonth's siege, a truce for a few months was concluded between the two nations, afterwards from time to time extended. Just before the surrender of the famished citizens of Calais, occurred the heroic incident of Eustace de St Pierre and his five companion burgesses of Calais, who offered themselves as victims to the king's fury to save their fellow-citizens, and were saved only at the impassioned entreaties of Queen Philippa. Meanwhile the Scots had sustained in 1346 a severe defeat at Neville's Cross, near Durham, their king, David II., being taken prisoner, while in 1349 the terrible Black Death had carried off a third of the total population of England, and permanently changed the whole relations between labourer and master.

The war began anew in 1355, and next year, on the 19th September, the Black Prince obtained a brilliant victory at Poitiers, where King John of France was taken prisoner. The Scotch monarch was released under promise of a ransom of 100,000 merks in 1357, and King John in 1360, when a peace was concluded between the French and the English, by which the latter were to retain their conquests. King John finding it impossible to raise his proposed ransom, honourably returned to captivity, and died in London in 1364. Shortly before this date, David, king of Scotland, whose residence in England had extinguished the little patriotism he ever had, entered into a secret agreement with Edward, in virtue of which his kingdom, if he died without male issue, was to be handed over to the English sovereign. Meanwhile, the Black Prince, who had married Joanna, daughter of the Earl of Kent, had received from his father Aquitaine and Gascony, and ruled there for some time very prosperously; but ultimately involving himself and his father in a war with France, which was disastrous in its issues, was obliged in 1374 to conclude a truce for three years. Edward waged war no more. In spite of his brilliant victories, in spite of the dazzling valour of his son, he was at the last unsuccessful. Under him, says Mr Freeman, 'England was successful in battles, but she was thoroughly beaten in war.' Neither in Scotland nor in France did he realise his desires. Affairs at home were no less unsatisfactory in the last years of his life, and public finance drifted hopelessly into ruin. He quarrelled with his parliaments, and saw public discontent sap the loyalty of his people, while he gave himself up to the influence of his rapacious mistress, Alice Perrers, and let the government slip into the hands of his third son, John of Gaunt. The Black Prince, who had headed a party opposed to his father's policy, died 8th June 1376, and the king himself expired almost alone on the 21st June 1377, after a reign of fifty-one years.

See William Longman's *Life and Times of Edward III.* (2 vols. 1869), and Rev. W. Warburton's *Edward III.* in 'Epochs of Modern History' (1875).

Edward IV., son of Richard, Duke of York, and Cicely Nevill, daughter of the first Earl of Westmoreland, was born at Rouen in 1442, and brought up at Ludlow Castle, being known during his father's lifetime as Earl of March. The Yorkist claim to the crown will be discussed under ROSES (WARS OF THE); here it is enough to say that Edward found himself, on his father's defeat and death at Wakefield (December 30, 1460), head of a strong and resolute party. With characteristic vigour he at once set out from Gloucester, won the battle of Mortimer's Cross (February 2, 1461), lost in the person of Warwick the second battle of St Albans fifteen days later; but only nine days thereafter, taking advantage of the reaction of the south against the excesses of Queen Margaret's victorious northern soldiers, entered London in triumph, and was hailed as king. A month afterwards he secured for himself the crown by the great battle of Towton, near York. The indefatigable queen, with the aid of French money, kept up the struggle in the north, but her defeats at Hedgeley Moor and Hexham (1464), and the capture of the unhappy King Henry (1465), in the meantime closed the door upon her hopes. The young Edward was handsome and frank in manners, and quickly became a most popular king. The commons granted him the wool-tax and tonnage and poundage for life. But Edward imperilled his popularity by his uncontrolled licentiousness, and ere long by his ill-advised and at first secret marriage with Elizabeth, the handsome widow of Sir John Grey of Groby, daughter of the Lancastrian Lord Rivers, displeased the great Earl of Warwick and many of his nobility, who had hoped to buttress the king's throne by a French or Burgundian alliance, and whose disaffection was further increased by the honours which were lavishly heaped upon the young queen's upstart relations. Warwick succeeded in detaching the king's brother, the Duke of Clarence, from his side, and made him his own by marrying him to his daughter Isabel. Meantime the tide of popular feeling showed the direction in which it was running by insurrections in the northern counties and in Lincoln. At length Warwick finding Clarence too weak a foundation on which to build a Yorkist revolt, crossed to France, and there made friends with his ancient enemy, Queen Margaret, and cemented the alliance by marrying his daughter Ann to her son, Prince Edward. In September 1470 Warwick landed in England, and Edward finding himself deserted on every side fled to Flanders; six months later he landed at Ravenspur, and pressed on to give battle to Warwick. His brother Clarence went over to his side, and in the final battle at Barnet, on Easter-day, April 14, 1471, the kingmaker fell on the field of his defeat. Edward next turned to meet Queen Margaret, and put an end to the war by the victory at Tewkesbury (May 4). He showed the savagery of his nature by the murder of the young Prince Edward, and the ruthless severity of his vengeance upon the other captives, some of whom had left sanctuary on promise of their lives being spared. The night of his arrival in London the old king, Henry VI., died in the Tower—of a broken heart as was given out. Edward henceforward sat securely on his throne, and used his power freely to extort money from his subjects by forced loans. In 1478 he stained his name by the private execution in the Tower of his brother Clarence—drowned according to an old tradition in a butt of Malmsey wine. Edward's partisanship of Burgundy against France had brought no glory to his army, the leaders of which were induced by French gold to abandon the war. Equally unsuccessful were his ambitious schemes for the marriages of his five daughters. Edward died suddenly, April 9, 1483, worn out before his time by his debaucheries.

See James Gairdner's *Houses of Lancaster and York* in 'Epochs of Modern History' (1874), and the Introductions in his edition of the *Paston Letters* (3 vols. 1872-75).

Edward V., son of the preceding, was born 4th November 1470. The story of his life is brief and tragic. At the death of his father, he was living

at Ludlow in Shropshire, a boy of thirteen. When the news reached Ludlow, Earl Rivers, his uncle by the mother's side, set out with him for London. Richard, Duke of Gloucester, however, contrived to obtain possession of his person at Northampton, and brought him to the capital himself, in the beginning of May 1483. Towards the end of the same month, Richard was appointed Protector of the kingdom. About the middle of June, the young Duke of York, brother of Edward V., also fell into his hands. The two hapless boys were then removed to the Tower, and were never more heard of. In 1674 some bones were discovered in a wooden chest below the stairs which formerly led to the chapel of the White Tower, and being supposed to be the remains of the princes, were re-interred in Westminster Abbey in the chapel of Henry VII. There is at least no doubt that they were murdered by command of their ambitious uncle Gloucester, who himself began his short reign as Richard III., July 6, 1483.

Edward VI., born at Hampton Court on 12th October 1537, was Henry VIII.'s son by his third queen, Jane Seymour, who died twelve days after his birth. Till he came to six years he was brought up 'among the women;' then his instruction commenced 'in learning of tongues, the Scriptures, philosophy, and all liberal sciences.' Cheke and Ascham were among his preceptors. On 21st January 1547 he succeeded Henry, when Edward Seymour, Earl of Hertford, his uncle, got himself made Protector. A *novus homo*, who from a country gentleman had risen to be ruler of England through the accident of his sister's queenship, Seymour allied himself with the reformed party against the nobles of the old régime, and sought by some high achievement to justify his rapid exaltation. During the first year of his protectorate he invaded Scotland, to enforce the marriage-contract between Edward and Mary, Queen of Scots. In the battle of Pinkie (10th September 1547) the Scots were utterly defeated, and Scotland lay at the mercy of Seymour, now self-created Duke of Somerset; but his presence was needed at home. He returned to find that his brother, Lord Seymour, the admiral, had been caballing against him. Somerset had him attainted; and on 20th March 1549 he was sent to the block, the boy-king consenting coolly to his death. That summer witnessed two rebellions—of Catholics in Devonshire, and of agrarian malcontents, under Ket the tanner, at Norwich. Both were suppressed; but two months afterwards a more formidable adversary arose in the person of Ket's vanquisher, John Dudley, Earl of Warwick, who worked the Protector's downfall by insinuations against him of 'ambition, vainglory, and self-enrichment' (such are the entries in Edward's Journal). Somerset was lodged in the Tower, pardoned, assailed anew, and this time beheaded (22d January 1552), Dudley meanwhile being created Duke of Northumberland. The people regretted, with good reason, Somerset, for Dudley was both a worse and a weaker man. Indifferent in matters of religion (though he died a professed Catholic), he too let the Reformation take its course under Cranmer (q.v.) and Cranmer's more headstrong colleagues; his single aim was to secure the succession for his own family. With this view he married his fourth son, Lord Guildford Dudley, to Lady Jane Grey, daughter of that Duchess of Suffolk to whom, by the will of her uncle, Henry VIII., the crown was to pass in default of issue by Edward, Mary, or Elizabeth. Northumberland now worked upon the dying boy to exclude his sisters, and nominate Lady Jane as his successor. Edward consented; and a 'device,' thus settling the succession, was drawn up. The king lived only a few weeks after, dying at Greenwich on 6th July 1550, of poison it was rumoured, but more probably from the effect of quack nostrums on a consumptive frame. On 8th August he was buried in Westminster with Protestant rites, but mass of requiem was chanted in the Tower. A truer estimate of this 'English Josias'—shrewd, obdurate, cold, yet anxious for his subjects' well-being, a very Tudor—may be formed from his own Journal than from any of the contemporary panegyrics. It is given, with a very full memoir, in the *Literary Remains of Edward VI.*, by J. G. Nichols (2 vols. Roxburghe Club, 1857).

Edward, THOMAS, the 'Banff naturalist,' son of a private in the Fife militia, was born at Gosport in 1814, and spent his early years at Aberdeen. After settling as a shoemaker in Banff in 1837, his irrepressible and inborn passion for the pursuit of natural history led him to collect many specimens, and discover new species, which he classified, described, and exhibited. He was a Fellow of the Linnean Society, and of the Royal Physical Society of Edinburgh. The publication of Smiles's *Life of a Scotch Naturalist* in 1876 awakened much sympathy in his favour, and a pension of £50 a year was conferred upon him. He died 27th April 1886.

Edwardes, SIR HERBERT BENJAMIN, a soldier and statesman of British India, was born at Frodesley in Shropshire, on 12th November 1819. Entering the army of the East India Company in 1840, he was, on the outbreak of the first Sikh war (1845), appointed on the staff of Sir Hugh Gough, and fought at Mudki and Sobraon. Shortly after the conclusion of the war he became assistant to Sir Henry Lawrence, British resident at Lahore, and in that capacity took an active share in punishing the Dewan Mulraj of Multan, who had murdered Mr Vans Agnew and Lieutenant Anderson, defeating him twice, and capturing his city (1849). During the Indian Mutiny, Edwardes, as commissioner of the Peshawar frontier, did very good service by conciliating Dost Mohammed of Afghanistan, and securing his neutrality. In 1865 ill-health obliged him to return to England, where he commenced to write a *Life of Sir Henry Lawrence*, which was completed after his death (at London, on 23d December 1868) by Herman Merivale. He also wrote *A Year on the Punjab Frontier in 1848–49*.

Edwards, AMELIA BLANDFORD, novelist and Egyptologist, was born in London in 1831. Her first novel, *My Brother's Wife* (1855), was followed by a dozen others, among them *Debenham's Vow* (1869), and *Lord Brackenbury* (1880). She also published a volume of *Ballads* (1865), and, besides books of holiday travel in Belgium and the Dolomites, *A Thousand Miles up the Nile* (1877). Miss Edwards was the founder, and one of the honorary secretaries, of the Egyptian Exploration Fund, and contributed papers on Egyptology to the principal European and American journals. Her scholarship was recognised in several degrees from American colleges, notably a doctorate from Columbia; and in 1889 she lectured on Egyptian subjects in the United States. Died April 16, 1892.—Her cousin, MATILDA BARBARA BETHAM-EDWARDS, was born at Westerfield, Ipswich, in 1836, and when quite a young girl attracted the notice of Charles Dickens, who published her poem, 'The Golden Bee,' in *All the Year Round;* it is included in her Poems (1885). Her first novel, *The White House by the Sea*, appeared in 1857, *Dr Jacob* in 1864, and *Kitty* (described by Lord Houghton as 'the best novel he had ever read') in 1869. Besides numerous other stories, many of which have been translated into French, German, and Norwegian, Miss Betham-Edwards has published *A Winter with the Swallows* (1867)

and *A Year in Western France* (1875), whilst she has edited Murray's *Handbook to Southern, Eastern, and Central France*, and Arthur Young's *Travels in France*, with Life (1889).

Edwards, HENRI MILNE. See MILNE-EDWARDS, HENRI.

Edwards, JONATHAN, theologian and metaphysician, was born at East Windsor, Connecticut, 5th October 1703, the only son among the eleven children of the Rev. Timothy Edwards, a worthy clergyman there for more than sixty years. The boy was precocious alike in learning and in piety, and graduated at Yale College in 1720. By that time all his spiritual difficulties had vanished, and given way to 'an inward sweet delight in God,' and he had determined to devote himself to the ministry. After acting as tutor at Yale from 1724 to 1726, he was ordained in 1727 colleague to his maternal grandfather, Solomon Stoddard, in his ministry at Northampton, Massachusetts. Two years later the death of the latter left him alone, and here for nearly twenty-four years he laboured with remarkable earnestness, guiding his flock through the excitement of a revival which the preaching of George Whitefield in 1740 and the year after helped to spread far and wide over New England. The singular happiness and success of his first seventeen years was at length broken by a bitter dispute with his people about the circulation of certain books which he considered as immoral in tendency, and further about the advisability of returning to the earlier Congregational rule of refusing to admit persons to communion who were not consciously converted. Edwards supported the more rigid view, and was obliged to resign his ministry in June 1750. He next laboured some years as missionary to the Housatonnuck Indians at Stockbridge, Berkshire county, Massachusetts, until 1758, when he was called to succeed his son-in-law, President Burr, of Princeton College, but died of smallpox only thirty-four days after his installation, 22d March 1758. Edwards is still America's most original thinker in metaphysics, and it is hardly likely that his treatise on the *Freedom of the Will* (1754) will ever be set aside (see WILL). He was a rigid and somewhat unsympathetic Calvinist in theology, but his heart throughout life was warmed with a piety of rare saintliness and elevation, already foreshadowed in the famous seventy resolutions drawn up in his twentieth year. His other works are only less memorable than his great treatise; they include *Original Sin* (1758), *True Nature of Christian Virtue* (1788), and *Dissertation on the End for which God created the World* (1789). The most notable adherents of the theological school founded by Edwards were Samuel Hopkins (q.v.); his son, Jonathan Edwards; Joseph Bellamy of Connecticut (1719–90), whose works were published at Boston in 2 vols. in 1850; Nathaniel Emmons, who died at Franklin, Massachusetts, in his ninety-fifth year, and whose works (with a Life) extend to 8 vols. (Boston, 1842); Timothy Dwight (q.v.); and Leonard Woods, professor at Andover (works in 5 vols. Andover, 1849–50). More or less complete editions of the works of Edwards have been published by Austin (6 vols. Worcester, Massachusetts, 1808–9), Williams & Parsons (8 vols. Lond. 1817), S. E. Dwight (10 vols. New York, 1829–30), Henry Rogers (2 vols. Lond. 1834), and by Leavitt & Co. (4 vols. New York). See Leslie Stephen's *Hours in a Library* (2d series, 1876).—JONATHAN EDWARDS the younger, second son of the preceding, was born in Northampton, Massachusetts, 26th May 1745, and had his education at the College of New Jersey, where he graduated in 1765. After his studies in theology he became tutor at Princeton, and in 1769 pastor at White Haven, Connecticut. Here he laboured with all his father's energy and uncompromising strictness till his dismissal by his congregation in 1795 on the plea of their inability to support a minister. Next year he was called to the church at Colebrook, Connecticut, and in 1799 to the president's chair of the new college at Schenectady, New York; but here he died the second summer after his inauguration, 1st August 1801. The circumstances of his death were strangely like his father's, and it was not a little striking that both had preached on the first Sunday of their fatal year from the text 'This year thou shalt die.' The younger Edwards greatly resembled his father in intellect, and his ablest work is the best exposition extant of his father's theory of the will. It is *A Dissertation concerning Liberty and Necessity* (1797). Another valuable contribution to theology is contained in his three discourses *On the Necessity of the Atonement and its Consistency with Free Grace in Forgiveness* (1785). His works were reprinted in 2 vols., with a memoir, by his grandson, the Rev. Tryon Williams, at Andover in 1842.

Edwards, OLIVER, American soldier, born in Springfield, Massachusetts, in 1835, entered the Northern army at the beginning of the civil war, and rose, gaining almost every step by acts of personal gallantry, to the rank of brigadier-general in 1865. His services were most conspicuous during the second day of the battle of the Wilderness; at Spottsylvania (1864), where he held the 'bloody angle' for eleven hours with his own brigade, and, at the head of twenty regiments, faced the enemy for thirteen hours thereafter; and at Sailor's Creek, where he captured Generals Custis Lee, and Ewell. General Edwards, after the war, returned to mercantile pursuits.

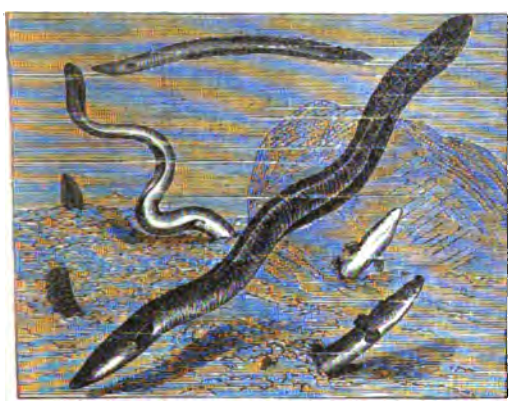
Edwin, king of Northumbria, was the son of Ælla, king of Deira, who died in 588. His father died when he was but three years old, whereupon Æthelric, king of Bernicia, seized his territories. The child was carried into North Wales, and there brought up. At length he found refuge with Rædwald, king of East Anglia, who took up arms on his behalf against Æthelfrith, the son of his oppressor, and defeated him in a great battle, in which the usurper fell (617). Edwin now obtained his father's kingdom of Deira, and ere long overran Bernicia, thus bringing under his rule a united Northumbria, which extended northward to Edinburgh, a city which he fortified, and which still retains his name. He next conquered Elmet (the West Riding of Yorkshire) from the Britons, and pushed his power westward to the sea, and even to Anglesea and Man. After Rædwald's death he also obtained the over-lordship in East Anglia, and overthrew the West Saxons, a victory which gave him the over-lordship of all England, save Kent. Edwin had already married Æthelburh, daughter of Æthelberht, the convert of Augustine. Under Paulinus' influence, and moved by his escape from assassination at the hands of the king of Wessex, and by his victory over Wessex, Edwin was converted to Christianity; and he and his nobles were baptised in the eleventh year of his reign. Thereafter, he became the most powerful prince in England. In 634 he fell in a disastrous battle at Hatfield Chase in Yorkshire. Edwin was canonised; his festival falls on 4th October. His story forms the subject of Alexander Smith's poem, *Edwin of Deira* (1861).

Eecloo, a town in the Belgian province of East Flanders, on the Liève, 12 miles NW. of Ghent by rail. It has manufactures of woollens, cottons, &c. Pop. 11,164.

Eel, a name somewhat widely applied in popular usage, but justifiably extended to all the members

of the family Murænidæ, which is included in the order Physostomi of bony fishes. The family is a large one, with representatives in almost all fresh waters and seas of temperate and tropical zones. As is well known, the body is much elongated, cylindrical or ribbon-shaped; the usual scales are absent or rudimentary; and there are no pelvic fins. If unpaired fins are present, they unite in a long fringe. Teeth are usually well developed. Over two hundred species are known, all carnivorous, and preferring to keep near the bottom, sometimes at great depths.

The genus Anguilla includes the eels *par excellence*, some twenty-five widely distributed species in all, the Common Eel (*A. vulgaris*) among the rest. The skin exhibits minute rudimentary scales, the upper jaw does not protrude, the tongue is free, the teeth small, the unpaired fins united in a continuous fringe. The common eel, though not without its mystery, is known to every one. The wide gape, the protruding lower jaw, the variable forms of head, the body cylindrical in front and then compressed, the long tail, the very varying colour, are familiar features. It occurs throughout most of Europe, frequenting, however, sluggish streams. Authorities usually distinguish two British species, *A. vulgaris* and *A. latirostris*, but the differences



The Common Eel (*Anguilla vulgaris*).

are slight. Stealthy in its habits, the eel lies in the mud during the day, and wriggles about at night in search of small water-animals, spawn, and dead carcasses. It is also certain that the eel often leaves the water, especially when grass meadows are overflowed or wet with dew, and travels by night over the moist surface in search of food; its small external gill-aperture helps it to remain some time without water. In cold weather it hides itself in the mud. The mystery concerns its life-history, which as yet is somewhat uncertain. The sexes are separate, and the reproduction oviparous. In autumn some of the larger females migrate seawards, while others probably remain in the rivers in winter somnolence. The migrating females meet the males at the river mouths or in the sea, and there the reproduction apparently takes place. In spring the female young migrate up the rivers in large persevering shoals, overcoming all obstacles, such as flood-gates. The flesh of the eel is eaten, both fresh and preserved. They are caught by eel-spears, eel-pots, baskets, and in various other ways. In the blood of Anguilla, Muræna, and Conger, which is scantier than in most fishes, there is a powerful poison. The blood is exceedingly acrid to the taste, and though rapidly fatal when injected under the skin, is not markedly injurious in the stomach. The virulence of the poison is destroyed by heat.

The genus Muræna includes a large number of marine species, mostly well coloured, some of great length (6 feet), and with formidable biting powers. One widely distributed species (*M. helena*) was highly prized by the Romans, and is still fished. The genus Conger (q.v.) is separately discussed. Muræsesox, Myrus, and Ophichthys are other important genera within the family Murænidæ.—The Electric Eel (*Gymnotus electricus*) belongs to a different though adjacent family (see ELECTRIC FISHES). The sand-eels (*Ammodytes*), which are

Sand-eel or Sand-launce (*Ammodytes lancea*).

often sought for bait, and are familiar to shore-wanderers, belong to quite a different set of bony fishes, and are also called *launce*. They are allied to the cods, and classified in the Anacanthini order. The marvellous adroitness with which they jerk themselves about in a pool, making use of the slightest cover of sand, is often admired.

A superstition has lingered through many centuries, finding typical expression in the works of Albertus Magnus, and repeated to-day in the experiments of country schoolboys, that horse-hairs left to soak in the brook grow into small eel-like animals. The fact at the root of this fancy is the frequent and sudden appearance of one of the Nematodes—the horse-hair worm.

The so-called 'eels' in paste, vinegar, fermenting and decaying substances, or stagnant water, are minute threadworms or Nematodes, often belonging to the genus Anguillula. Their bodies have the usual threadworm shape, and are almost transparent, though with thick cuticle. The rate of multiplication is very rapid; both eggs and adults have considerable power of reviving after Desiccation (q.v.). Adults have been known to reawaken after a maximum desiccation of fourteen years. See ASCARIS, NEMATHELMIA, THREADWORMS, &c.

Eel-pout, a name given in some parts of England to the Burbot (*Lota vulgaris*), and on some parts of the Scottish coast to the Viviparous Blenny (*Zoarces viviparus*).

Effen'di, a title of respect among the Turks, bestowed upon civil officials, and upon educated persons generally, in contradistinction to the military title of Aga. It is nearly equivalent to the French Monsieur, but is suffixed to the personal name.

Effervescence. Nearly all gases are more or less soluble in water, the amount of solubility depending on various conditions of pressure and temperature. As a rule, the lower the temperature and the greater the pressure, the greater is the solubility of a gas, so that when the temperature of such a solution is raised, or the pressure lowered, the gas escapes in small bubbles, giving rise to the phenomenon of effervescence. The most familiar instance of effervescence is when a bottle of soda-water is uncorked, the excess of carbonic acid gas over what can remain in solution escaping with effervescence. Again, when a seidlitz powder is mixed with water, effervescence occurs, owing to the inability of the water to retain the gas in solution. Many slight circumstances affect effervescence. Most people know that by stirring a glass of soda-

water, or by dropping into it a fragment of cork or a crumb of bread, greater effervescence occurs. Sometimes the liquid is rather viscid, and a persistent froth is produced, as when a siphon of lemonade is discharged into a tumbler. In such a case, the addition of a few drops of milk or of a little alcohol causes more rapid effervescence and settling of the froth. In the former of these cases, the bread crumb or the stirring acts by making it more easy for the gas to form bubbles and escape. In the latter case, the effect of milk may have a twofold cause, one similar to that of the crumb, the milk globules acting as nuclei; the other similar to the calming influence of oil on sea foam, the natural oil, butter, here coming into play. The alcohol merely acts by thinning the liquid.

Efflorescence, in Chemistry, is the term applied to the appearance of a white incrustation on the surface of certain bodies, as when a salt loses its water of crystallisation, and presents a white powdery appearance on the surface. Common washing-soda exposed to the air affords a good illustration of this phenomenon.

Eft (A.S. *efeta*, 'lizard'), synonymous with Newt (q.v.), a combination of the same root with the *n* of a prefixed *an* (*an-eft*, *an-ewt*).

Egalité. See ORLEANS (DUKES OF).

Egan, PIERCE (1772–1849), was the author of many works, including *Boxiana* and *Life in London*. The last, which Thackeray has immortalised in one of his *Roundabout Papers*, owed much to its coloured illustrations by the brothers Cruikshank.—His son, PIERCE EGAN the younger (1814–80), wrote innumerable novels for *Reynolds' Miscellany* chiefly and the *London Journal*.

Egbert, king of the West Saxons, was the son of Ealhmund, who bore rule in Kent, and was a descendant of the House of Cerdic. For his laying claim to the West Saxon kingship after the death of Cynegils (786), he was obliged by his more powerful rival, Beorhtric, to flee to the court of Charlemagne, whence he returned in 802 to fill the throne of Wessex. England was at this time divided into three great sovereignties: Northumbria, extending over what were occasionally the separate kingdoms of Deira and Bernicia; Mercia, which had now subjugated the petty powers of Kent, Essex, and East Anglia; and Wessex, which had absorbed Sussex. For his first twelve years Egbert reigned in peace; then followed a war with the West Welsh (Cornish), and a struggle with the Mercians, of which the turning-point was the great victory of Ellandune (probably near Winchester), and which ended in his being recognised as over-lord of that kingdom. In 829 the Northumbrians also, overawed by his army, accepted him as their suzerain, and thus Egbert became the first real king of England, although he did not formally assume that style, and continued to govern Mercia through its own king. Kent he bestowed upon his son Ethelwulf in 828, and did much to strengthen his own power by increasing the influence of the see of Canterbury. In his last years he had to struggle with a new and terrible enemy in the Scandinavian pirates, who began to harass the coasts. In 835 Egbert was defeated in a great battle in Dorsetshire, but in 837 he defeated, in a great battle at Hengestdune near the Tamar, a huge northern host allied with West Welsh insurgents. Egbert died in 839, having reigned thirty-seven years.

Egedé, HANS, the apostle of Greenland, was born in Norway in 1686, studied theology in Copenhagen, and was appointed pastor of Vagen in Norway in 1707. Having determined to proceed to Greenland to convert the natives, he resigned his cure in 1717, and four years later, after a preliminary study of the language, embarked for Greenland, with his wife, two sons, and some companions, in all forty-six persons. He remained fifteen years in Greenland, during which time he laboured zealously among the people, and by his preaching and teaching secured a permanent footing there for the Christian mission, which owed its origin to him. Latterly some Moravian missionaries invaded his province, with whom Egede failed to agree. The death of his devoted wife, Gertrude Rask, in 1736 drove him from Greenland, but at Copenhagen he was busy promoting the cause of the Greenland mission, of which in 1740 he became superintendent or bishop. He died 5th November 1758. He has described the course and success of his labours in *Det gamle Grönland's nye Perlustration* (Copenhagen, 1729 and 1741).—His son, POVEL EGEDE, born in Norway in 1708, succeeded his father in Greenland, and, as bishop, completed in 1766 the translation of the New Testament into the language of Greenland begun by his father, and prepared also a catechism (1756) and a prayer-book (1783) in the same tongue. He died at Copenhagen in 1789.

Eger, a town and river of Bohemia.—(1) The town stands on the right bank of the Eger, 66 miles NW. of Pilsen by rail, and near the Bohemian frontier. It was formerly a border fortress of some importance, but its fortifications were razed in 1809; it is now the chief railway centre in north-west Bohemia. The ruins of the imperial burg or citadel consist of a square black tower, a chapel (in the Romanesque and early Gothic style), and part of the great hall. The inhabitants of Eger (18,658 in 1890) carry on considerable trade and various industries, weaving, brewing, shoemaking, &c. In the town-house Wallenstein was murdered on 25th February 1634. Eger was taken by the Swedes in 1631 and 1647, and by the French in 1742.—(2) The river Eger rises 12 miles NW. of the town of Eger, in the Fichtelgebirge, at an altitude of 2362 feet, and flows in a general east-north-east direction, joining the Elbe opposite Leitmeritz, after a course of 190 miles. It is not navigable, owing to its falls and the boulders that obstruct its channel; but it abounds in fish.

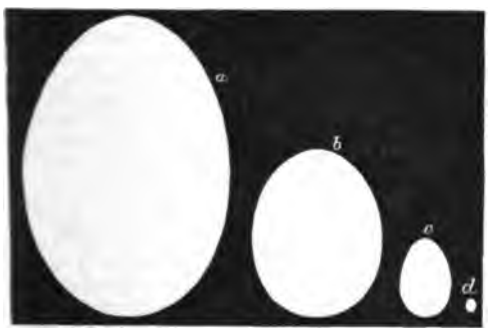
Egerdir, a small town of the vilayet of Konieh, Asia Minor, gives name to a beautiful fresh-water lake, 30 miles in length, lying between the Sultan Dagh and the northern offshoots of the Taurus Mountains.

Egeria, the Nymph or Camena from whom, according to the legend, King Numa received the ritual of public worship which he established in Rome. The grove where Numa met his mistress to receive her instructions was dedicated by him to the Camenæ. Roman legends speak of two groves dedicated to Egeria—one near Aricia, the other before the Porta Capena at Rome, where the grotto of Egeria is still shown.

Egg, the female reproductive cell from which the embryo is developed—a process which, in all but parthenogenetic animals (see PARTHENOGENESIS), begins only after fertilisation by the male sperm. Using the word as equivalent to ovum, we may talk with equal accuracy of the egg of any animal, whether sponge, butterfly, fish, bird, or elephant. The essential part of the ovum is generally minute, and the entire element often so remains, alike in the lowest and the highest animals; the presence of extrinsic material, however, often makes the egg large and conspicuous. The most important and frequent extrinsic addition is the yolk, which serves as nutritive capital for the embryo or young animal. Next in importance are the various sheaths which surround the egg, especially

when the outermost of these forms a chitinous, horny, or limy shell. Gristly fishes, reptiles, and birds afford very good examples both of abundant yolk and firm shells. We commonly associate eggs with (oviparous) animals which bring forth their young in that form, but this is a question of degree, for oviparous and viviparous forms often occur among nearly related animals; the common ringed snake, which usually lays eggs, may be artificially induced to bring forth its young alive, and even among mammals, where the connection between mother and offspring is characteristically intimate and prolonged, the two lowest genera (see ORNITHORHYNCHUS and ECHIDNA) are oviparous. For technical details in regard to the egg, the reader is referred to the articles BIRD, CELL, EMBRYOLOGY, and REPRODUCTION; attention will be directed here only to four points—size, shell, colouring, and economic interest, all with special reference to the eggs of birds.

Size of Egg.—The accompanying diagram shows the striking contrast in relative size between the



eggs of four birds—the extinct moa, *a*, the ostrich, *b*, the hen, *c*, and a humming-bird, *d*. A moa's egg has been found measuring 9 inches in diameter, 12 in length, 27 in circumference. Ernst Krause mentions, in his most vivid of all general natural history books, that in the 17th century the inhabitants of Madagascar used to come to the Île de France to buy rum, which they received in great vessels formed from the egg-shells of the extinct Æpyornis. These shells, some of which are to be seen in European museums, measure 3 feet in circumference, and hold over 2 gallons—i.e. some six times as much as an ostrich egg, or 150 times as much as a fowl's. In contrast to the above, the weight of the humming-bird's eggs is computed in grains. (Of European birds, the largest are those of the swan, the smallest those of the golden-crested wren.) It is not in birds alone that we find striking contrasts in the size of eggs; those of a skate contrasted with those of a salmon illustrate a striking difference. The difference in the size of eggs means a difference in the amount of yolk and other extrinsic substances present, but what conditions this difference is a difficult question. The size of the egg can only be said to be generally proportionate to the size of the bird, thus the cuckoo is much larger than the lark, but the eggs of the two are about the same size; the guillemot and the raven are of about equal size, their eggs vary as ten to one; and many other examples of disproportion might be given. Hewitson has noted that the eggs of birds whose young are rapidly hatched and soon leave the nest are large. Professor Newton remarks that 'the number of eggs to be covered at one time seems also to have some relation to their size.' From what one notices in the poultry-yard, and from comparing the habit of different birds, it seems probable that a highly nutritive, sluggish bird will have larger eggs than one of more active habit and sparser diet.

The *shell* varies in composition in different classes. That of insects is chitinous (see CHITIN), of gristly fishes horny; a varying amount of lime is always present in reptile eggs, and predominates of course in birds. A bird's egg-shell consists almost wholly of carbonate of lime, but there is a little phosphate of lime and both salts of magnesia. Mr Irvine of Granton has made the interesting experiment of keeping fowls entirely without carbonate, allowing them only other salts of lime; the result was, however, that a normal carbonate of lime shell was still formed. The exact mode of formation of the limy shell is obscure; one can say little more than that the shell is secreted round the egg by the walls of the uterus or lower part of the female duct. In shape the egg is generally oval, but may be almost spherical, as in the kingfisher and owl; or pear-shaped, as in some of the auk family; or even doubly conical, as in the grebe. In its surface texture the shell varies greatly, enamel-like in the kingfisher, oily in the ducks, pitted in some of the ostrich order, rough and incrusted in pelicans. Less conspicuous, but apparently to some extent characteristic of different families, is the minute structure of the shell.

Colour.—During the formation of the shell in the lower part of the oviduct of the bird, pigment is also deposited. This occurs at various stages, producing the ground colour, the deeper, and the more superficial markings. The spots are normally circular, and most abundant on the anterior, larger, 'head' end, which first protrudes. As the egg is moved onwards, rubbing against the walls of the duct, the spots become in varying degrees blotched and diffused. The pigments themselves are numerous (Mr Sorby distinguishes seven), and are allied to the red colouring matter of the blood and to the pigments of the bile. Thus two of the most important, oörhodein and oöcyan, are allied, according to Sorby, to hæmoglobin and bile-pigment respectively. See PIGMENTS.

The real import of the pigment cannot be said to be understood. The coloration varies in a single nest, and sometimes widely in a species. In quantity and quality the pigments change with the constitution of the bird, and Professor Newton inclines to the opinion that the richest coloration is produced by birds at their prime. In eggs which are much exposed, like those of some marine birds, a bleaching action can be detected, and M'Aldowie has recently maintained that the colouring varies in direct ratio to the amount of light to which the eggs are exposed. One of the most interesting facts in connection with the colouring of birds' eggs is their frequent similarity to their surroundings. Conspicuous eggs are usually in covered nests; and where the nests are rude and unconcealed, the eggs are very often like the colour of the ground. The advantage of this is obvious, but the mode in which the advantage would operate so as to establish specific colours is far from clear. Mr A. H. S. Lucas, in discussing how the colouring comes to be protective, considers that the effect of the surroundings, during the time of the formation of the shell, upon the mental or nervous constitution of the mother-bird, is a very important factor.

Economic Import.—As the eggs of birds contain all the essentials for the nutrition of a young animal, they form, like milk, a highly nutritious diet for adult organisms. The contained albumen, fat, lecithin, and phosphates are all advantageous; and it need hardly be said that both man and animals are well aware of this fact (see POULTRY). The shells are occasionally turned to account—e.g. those of ostriches, for decorative purposes.—The enthusiasm for egg-collecting, shared by so many

naturalists, has probably not been equalled in any other department of natural science. Only a few quests, such as that for the eggs of the birds of paradise, have baffled the perseverance of collectors. The high prices paid for some treasures—e.g. the eggs of the great auk (£225 was paid for one in 1888) are only surpassed by those of some mollusc shells. This so-called sub-science of 'oölogy' has not, of course, been prosecuted without results of interest both in regard to the classification and general life of birds, but inquiry has largely passed from the collection and contemplation of egg-shells to the investigation of the embryo, and the deeper penetration has been richly rewarded. For some further particulars as to the egg-trade, imports of eggs into Britain, &c., see POULTRY.

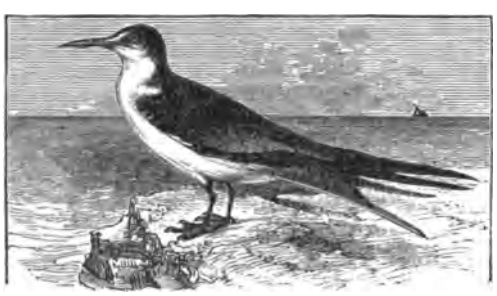
Brewer, *North American Oölogy* (Washington, 1859); Cassell's *Book of Birds;* Hewitson, *Coloured Illustrations of the Eggs of British Birds* (3d. ed. Lond. 1856); Lucas, *Trans. Roy. Soc. Victoria*, xxiv. (1888); M'Aldowie, *Jour. Anat. Phys.* xx. (1886); Newton, article 'Birds,' *Encyclo. Brit.;* Sorby, *Proc. Zool. Soc.* (Lond. 1875); Carus Sterne (Ernst Krause), *Werden und Vergehen* (3d. ed. Berlin, 1886); Thienemann, *Fortpflanzungsgeschichte der gesammten Vögel* (Leip. 1845-56); Wolley, *Oötheca Wolleyana* (Lond. 1864). See articles AUK, EIDER, OSTRICH, &c.

Egg. See EIGG.

Egga, a trading town of Upper Guinea, in the kingdom of Gando, on the Niger, with a pop. of 10,000 to 15,000. Pottery, iron, gold, and wooden wares, thick cloth, generally dyed blue, and leather are manufactured, and an active river trade is carried on, especially in ivory.

Eggar Moth, the name of certain species of moth, of the genus Lasiocampa or Gastropacha, allied to the silkworm moths. The Oak Eggar (*L.* or *G. quercus*) is common in England, of a chestnut to yellow colour, with a black caterpillar. The males are said to be readily decoyed by a captive female. The Lappet Moth (*G. quercifolia*) is another well-known species, less frequent in Britain. The Lackey Moth (*G.* or *Clisiocampa neustria*) is a smaller form, with gorgeous blue, red, and yellow striped, gregarious caterpillars.

Egg-bird, or SOOTY TERN (*Sterna fuliginosa*), in the gull family, famous for its edible eggs and breeding societies or 'wide-awake fairs.' It abounds in the West Indies, and Ascension Island is one of its most frequented breeding-places. The adults have beautiful black and white plumage, but the young are of a light sooty colour. The



Egg-bird (*Sterna fuliginosa*).

nests are rough excavations, and there appears to be usually only one egg. This is of a pale-cream colour, sparsely marked with light-brown and purple tints. They are much valued, and the gathering of them in the spring months forms an important West Indian industry. Those of the Noddy (q.v.), of the Sandwich Tern, and other species are also gathered and eaten. See TERN.

Egg-plant (*Solanum melongena*), a species of Solanaceæ, a native of Northern Africa, whose plant grows to a height of two feet; in Britain it is a greenhouse annual. The egg-like fruit known as Egg-apple, Aubergine, &c., is a favourite article of food in the East Indies, and has thence been introduced to most warm countries. It varies in size from that of a hen's egg to that of a swan's egg, or larger, in colour from white or yellow to violet. Egg-plants are much grown in the United States, where 'Jew's-apple' is one of the names for the fruit.

Egham, a village of Surrey, on the right bank of the Thames, 8 miles SSE. of Windsor, and 21 W. of London. In the vicinity are Runnymede (q.v.), Cooper's Hill (q.v.), and the Royal Holloway College for Women, opened by the Queen in 1886. Pop. of parish (1881) 8692; (1891) 10,187.

Egina. See ÆGINA.

Eginhard, or EINHARD, the biographer of Charlemagne, was born in Mainyau, in East Franconia, about 770, and on account of his ability was sent at an early age to the court of Charlemagne, where he became a pupil of Alcuin, and ere long a favourite of the emperor, who appointed him superintendent of public buildings. His artistic skill earned him the scriptural name of *Bezaleel* (Exod. xxxi. 2), and to him have been ascribed the building of the bridge at Mainz, the royal palaces at Ingelheim and Aix-la-Chapelle, and the basilica in the latter city. Eginhard accompanied the emperor in all his marches and journeys, never separating from him except on one occasion, when he was despatched on a mission to Pope Leo. Louis, the successor of Charlemagne, continued his father's favour to Eginhard, and appointed him preceptor of his own son Lothair. For years afterwards he was lay abbot of various monasteries, but ultimately becoming tired of court life, he retired with his wife Emma to the secluded town of Mühlheim, the name of which he changed into Seligenstadt, having built a church there to contain the bones of St Marcellinus and St Peter. Here he died, 14th March 840, and was buried beside his wife, who had died four years before. The two coffins are now shown in the chapel of the castle at Erbach, the counts of which trace their descent from Eginhard.

His *Vita Caroli Magni*, completed about the year 820, with respect to plan and execution, as well as language and style, is incontestably the most important historical work of a biographical character that has come down to us from the middle ages. It was frequently used as a schoolbook, and was therefore copied *ad infinitum*. The best editions are those of Jaffé (1876) and Holder (1882). An English translation by W. Glaister appeared in 1877. Of Eginhard's valuable *Epistolæ*, sixty-two in number, the French edition of his works by Teulet, with a translation and life (1848), is the best and most complete. Eginhard's *Annales Francorum* embraces the period from 741 to 829. A fine legend, unhappily without foundation, makes Eginhard's wife Emma a daughter of Charlemagne. A mutual affection had arisen between them, and once when the lovers had met secretly by night, a sudden fall of snow covered the spacious court, thus rendering retreat impossible without leading to a discovery. A woman's footprints could not excite suspicion, so Emma carried her lover across the court on her back. This scene was observed from a window by Charlemagne, who united the affectionate pair in marriage. On this legend Fouqué founded his play of *Eginhard and Emma*, and Longfellow has made it the subject of one of the *Tales of a Wayside Inn*. See Varn-

hagen's monograph on the sources of those tales (Berlin, 1884), and Bacha's *Étude* (Paris, 1888).

Eglantine, the old and poetic name of the Sweet Briar (*Rosa rubiginosa*), is also sometimes applied to other of the smaller-flowered species of rose—e.g. *Rosa lutea*. The earlier English poets seem to have given the name to any wild rose: Shakespeare means by it sweet briar; Milton seems to confound several quite distinct plants (honeysuckle, &c.) under this name; which has of late been bestowed on the Australian hardy evergreen *Rubus eglanteria*.

Eglinton and Winton, Archibald William Montgomerie, Earl of, K.T., twice Lord-lieutenant of Ireland, was born at Palermo in 1812. By male descent a Seton, he was also the representative of the Anglo-Norman family of Montgomerie, one of whose members settled at Eaglesham, in Renfrewshire, about 1157. Alexander de Montgomerie, lord of that ilk, was created a baron of parliament about 1455, and the family was further ennobled by the creation of Hugh, Lord Montgomerie, as Earl of Eglinton in 1506. The direct male line of the Earls of Eglinton terminated in Hugh, the fifth earl, who died in 1612, when his titles and estates passed to Sir Alexander Seton, third son of the daughter of Hugh, third Earl of Eglinton, who married Robert, first Earl of Winton. In 1840 Lord Eglinton was served heir-male of George, fourth Earl of Winton, a title which had been forfeited on account of the participation of the fifth earl in the rebellion of 1715. This forfeiture, according to law, affected all heirs entitled to succeed under the same substitution with the forfeited earl, but these being extinct, it could not affect the right of a collateral heir, which Lord Eglinton was. He therefore assumed the title of Earl of Winton, which was confirmed to him by patent in 1859, giving him that dignity in the peerage of the United Kingdom. He was a well-known patron of the turf and field-sports, and his name is associated with a splendid reproduction of a medieval Tournament (q.v.), which he gave at Eglinton Castle in 1839. Amongst the knights there was Prince Louis Napoleon, afterwards Napoleon III. Lord Eglinton, who was at various times Lord-lieutenant of Ayrshire, Lord Rector, and Dean of the Faculty of Glasgow University, &c., died 4th October 1861. See Sir William Fraser's *Memorials of the Montgomeries* (2 vols. 1859).

Egmont, Lamoral, Count of, Prince of Gavre, was born in the castle of La Hamaide, in Hainault, in 1522, and inherited his property and titles on the death of his elder brother Charles. He accompanied Charles V. on his expedition against Algiers in 1541 and in all his later campaigns, married with great splendour the sister of the Elector Palatine at Spires in 1545, was invested with the Golden Fleece, and in 1554 was sent to England in an embassy to ask for Philip the hand of Mary. He led the cavalry with brilliant courage at St Quentin (1557), and next year at Gravelines, for which he was nominated by Philip governor of Flanders and Artois. He now entered into alliance with the party in the Netherlands that were dissatisfied with the Catholic policy of Philip, and from a courtier became all at once a hero of the people. His proud, imperious character, however, and his subsequent conduct, have led some historians to suppose that in this he was less actuated by high motives than by self-interest, or at least by disappointed ambition. Yet the more common opinion is, that he was a humane and virtuous patriot, who, although indifferent to Protestantism as a religion, was anxious to do justice to all the members of that oppressed faith. When Margaret, Duchess of Parma, against the will of the Protestant party, was made regent of the Netherlands, Egmont and the Prince of Orange entered the council of state, and held the command of the few Spanish troops. At first he sided with the party who were discontented with the infringement of the liberties of the provinces and the introduction of the Inquisition; but when insurrections took place, he at last broke with the patriotic Prince of Orange and the 'Beggars' League,' as it was called. He seemed to have restored order, and to be maintaining it, when, in April 1567, the Duke of Alva was sent as lieutenant-general to the Netherlands. The Prince of Orange and other chiefs of the insurrection left the country; Egmont, wishing to save his private property, remained, thinking his return to the policy of the court had secured his safety. When Alva entered Brussels, 22d August, Egmont went to meet him, and sought to secure his favour by presents. He appeared to have gained his confidence, when suddenly, after a sitting of the council, he and Count Horn were treacherously seized, and carried to the citadel of Ghent. The states of Brabant sought to withdraw Egmont from the Bloody Tribunal, as it was called, instituted by Alva, and Egmont himself, as a knight of the Golden Fleece, denied its competency. But neither this nor the pleading of his wife—the mother of eleven children—could move the stony heart of Alva. Egmont was charged with over eighty counts of accusation; and as he persisted in protesting against the incompetency of the court, and thus left many points unanswered, he was held guilty of contumacy, and along with Count Horn, condemned to death. On the following day, June 5, 1568, although Egmont hoped for pardon to the last, and intercession was made for him from the highest quarters, they were both beheaded in the market-place of Brussels. He met his death with the most heroic courage. All his faults were forgotten in the cruel injustice of his fate, and his memory has gone down into history glorified with the aureole of the patriot and the martyr. A monument to him was erected at Brussels in 1865; a more enduring memorial is Goethe's noble tragedy.

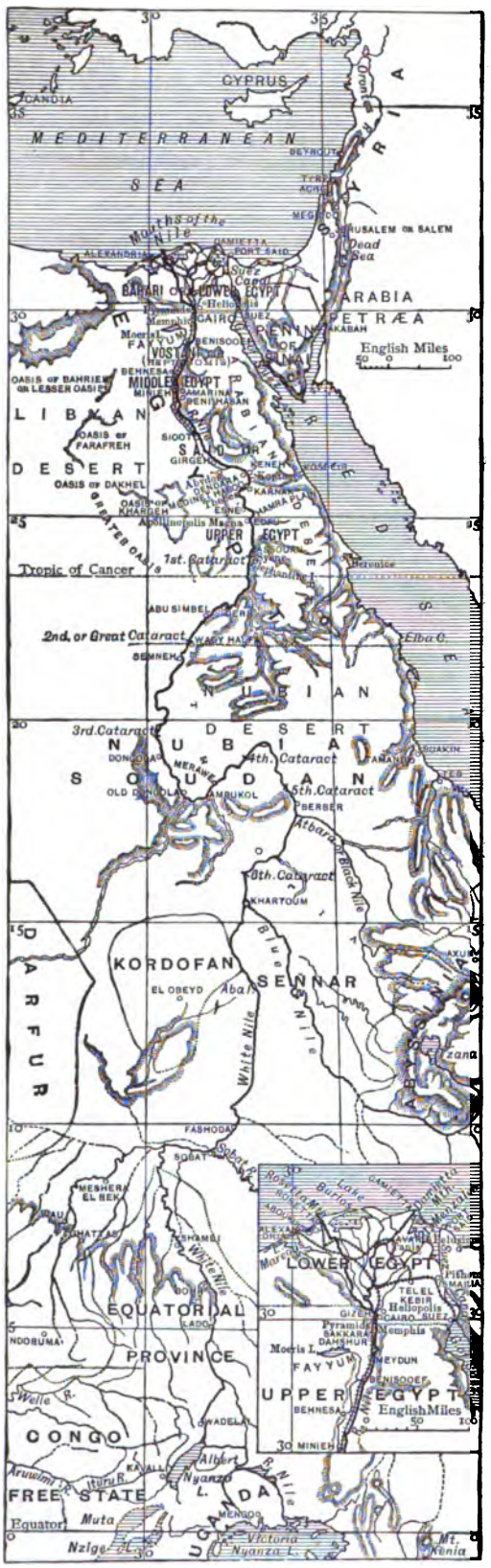
See *Correspondance de Marguerite d'Autriche, Duchesse de Parma* (1842), and *Correspondance de Philippe II. sur les Affaires des Pays-Bas* (1848–52); Juste, *Le Comte d'Egmont et le Comte de Hornes* (1862); and Motley's *Rise of the Dutch Republic*.

Egoism (Fr. *égoisme;* Lat. *ego*, 'I'), an ethical term used in the sense of selfishness; it is specially opposed to Altruism (q.v., and see Ethics). The word is sometimes used to denote a metaphysical system of subjective idealism, in which the Ego is the sole reality (see Fichte).—*Egotism*, also derived from Lat. *ego*, is used rather in the sense of self-conceit, a tendency to refer constantly to one's self, and quote one's own authority.

Egremont, a market-town of Cumberland, on the river Eden, 6 miles SE. of Whitehaven, whither it sends by rail the iron ore mined in the neighbourhood. On an eminence to the west stand the ruins of Egremont Castle, the legend of whose horn forms the subject of a poem by Wordsworth. From 1749 till 1845 Egremont gave the title of Earl to the Wyndham family. Pop. (1881) 5976; (1891) 6273.

Egret. See Heron.

Egypt, a country in North-east Africa, extending from the Mediterranean to the first cataract of the Nile at Assouân, from 24° 6′ to 31° 36′ N. lat. The name is derived from the Greek *Aigyptos*, perhaps a transliteration of *Hakeptah*, 'the city of Ptah'—i.e. Memphis, or formed from the Sanskrit root *gup*, 'to guard,' as *âgupta*, 'guarded about.' In Hieroglyphics and Coptic, it was called *Kemi*



(Black Land), from the colour of the soil; and by the Hebrews *Mazor*, 'guarded' or 'fortified' (in the singular—i.e. Lower Egypt), or *Mizraim* (in the dual—i.e. Upper and Lower Egypt, but also used as a singular), modified by the Assyrians into *Musr*, and by the Persians into *Mudraya*. The name is still preserved in the Arabic *Misr* (vulgarly *Masr*), a word applied alike to the country and its capital, Cairo. Egypt is literally, what Herodotus termed it, 'the gift of the Nile,' *dôron tou potamou*; for it extends only so far as the annual inundation of the river spreads its layer of alluvial sediment, brought down from the washing of the Abyssinian mountains, turning the barren rock into cultivable soil, and then retreating to its normal limits, leaving the rich deposit to the influences of sun and air and human labour. Geologically and ethnologically, Egypt is confined to the bed of the flooded Nile, a groove worn by water in the desert; and the bordering deserts and the southern provinces of Nubia, Khartoum and the rest, towards the equator form no part of the Egypt of nature or of history, though from time to time they have been politically joined to it. Thus limited, Egypt occupies little more than 11,000 sq. m., or about a third of the area of Ireland.

The Nile after breaking through the rocky barrier at Assouân, pursues a northerly course, varied by only one considerable bend near Thebes, until, a few miles north of Cairo (30° 15′ N. lat.), it divides into two main streams, terminating in the Rosetta and Damietta mouths, through which, after a course of 3300 miles, it pours during 'high Nile' some seven hundred thousand million cubit metres daily into the Mediterranean Sea. The other five mouths which existed in antiquity have silted up; and the triangular or Δ-shaped district inclosed by them, and supposed by the ancients to have been recovered from the sea, formed the Delta, now called Lower Egypt. The basin of the Nile is bounded by the smooth rounded ranges of the Arabian hills (which, like the so-called Arabian desert, are not in the Arabian peninsula, but in Egypt, between the Nile and the Red Sea) on the east, and the Libyan on the west, neither rising as a rule higher than 300 feet above the sea-level, though in rare cases, as near Thebes, the eastern hills attain an altitude of 1200. The general appearance of the valley is thus described: 'In the centre the brown-toned river, turning reddish when swollen by the rains of the inundation; higher up on either side, but chiefly on the western, the bright green fields of waving corn, or beans, or lupin; then a border, still higher, of dusky barren rock; and then the slopes of the deserts—the long red and yellow and gray ridges of sand and limestone rock, generally low and tame in outline, and lying at some distance back from the river, but sometimes closing even to the very bank in bold headlands, scored by torrent-beds where water rarely flows, and then shearing away to the distance of several miles, and leaving a wide level plain of cultivable land' (Lane-Poole, *Egypt*). One great physical peculiarity of Egypt is the general absence of rain; occasional showers have indeed become more frequent of late years, but the land still depends for irrigation upon the annual overflow of the Nile. The climate is remarkably mild, especially south of the Delta and in the desert; from Cairo to Alexandria the air contains more moisture and is less salubrious, while the Mediterranean coast is subject to rain, and infected by the belt of salt-marshes. Everything in the Egyptian climate proceeds with regularity, even the winds. From June till February cool northerly winds prevail, the Etesian breezes that waft the traveller's dahabîya up the Nile; then till June comes a period of easterly, or, still worse, hot southerly sand-winds called the *Khamâsin*, or 'Fifties' (as blowing fifty days).

The simoom is a violent sand-wind, commoner in the desert than in the valley, but rare anywhere. Earthquakes are occasionally felt; and the temperature in winter in the shade averages 50° to 60° F., and in the heat of summer 90° to 100° in Lower Egypt, 10° higher in the upper valley. The most remarkable phenomenon is the regular increase of the Nile, fed by the fall of the tropical rains, which commence in 11° N. lat. in the spring, and falling first into the White, and then into the Blue Nile, reach Egypt in the middle, and the Delta at the end, of June. In the middle of July the red water appears, and the rise may be dated from that time; it attains its maximum (an average rise of 36 feet at Thebes, of 25 at Cairo) at the end of September, and begins to decline visibly in the middle of October, loses half its height by January, and subsides to its minimum in April. By the end of November, the irrigated land, over which the water has been carefully equalised by drains and embankments, has dried and is sown; soon it is covered with green crops, which are reaped in March. The state of the Nile, in fact, marks the season more accurately than the variation of temperature. Except in the dry air of the valley and desert, Egypt is by no means remarkably healthy; in addition to occasional visitations of plague and cholera, ophthalmia, diarrhœa, dysentery, and boils prevail, and European and even Nigritic races are with difficulty acclimatised. With prudent modifications of our modes of life, however, English people, even young children, thrive well in most parts, and for certain classes of invalids, for instance consumptives, the desert air is wonderfully recuperative.

Geology.—Egypt is separated from Nubia by a low hilly region about 50 miles broad from north to south, composed of granitic rocks. The same crystalline rocks extend up the shore of the Red Sea to near the opening of the Gulf of Suez, stretching inland for fully 30 miles. The scenery in this district is wild and rude, and the course of the Nile is frequently interrupted by cliffs and broken masses of granite, which form striking cataracts. The granitic region terminates at Assouân, the ancient Syene, whence most of the materials for the colossal monuments of Egypt were procured. The Arabian and Libyan ranges, on the right and left of the river, are alike composed of cretaceous strata, the predominant rock being sandstone, which is durable and easily worked, and was therefore extensively used in the erection of ancient temples, pyramids, and tombs. The cretaceous sandstone extends from the granitic rocks forming the first cataract at Assouân for about 85 miles to Esné, where it is covered by a limestone belonging to the upper chalk series. This continues on both sides of the valley for about 130 miles, when it is covered by a tertiary nummulite limestone, which forms the further prolongation northward of both ranges of hills. The easy disintegration of these beds renders the scenery in the limestone districts tame and monotonous; frequent tablelands occur, on one of which are built the three pyramids of Gîzeh (q.v.), the material employed being the predominant limestone.

Over a large extent of Egypt these rocks are covered with moving desert sands, and in the flat lands bordering the Nile they are coated to a depth of about 30 feet (at the river's bank, thinning away towards the desert) with the alluvium brought down by its waters, which has formed the Delta at its mouth. This alluvium consists of an argillaceous earth or loam, more or less mixed with sand, and a quartzose sand probably derived from the adjacent deserts by violent winds. It is remarkable that this sedimentary deposit has no traces of stratification, and also that within short distances great variety is observed in what are apparently synchronous deposits. The increase of the deposit is estimated at about 4½ inches in a century. The rocks of Egypt afforded the stones used in its edifices and sculptures; granite, syenite, basalt (from Assouân), breccia diorite, verde antique, and fine red porphyry (from the mountains in the Arabian desert), sandstone and limestone (from the hills bordering the Nile), and alabaster (from Tell-el-Amârina). Emeralds, gold, silver, and copper, were formerly found near the Red Sea; and salt, natron, and—since 1850—sulphur are still among the mineral products of Egypt.

Natural History.—The signal peculiarity of the vegetation of the Nile Valley is the absence of woods and forests. Even clumps of trees (except palms) are rare, though some have been recently planted. The Pharaohs got their timber chiefly from the Lebanon, and modern Egypt is supplied from the forests of Asia Minor. The date and the doom palm, the sycamore, acacia, tamarisk, and willow are the commonest trees; the myrtle, elm, and cypress are rarer; the mulberry belongs to Lower Egypt. Among fruit-trees, the vine, fig, pomegranate, orange, and lemon abound; apricots, peaches, and plums are of poor flavour; Indian figs (prickly pears) and bananas have been naturalised; and water-melons are at once the meat and drink of the people in the hot days. Of flowers, the celebrated lotus, or water-lily, has supplied many ideas to Egyptian architects.

The lack of jungle or cover of any sort accounts for the poverty of the Egyptian fauna. The hyæna, jackal, wolf, fox, hare, rabbit, jerboa, lynx, ichneumon, and weasel are common enough; the antelope is the chief quarry; the wild ass and wild cat are almost extinct; and the crocodile, like the hippopotamus, scared by European rifles, is beating a retreat to the tropics. The ordinary beasts of burden are the ass and camel; the latter is always one-humped, and, like the draught buffalo and the horse, is an importation unknown to the ancient Egyptians prior to the 18th dynasty. The short-horned cattle, famous from the time of the Pharaohs, are seldom killed by the natives, and mutton is the staple butcher-meat in Egypt; goats also are common. The dog is considered unclean by Mohammedans, and is used merely as a scavenger and watch-dog. Of domestic birds, water-fowl were anciently the most numerous, and still abound; the small gallinaceous poultry we now see are probably not of older date than the Persian invasion. Pigeons have always been abundant. There are three or four varieties of vulture; eagles, falcons, hawks, and kites are common, as is also the Ibis (q.v.), conjecturally identified with the sacred ibis of which many fables have been related. The ostrich is sometimes seen in the desert. Of reptiles, besides the vanishing crocodile, lesser saurians—chameleons and lizards—abound. The trionyx, or soft tortoise, is plentiful in the Nile. Serpents are numerous, and among these the dreaded cobra and the Cerastes (q.v.). The Nile is full of fish, generally of rather poor flavour; the best are the binny (see BARBEL), the bulty, the latus (one of the perch family), and the bayad or silurus. The Sacred Beetle (*Scarabæus sacer*) is one of the most remarkable insects. The scorpion's sting is sometimes fatal, and dangerous spiders (*solpuga*, erroneously called tarantulas by Europeans), to say nothing of minor insect pests, and locusts, remind us that the Plagues of Egypt are not merely ancient history.

Egypt is essentially an agricultural country, and in some parts, by the aid of regulated artificial irrigation, the rich alluvial deposit will bear three crops in the year. Wheat is the chief cereal; but

barley, maize, durra, beans, lentils, clover, &c. are also largely grown, with very little trouble beyond the management of the water. The extensive culture of papyrus, which anciently supplied material for paper, has in modern times been superseded by that of the sugar-cane, cotton, indigo, and tobacco.

Divisions.—In ancient as in modern times Egypt was always divided into the Upper and the Lower, or the Southern and the Northern, country; and at a very early period it was further subdivided into a number of *nomes*, or departments, varying in different ages; forty-two was probably the usual number. A third great division, the *Heptanomis*, or seven nomes, preserved in the modern 'Middle Egypt' (*Wustâni*), was introduced at the time of the geographer Ptolemy. Each nome or department had a separate local municipal government of a nomarch or lieutenant-governor, besides governors of the cities and of the temples, scribes, judges, and other functionaries. Its limits were measured and defined by landmarks. In the 5th century A.D. Egypt was divided into Augusta Prima and Secunda on the east, and Ægyptiaca on the west, Arcadia (the Heptanomis), Thebais Proxima as far as Panopolis, and Thebais Supra to Philæ. Under the Mohammedans, the triple division into Misr el-Bahri (Lower Egypt), el-Wustâni (Middle), and es-Sa'îd (Upper) has prevailed, but the number of subdivisions has varied; at present there are altogether thirteen provinces, of which half are in the Delta. For the divisions of the territory outside Egypt proper, annexed in 1876, and abandoned in 1885, extending as far south as the Victoria Nyanza, see SOUDAN.

The *population* of the country must have been large at the earliest period, as 100,000 men were employed in the construction of the Great Pyramid alone during the 4th dynasty, nearly 3600 years B.C. It has been placed at 7,000,000 under the Pharaohs, distributed in 1800 towns, which had increased to 2000 under Amasis (525 B.C.), and upwards of 3000 under the Ptolemies. In the reign of Nero it amounted to 7,800,000. The population in 1844 was 2,500,000; in 1859, 5,125,000; and in 1882, 6,817,265 in Egypt proper, or including Nubia, Dar-Fûr, and other dependencies, nearly 17,000,000. Seven-eighths of the inhabitants consist of native Mohammedans; the Copts (q.v.) are estimated at 300,000, and the rest are composed of Bedawis (Bedouins), Negroes, Abyssinians, Turks, Syrians, Greeks, Armenians, Jews, and Europeans. The dominant population appears, from the language, and from the physical conformation of the mummies, to have been of mixed origin, part Asiatic and part Nigritic; and there seems to have been an aboriginal race of copper colour, with rather thin legs, large feet, high cheek-bones, and large lips; both types are represented on the monuments. The statements of Greek writers that a system of castes prevailed in Egypt are erroneous. What they took for castes were really conditions of society, and the different classes not only intermarried, but even, as in the case of priests and soldiers, held both employments. As in all bureaucracies, the sons often obtained the same employments as their fathers.

Religion.—The Egyptian religion was a philosophical pantheism, the various attributes of the Deity being divided amongst the different gods of the Pantheon. Unlike the Greek, where a god was honoured in a separate temple, each Egyptian divinity was accompanied by a *put* or 'company' of companion-gods. The principal nomes and cities had each a family group of gods, consisting of a parent deity, a wife and sister, and a son. Thus Ptah or Hephæstus, the eponymous and principal god of Memphis, formed a triad with the goddess Sekhet (fig. 1) or Bast, and Imhotep; at Thebes the triad was Amen-ra, Mut, and Khons; and at Apollinopolis Magna, Har-bahud (Horus), Hathor, and Har-pakhrut (Harpocrates). These triads were usually, if not always, accompanied by inferior deities completing the *put;* and personifications of the elements, passions, and senses were introduced. The worship of some triads, however, became universal—that of Osiris, Isis, and Horus being found all over Egypt at the earliest period. The gods, indeed, are stated by the Greeks to have been divided into three or more orders or systems. The gods of the Memphite order were Ptah, Ra, Shu, Seb, Osiris, Set or Typhon, and Horus; and Amen, Mentu, Atmu, Shu, Seb, Osiris, Set, Horus, and Sebak, according to the Theban system. Difficulties arise from the tendency to fuse different gods into one, particularly at a later period: Amen-ra, for example, being identified with Horus; and Horus, Ra, Khnum, Mentu, and Tum being merely considered the sun at different periods of his diurnal course. Very little light is thrown on the esoteric nature of the deities by the monuments, and the classical sources are untrustworthy; but the antagonism of good and evil is shown by the opposition of the solar gods and the great serpent Apap, a type of darkness, and the hostility of Osiris and Set or Typhon. Some of the gods were self-existent, others emanated from a father, and some were born of a mother only, while others were the children of greater gods. Their energies and powers differed, and their types, generally with human bodies, have often the heads of the animals which were their living emblems, instead of the human.

Fig. 1.—Sekhet.

A few foreign deities became at the close of the 18th dynasty engrafted into the religious system—as *Bar*, Baal; *Ashtarata*, Ashtaroth; *Anta*, Anaitis; *Ken*, Kiun; *Reshpu*, Reseph; *Set*, or Sutekh, sometimes identified with Baal. All the gods had human passions and affections, and their mode of action was material; they walked on earth, or sailed through ethereal space on boats. First amongst the deities comes Ptah, the opener, represented as a bow-legged dwarf or embryo, the Phœnician Pataikos, the creator of the world, the sun and moon, out of chaos (*ha*) or matter, to whom belong Sekhet, 'the lioness,' and Bast, Bubastis, lion-headed goddesses presiding over fire, and Nefer-Tum, his son, a god wearing a lotus on his head. Next in the cosmic order is Khnum—worshipped at Elephantine—the ram-headed god of the liquid element, who also created the matter of which the gods were made; and connected with him are the goddesses Heka the Frog, or primeval formation, Sati, or 'sunbeam,' and Anuka, alluding to the genesis of the cosmos. The Theban triad comprised Amen-ra (fig. 2), 'the hidden' power of the 'sun,' the Jupiter; *Mut*, the 'Mother' goddess or 'Matter,' the Juno; *Nit*, the 'Shuttle,' the Minerva; and Khons, 'Force' or Hercules, a lunar type. A subordinate type of Ammon is Khem or Amsu, 'the enshrined,' who, as *Harnekht*, or Powerful Horus, unites beginning and end, or cause and effect.

The solar system comprises *Ra*, the Sun, who, traversing the empyreal space of Gates, passes each hour a separate region, and, as he descends behind the west hills of the horizon, becomes Atmu, also a demiurge; while as Mentu he is the rising sun, and as Khepra, a scarab-headed god, the male creative or existent principle; and he is identified with

Amen, Khnum, and other deities. Day and night, Ra and his satellites pursue the Apap or Serpent Darkness with alternate success. The souls of the blessed come off from earth, and entering the boat of Ra, there enjoy the perpetual streams of light which emanate from his orb. From *Ra* or Helios spring Shu and Tefnet, Hathor and Mat. *Seb* or 'Time,' and *Nut* or the 'Firmament'—i.e. Kronos and Rhea, gave birth to Osiris, Isis, Nephthys, Set, and the elder Horus, a group of terrestrial and infernal deities. The myth of Osiris—destroyed by his wicked brother Set, and hewn in pieces, recovered by Isis, and avenged by Horus his son, embalmed by Anubis (fig. 3) and the genii of

Fig. 2. Amen-ra.

Fig. 3. Anup or Anubis.

Fig. 4. Thoth.

the dead, and defended by Thoth (fig. 4), the Egyptian Hermes, at the 'great judgment' before his accusers, Set and the conspirators—was the type of the judgment and future destiny of man, and all deceased were called by his name (see OSIRIS). Numerous inferior deities, such as Hapi, the Nile, appear either as other forms of the superior deities or local varieties of the myths. Each deity had its sacred animal, which received a local worship, and which was considered to be the 'second life' of the deity it represented. The special animal selected was installed in the adytum of the temple, and gave oracular responses. The most remarkable of these animals was the Apis bull of Memphis, whose worship had a national extension. The Egyptians believed in the transmigration of souls, and all not sufficiently pure to be admitted into the courts of the sun, or whose bodies had perished before the expiration of 3000 years (see EMBALMING), passed from body to body, having first descended to the Hades, and passed through the appointed trials and regions, endeavouring to reach the manifestation to light. In this progress, the soul was required to know and tell the names of the doors, regions, and their guardian demons through which it had to pass. The Sacred Bark (fig. 5), so frequently represented in the mural pictures, in which the mummy was ferried across the temple lake, or the Nile itself, to its tomb, was typical of that Boat of the Sun which would eventually bear the purified spirit to the Elysian fields. See TRANSMIGRATION, DEAD (BOOK OF THE).

Religious Monuments.—The religious edifices of the Egyptians consist principally in tombs and temples. These are indeed the chief survivals of their marvellous architecture, for of their private houses (which were constructed almost exclusively of sun-dried brick) and military forts, &c., only the foundations as a rule remain. The Pyramids (q.v.) themselves are royal tombs, huge cairns reared to mark and to guard the sarcophagi of kings, with small temples dedicated to their shades in front. These and the smaller tombs around form the earliest class of Egyptian monuments. The next are the rock-tombs of the 11th and 12th dynasties, in which the subterranean character of the pyramid-vaults is retained in the deep well or mummy-pit; but an entrance chapel takes the place of the separate temple, and is sometimes, as at Beni-Hasan, decorated with a portico and proto-Doric columns, while the walls are adorned with pictures drawn from the daily life of the deceased, and forming a complete commentary on the manners and customs of the people. Finally, the fighting monarchs of the 18th and following dynasties of the Theban epoch effected a further change: here the temple stands to the tomb (which is excavated in the hill behind) as the entrance chapel does to the subterranean rock-tomb. Examples of this period abound at Thebes. In the Valley of the Tombs of the Kings in the Libyan Hills are the exquisitely painted grottoes of Rameses III. and others of his line, and below in the plain are the corresponding funereal or commemorative temples—the Rameseum, Amenopheum, and others at Kurna and Medînet Habû. 'The Egyptian temple was not a place for congregational worship, but for priestly procession; and hence its chief characteristics are aisles and portals. Inside the great square crude brick wall, which surrounded everything, except perhaps the sacred lake over which the dead were ferried, an avenue of sphinxes—lions with men's or rams' heads—leads up to the first propylon, a gateway flanked by two tapered square towers, and often a couple of obelisks or colossal statues in front, or royal figures seated against the façade of the towers. Within this gateway is the great

Fig. 5.—Sacred Bark.

open court (peristyle), with colonnades of the peculiar Egyptian columns, with capitals of papyrus buds or flowers, and shafts sometimes tapered at the base and tied near the top like a bundle of reeds, or guarded in front by the standing figure of Osiris. Behind this court is the hypostyle or large hall of assembly, with a roof supported

by a forest of columns; and between the two courts is a towered portal, and perhaps obelisks or statues. Finally, behind the second hall, separated sometimes by a vestibule, is the adytum or sanctuary, where the emblem of the god is kept in a mysterious darkness, penetrated only by the priests whose vestries and treasuries adjoin the holy of holies. The whole of the temple—walls, columns, roofs, gateways—is covered with sculptures and paintings representing the great achievements of the king who built the temple, and various acts of adoration performed by him in honour of the gods.

'The great temple of Karnak at Thebes has a first propylon of a width of 360 feet, giving access to an open court, 329 by 275 feet, with columns on either side, and a double row in the middle to guide the procession. Another great portal admits to the hall of columns or hypostyle, the most magnificent work of its kind in Egypt. It is 170 feet long and 329 wide, and its ruined roof is upheld by 134 columns, 12 of them 62 feet high and 12 feet across, forming a great central aisle, and the rest 42 feet high and 9 thick. It was the work of Seti I. and his son Rameses II., and on its outside walls the sculptures tell the glorious history of these two warrior kings, how they fought against the Hittites, and the Ruten, and the Arabs, and the Syrians, and the people of Armenia, and charged them in their mighty chariots, and put them to flight, and took from them their strong cities. The battle scenes are vigorously drawn.'—Lane-Poole, *Egypt*. Karnak is a mass of ruins, however; some of its obelisks are fallen, and one from the neighbouring Luxor has been transplanted to Paris, just as one of the obelisks from Heliopolis was removed by Cleopatra to Alexandria, whence it has now changed its site to the Thames Embankment, while another has gone to New York. To see an almost perfect Egyptian temple, though of much later date, Edfu (q.v.) must be visited.

Fig. 6.—Column from the Hypostyle of Karnak.

Ancient Civilisation.—When first the Egyptians appear on the page of history they are already possessed of a marvellously advanced civilisation, which presupposes thousands of years of development, even before the remote period, nearly 4000 B.C., when the pyramid builders reigned (for dates compare the next section, on *Chronology and History*). In the sciences, as early as the 4th dynasty, the notation of time, the decimal system of numbers, weights and measures adjusted to a pound of 1400 grains, the geographical division of the country, and the division of the year (of 365 days) into three periods (of four months of 30 days) and twelve months, were already known, while the form of the buildings implies a knowledge of geometry and its sister sciences. An empirical knowledge of astronomy was probably possessed; nor could the arts have reached such a high development without some acquaintance with chemistry; and tradition assigns a knowledge of medicine and anatomy to a still earlier age. The art of literary composition also existed in the 4th dynasty, for fragments of the religious or so-called Hermetic books of that age have reached us (see PAPYRUS); and Cheops himself was an author. The language of the period, although concise and obscure, was nevertheless fixed; and a code of manners and morals, under the 5th dynasty, has been handed down. For the Egyptian writing, see HIEROGLYPHICS. Architecture had attained great refinement at an early period; not only were the chambers and temples, and other edifices, squared and directed to face the cardinal points, but the use of a kind of false arch, or stones disposed so as to form an angle overhead to relieve superincumbent pressure, *en décharge*, was practised as early as the 4th, and the vault or arch was in existence in the 11th and 18th dynasties, the latter eight centuries before the Cloaca Maxima of Rome. The transport of enormous blocks of stone testifies to an early development of engineering skill. Columns were in use as early as the 4th dynasty; and in the 12th the so-called proto-Doric ones of Beni-Hassan, with cornices and triglyphs, show that the Greeks derived this order of architecture from Egypt. The symmetrical arrangement of the temples, consisting of rectangular courtyards and hypæthral halls of many columns built before the original shrine, with their gateways slightly converging to the apex, and their bold and severe lines, and the obelisk and the pyramid, forms admirably adapted to resist the inroad of time, not to mention the remarkably fine masonry, prove the high development architecture had acquired at the remotest age. Nor was sculpture less advanced, for long before the age of the mythical Dædalus the statues of the 4th dynasty, of nearly 4000 B.C., had been moulded with great accuracy to a fixed canon; and although their architectural employment had rendered their action conventional—such as the arms pendant, the left foot advanced, and the feet not detached but when in stone, with the part between them retained—and although the ears were placed too high in the head, while a kind of pillar was fixed behind in standing figures, yet in portraiture they had attained to great perfection. The sculptures found at Meydûm, the celebrated figures of Rahotep and Nefert (possibly later than the rest here mentioned), the carved wooden statuette of the village sheikh (fig. 7), the chiselled statues of Khafra, all belonging to the

Fig. 7.—Village Sheikh. (Statuette in wood: Boulak Museum).

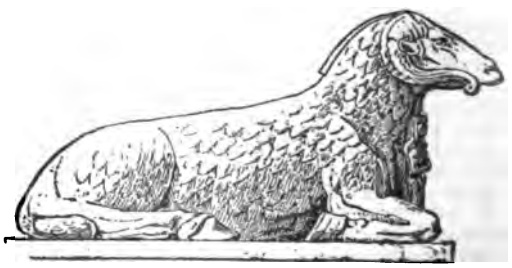


Fig. 8.—Ram-headed Sphinx.

remotest antiquity, prove the early Egyptians to have possessed extraordinary skill in the plastic arts; nor are these, the most ancient sculptures in the world, moulded in the conventional lines which characterised most of the later Egyptian representations of the human form. The lions and sphinxes of the later period, moreover, are often executed with a spirit surpassing the power of Greek artists. A peculiar kind of bas-relief prevailed in Egypt, the figures being sunk below the surface like the intaglio figures of a gem, but in slightly convex relief. This style, called incavo-relievato, or intaglio, has been most successful in preserving the hieroglyphs of the monuments. Bronze statues cast from moulds, and having a leaden or other core, were first made in Egypt, and subsequently introduced into Greece by Rhœcus. This art flourished best under the earlier dynasties, and had much degenerated in the 19th and 20th, although subsequently revived by the 26th. Painting appeared at the same age chiefly in tempera or whitewashed surfaces, although fresco was occasionally used; encaustic appears only under the Greeks and Romans. Painting, of course, was freer than sculpture, but yet had a rigid architectural character, and followed the same canon as sculpture, the colours used being generally the pure or primitive, and the background generally white. The architectural details of Egyptian temples and the hieroglyphs appear to have been always coloured, and this added additional charm to the sculptures. The religious papyri or rituals were also often embellished with elaborately coloured vignettes, resembling the illuminations of medieval manuscripts. Nor had the Egyptians attained less eminence in the art of music, the harp and flute appearing in use as early as the 4th, and heptachord and pentachord lyres as early as the 12th dynasty; besides which, drums, tambourines, flutes, cymbals, trumpets, and guitars are seen in the 18th, and the national instrument, the jingling sistrum (fig. 10), in the 4th. Many of the instruments are of great size, and must have produced considerable effect. Nor was the art of song wanting: measured recitations or chants occur on monuments of the 12th dynasty, while the lays of Maneros traditionally dated from a still earlier period. Poetry, indeed, was at all times in use, and the antithetic genius of the language suggested the application of the strophe and antistrophe, although it is not possible to define the metre. In the mechanical arts many inventions had been made; the blowpipe, used as a bellows, appears in the 5th dynasty, bellows and siphons in the 18th. The saw, the adze, the chisel, press, balance, and lever appear in the 5th, the harpoon in the 12th, razors in the 12th, the plough and other agricultural implements in the 5th. Glass of an opaque kind is seen in the 4th, and dated specimens in the reign of Thothmes III. give the priority to Egypt (see GLASS). A glazed pottery or porcelain (see POTTERY), the potter's wheel, and the kiln, appear in the 4th; and the art of metallurgy, with the use of tin, at the same period. In the military art the Egyptians used at an early age defensive armour of shields, cuirasses of quilted leather, and helmets; while spears, clubs, maces, swords, daggers, bows, and hatchets formed their offensive weapons. For sieges they employed the testudo, ladders, torches and lanterns, and mines. The army was composed of infantry till the beginning of the 18th dynasty, when war-chariots were introduced; for, prior to that period, the ass

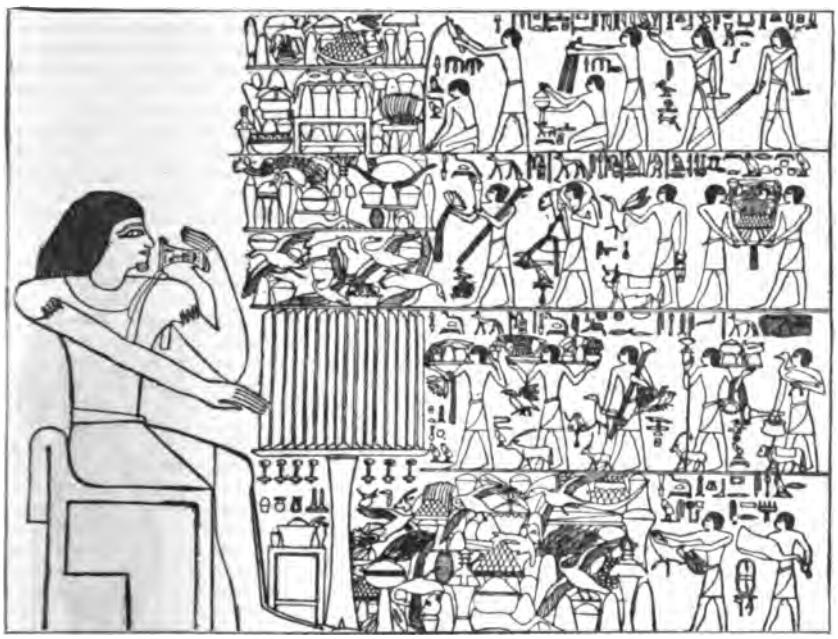


Fig. 9.—Wall-painting from the Tomb of Ptah-hotep, at Sakkara: of the Pyramid age.

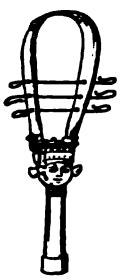


Fig. 10.—Sistrum.

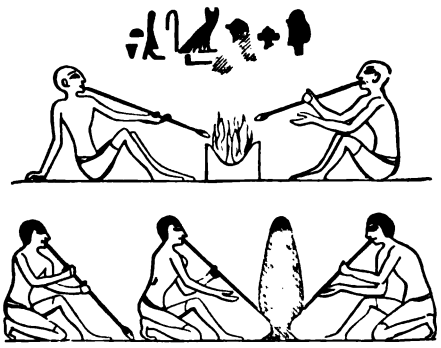


Fig. 11.—Egyptian Glass-blowers.

only was known and used for transport; and carriages not having been invented, persons and goods were transported on the panniers of asses, or on a kind of saddle slung between two of these useful animals. War-boats no doubt existed at an early period, and are mentioned as early as the 12th dynasty; and sea-going vessels under the 11th, but no fleet till the 18th. The Nile, however, was constantly navigated by row-galleys with sails. An extensive commerce was carried on with neighbouring nations, and their tribute enriched the country with slaves, cattle, gems, valuable metals, and objects of curiosity. Rare animals were collected for ostentation. Under the earlier dynasties the chief occupation of the nation appears to have been rearing cattle, cultivating grain, indulging in banquets, fishing, fowling, and the chase; and the establishment of each noble contained in itself all the organisation and artificers necessary for its maintenance. How transactions were carried on without the use of money is not very clear, unless gold circulated moulded in the shape of rings adjusted to a given weight; but coin plate is mentioned by its pound (*uten*) and its ounce (*kat*). The Persians first introduced money (see NUMISMATICS). The wealth of families was, however, spent on the tombs and furniture of the dead, and the preparations for embalming, which were on so vast a scale that filial piety did not disdain to mortgage not only the sepulchres, but the very mummies of its ancestors (see EMBALMING). Amusements were various, from the singlestick and juggling, the dance of the *ghawâzi* (fig. 12), the bull-fight, to draughts, dice,

Fig. 12.—Musicians and Dancers.

and *mora*. In fact, ancient Egypt had a material civilisation, which exerted all the requirements of industry, and forgot none of idleness. Pleasure was the object of existence, not, however, untempered by the voice of reason or the appeals of conscience, for the moral code was, theoretically at least, as pure as that of contemporary nations.

The civil government was administered by the three highest professions. The priests, distinguished by their superior knowledge, cleanliness, and godliness, had the ecclesiastical; the temples were ordered by high-priests and an inferior hierarchy, with overseers, and governors of revenues, domains, and donatives; and each temple, like a monastic institution, had its carefully subdivided organisation. The political and civil government was administered by royal scribes, or secretaries of state, who superintended the revenue, justice, foreign affairs, and all the interests of the executive. Sacred scribes attended to the ecclesiastic interests, and inferior scribes to the local interests. The public works, the collection of grain and of the linen dues, the cattle, workmen, wells, irrigation, had each their separate superintendents and scribes. The military force—of 410,000 men, at a later period, comprising all arms of the service—was ruled with severe discipline, and under the direction of nomarchs, colonels, captains, and lieutenants; while in the time of Rameses II. there were territorial regiments. The criminal and civil law was administered by judges, who held travelling assizes, and to whose tribunals the necessary officers were attached. The athlophoros or standard-bearer also transmitted the decrees of the royal chancery. The execution of deeds required so many witnesses that fraud evidently often occurred. The superior position of women in the social scale, notwithstanding the permission to marry within degrees of consanguinity usually forbidden, shows that the Egyptians reached a higher point of delicacy and refinement than either their western or eastern successors. Colossal in its art, profound in its philosophy and religion, and in possession of the knowledge of the arts and sciences, Egypt exhibits the astonishing phenomenon of an elevated civilisation at a period when the other nations of the world were almost unborn.

Chronology and History.—In the time of Ptolemy Philadelphus, in the 3d century B.C., Manetho of Sebennytus, high-priest of Heliopolis, who had the best records of his country at his command, drew up, at the request of the king, a history, in which he divided the space of time from Menes to the conquest of Egypt by Darius II. into 30 dynasties. The original work of Manetho has perished, but chronological epitomes have been preserved by Julius Africanus, a writer of 300 A.D., Eusebius, and Georgius Syncellus, 800 A.D., and a comparison of their statements, corrupted as they are, with the records of the monuments has clearly established the truth and authenticity of Manetho's authorities. The Hebrew Scriptures, Herodotus, Diodorus, Josephus, Eratosthenes, and others also contain chronological information, and the learned of Europe have long endeavoured to reconcile the conflicting statements of these authorities. Unfortunately, the information derived from inscriptions on the monuments is defective at certain periods, while in all the national custom of dating in kings' reigns only, without the use of the controlling date of any cycle, renders the subject still more obscure; for the Sothiac cycle, or Dog-star period of 1461 'vague' and 1460 sidereal years of 365¼ days, was not in official use. Even the famous Table of Kings at Abydos leaves us mystified, while the celebrated hieratic papyrus at Turin, belonging to the age of the 19th dynasty, which contained a system of chronology arranged on a principle of cycles and regnal years, has unfortunately suffered so much mutilation that it is impossible to reconstruct it satisfactorily; and we are obliged to arrange the history according to the dynastic successions of Manetho, without being always able to affix the precise duration of each dynasty, or to determine how many of them may have ruled contemporaneously.

Egypt was fabled to have been first governed by a dynasty of gods, who, according to Manetho and other Greek authors, were Hephæstus (Ptah), Helios the Sun (Ra), Sôs (Shu), Kronos (Seb), Osiris (Hesiri), Typhon (Set), and Horus (Har). These gods reigned 13,900 years, and were succeeded by the demigods and manes, whose sway occupied 4000 more years. It is singular that, with the exception of the Osirid saga related above, Egyptian mythology can hardly be said to exist; there are few or no legends about the gods. Their characters are differentiated, but their exploits are unsung.

The epoch of Menes is the first human point in the history of ancient Egypt, and has been placed at 5004 B.C. by Mariette, 4455 B.C. by Brugsch, and 3892 B.C. by Lepsius, the three leading authorities. No contemporary monuments of Menes exist, but he is said to have been king of This (near Abydos); to have changed the patriarchal life of the nation, instituted laws and divine worship, and marched north and founded Memphis and

the temple of Ptah, after diverting the course of the Nile by a dyke to make it a barrier against the Arabs on the east; and finally to have been devoured by a crocodile. He is clearly no legendary creation, but a real founder of a state. His first or second successor, Athothis, is said to have been a physician, and to have written treatises on anatomy, and to have built the palace of Memphis. Uenephes, the fourth of this line, is conjectured to have founded the Pyramid of Steps at Sakkara. This dynasty reigned about 250 years, and was succeeded by the 2d, supposed to have lasted about 300 years, of which no contemporary monuments remain. This dynasty, however, introduced the worship of sacred animals, and enacted that a woman might reign over the land. With the 3d dynasty, which endured about 200 years, from 3966 B.C. (Brugsch), monumental history properly begins: King Senoferu conquered the Sinaitic peninsula, and opened the copper-mines of the Wady Maghâra, where his name and portrait may be seen. He was probably buried in the Pyramid of Meydûm, near which some tombs have preserved writings, pictures, and sculpture of his time, amongst others the famous seated figures of Rahotep and his wife Nefert (fig. 13),

Fig. 13.—Head of Nefert from Meydûm.
(Boulak Museum.)

believed to be the oldest statues in the world. The 4th dynasty, also of Memphites, had an existence of 167 years (3733–3566 B.C.). Khufu, the Cheops of Herodotus, constructed the Great Pyramid at Gîzeh, and rebuilt the Temple of Isis, hard by the Sphinx. Tradition, probably groundless, makes him a detestable and impious tyrant. Khafra (Cephrenes), his successor, built the second of the Gîzeh pyramids, and Menkaura, or Mycerinus, the third. The so-called Book of the Dead (see DEAD, BOOK OF THE), or Ritual, which dates from this period, and the high civilisation which Memphis had then attained, mark an epoch in Egyptian history, and the numerous tombs in the vicinity of the pyramids, constructed during this and the subsequent dynasty, exhibit a highly advanced state of civilisation and of art; the statues of Khafra (fig. 14) found near the Sphinx, carved in black diorite, are notable evidence of both artistic and mechanical skill; the cultivation of farms, the chase, the arts, enjoyed a great part of the attention of the Egyptians; but horses and wheel-carriages were alike unknown, although the simpler mechanical instruments had been invented.

The 5th dynasty was also Memphite, and consisted of nine kings, reigning about 200 years, of whom the last, Unas, built the truncated pyramid near Sakkara, now called the Mastabat-Faraûn, or 'Pharaoh's Seat.' The next dynasty, the 6th, probably belonging to a different part of Egypt and not specially Memphite, was more remarkable, and tombs and inscriptions of the period are found from Assouân to Tanis, and in the valley of Hammamat, leading from Coptos to the Red Sea. The great figure of this house is Pepi I., of whom, and his general Una, and his wars and expeditions and public works most interesting records remain. The pyramids of Dahshûr probably belong to his time. The dynasty ended, according to Manetho, with the fair Queen Nitocris, said to have been buried in the Third Pyramid of Gîzeh, which she may have enlarged. Nitocris is the subject of various legends, and is believed by the Arabs to be a witch who still haunts the pyramid.

Fig. 14.
Statue of Khafra.
(Boulak Museum.)

From the 6th to the 11th dynasty Egyptian history is almost a blank, but remains of the 11th, consisting of a line of monarchs called Entef and Mentuhotep, have been identified by the discoveries of their coffins at Thebes, and by the tablets referring to the construction of the fortress of Coptos and in honour of a local god. The successive reigns and monarchs of the 12th dynasty (from 2466 B.C.) are fixed by numerous monuments. Amenemhat I., the founder of the line, opened the quarries of Tura, embellished On or Heliopolis, and founded the temple of Amen at Thebes. The monuments of his son Osirtasen I. exist in the Fayyûm, at Beni-Hassan, and Heliopolis; he subjected some of the Ethiopian tribes. Osirtasen III. established the southern frontier at Semneh, which he fortified, and was subsequently deified in Nubia. Amenemhat III. excavated the Mœris Lake, in the Fayyûm, constructed the Labyrinth, and built the neighbouring pyramid. Another great blank occurs between the 13th and 18th dynasties. About 2000 B.C. the advance of the kings of Chaldea and Elam in Asia, or some revolution, precipitated the Hyksos or Shepherd Kings, who appear to have been a Tartar race, on Lower Egypt. These invaders overthrew the reigning dynasty of Lower Egypt, took Memphis by assault, and established themselves in the city of Avaris, subsequently called Tanis, where their monuments still exist (see reports of the Egypt Exploration Fund). Joseph was probably the vizier of one of these kings, Apepi, at Tanis; and 'storehouses' such as he built are still visible at Pithom (Tell-el-Maskhûta). But the Egyptian rulers of Upper Egypt overthrew their rule. Aahmes I. (Amosis), of the 18th dynasty (about 1700 B.C.), took Avaris by assault, besieged Sharuhan in Palestine, and attacked the Nubians. The Hyksos endeavoured to substitute the worship of Set for Ra, but Aahmes I. restored the ancient temples and the old religion. Amenhotep I., his son and successor, who reigned under the tutelage of his mother, an Ethiopian queen, continued the Ethiopian campaigns, and embellished Thebes. Thothmes I. carried his arms to

Tombos, in the heart of Nubia, and as far as the Euphrates, and erected splendid buildings at Thebes. Thothmes II., who reigned under the guardianship of his sister-wife, Hatasu, defeated the Shasu or Arabs. His brother and successor, Thothmes III., elevated Egypt to the highest pinnacle of glory; and by the victory of Megiddo, in his twenty-third year, subjected the whole of Syria and part of Mesopotamia to his arms, receiving immense tributes from Kush and the Ethiopian races of the south, the islands of the sea, and Assyria, Babylon, Phœnicia, and Central Asia, and endowing the temples of Thebes with the revenues of tributary cities. A calendar preserved at Elephantine recording the heliacal rise of the Dog-star on the 28th Epiphi has been held to show that the year 1444 B.C. fell in his reign, but this seems historically a century too late. Thothmes III. (fig. 15) recovered the copper-mines of Maghâra, and adorned temples throughout Egypt. Amenhotep II. continued the conquests of the Ruten (Palestinians), took Nineveh by assault, and vanquished the Ethiopians. Amenhotep III. maintained the frontiers of the empire. At this period a heresy was introduced into Egypt, favoured by the Queen Taia. Amenhotep IV. became a worshipper of the Aten or solar orb, to the exclusion of the other deities of Egypt, especially of Amen-ra. The capital was removed to Tell-el-Amârina or Alabastron; the king changed his name to Akhunaten, and a succession of three heretical monarchs ruled Egypt for about thirty-three years, till Haremhebi or Horus restored the orthodox faith and the limits of empire.

Fig. 15.
Head of Thothmes III.

The link which connects the last monarchs of the 18th with the monarchs of the 19th dynasty has been lost; but Horus was succeeded by Rameses I.—the first of a long line of monarchs—who appears to have formed a treaty with the Khita or Hittites, and to have maintained the conquests of Egypt as far as Wady Halfa. He was succeeded by Seti I. or Sethos, who attacked the Remenu or Armenians, the Ruten, and the Shasu, who had again advanced to the Pa-khetem stronghold on the confines of Egypt. Naharana or Mesopotamia, and Sharu or Syria, Punt or Arabia Felix, and the opposite coast had also been invaded by his arms. The city of Atesh or Katesh, the supposed Cadytis, was also besieged by Sethos, whose Asiatic victories introduced into Egypt the worship of Baal and Ashtoreth. Tyre, Aradus, and Bethanath in Canaan were garrisoned by his forces. Egypt was also embellished with many noble monuments in his reign. He was buried in a deep excavated rock-tomb in the Bibân-el-Mulûk ('tombs of the kings'). Rameses II. (fig. 16), the son of Seti I., seems to have succeeded him at the very youthful age of seven. Four years later he defeated the Khita (Hittites, q.v.) and their Syrian confederates at the battle of Katesh, in which many of the princes and officers of the Khita were drowned in the river Arunata or Orontes. The battle continued two days, and the panegyric of an Egyptian scribe, Pentaur, has invested Rameses with the power of a god. The war lasted four years, and the king took Shaluma or Salem, the ancient site of Jerusalem, and other cities. In his twenty-first year a treaty of peace and extradition was established between the Egyptians and Hittites, and Rameses married a Hittite princess. It is the tablet of this monarch which is found at the Nahr-el-Kelb, the Pass of the Lycus, near Beyrout. This monarch subjected Ethiopia, which had revolted, to his arms, reimposed the tribute, and placed the country again under the government of the princes of Ethiopia, or Egyptian viceroys. He also established a fleet on the Mediterranean. His name and reputation formed the basis of the legendary Sesostris; the exploits of the monarchs of the 18th dynasty, and probably of his successors, being united with his fame. The reign of Rameses, although it exhibits a decline of art, yet demonstrates Egypt to have been in the height of its glory; and his epoch appears to have been about 1322 B.C., a special calendar having been sculptured to record the coincidence of the heliacal rising of the Dog-star and 1st Thoth, or commencement of the fixed and canicular (sidereal) year. His place of burial is uncertain—perhaps in the vaults of the Ramesseum. His thirteenth son, Merienptah or Meneptah, succeeded him upon the throne, transferred the capital to Memphis, successfully contended with the Tamahu and the Rebu, or Libyans, and appears to be the Amenophis of Manetho, and the Pharaoh (q.v.) of the Exodus. He introduced the heretical worship of Set, or Typhon, and was succeeded by Seti II. and others, whose inglorious reigns close the 19th dynasty.

Fig. 16.—Rameses II.

The connection of Rameses III. with the previous dynasty is obscure. He warred chiefly with the Philistines and other maritime tribes of Greece and Asia Minor, and gained naval victories in the Mediterranean, and repeated the conquest of Ethiopia. He was followed by the splendid but inglorious line of the Ramessids, the sixth of whom gained victories in Ethiopia. The fall of this dynasty appears to have been owing to internal revolution, as their Tanite successors held the office of high-priests of Amen-ra at Thebes. They held the government for a hundred and thirty years, and maintained relations with foreign countries, one of the monarchs having married a princess of the Ruten. The 22d dynasty is rather confused. They were also high-priests of Amen-ra. Shashank I. is the biblical Shishak. His invasion of Israel with 12,000 chariots and 60,000 cavalry is recorded on the portico of the Bubastites at Karnak. The other monarchs of this line, Osorkon I., Takelot I., and their successors, have left no remarkable records, except Osorkon II., who adorned the splendid Temple of Bubastis, discovered by Mr Naville while working for the Egypt Exploration Fund; and the dynasty, which appears to have been of foreign origin, is more chronologically than historically important, the attack on Jerusalem falling about 930 B.C. The 23d, Tanite, dynasty, which succeeded it, exhibits a decadence in Egypt, and was succeeded by the 24th dynasty, consisting of a single monarch, the celebrated Bekenrenf or Bocchoris, who reformed the laws, but having been taken prisoner by the Ethiopian Sabaco, of the 25th dynasty, was burned alive. From this period, the history of Egypt becomes involved with that of Judæa and Greece. Tirhaka came to the assistance

of Hezekiah against Sennacherib, and added to the temple of Gebel Barkal in Ethiopia. According to the Assyrian cuneiform inscriptions, the Ethiopians were expelled by the Assyrians, and the country was placed under various nomarchs. This state of affairs was closed by the rise of Psammitichus I., of the 26th dynasty, who, by the aid of Greek mercenaries, overthrew the other petty princes. His age marks a revival in art, and restoration of the old constitution of the empire. His successor, Nekao or Necho II., planned the canal across the Isthmus of Suez, from which he desisted, warned by the advice of an oracle, after having lost a vast number of men in the attempt. Under his reign, the Phœnician navigators first passed the line. After defeating Josiah, king of Judah, and conquering Palestine, he was himself defeated by Nebuchadnezzar at Carchemish. Psammitichus II. carried his arms into Ethiopia. Apries, his successor, having lost all the conquests, was deposed by Amasis, his successor, and strangled. Amasis favoured in different ways the Greek colonies in Egypt, married a Cyrenæan wife, and conquered Cyprus, but incurred the enmity of Cambyses, who overthrew his son and successor at the battle of Pelusium (527 B.C.). Cambyses treated Egypt with considerable moderation, but after an unsuccessful expedition against the Ethiopians, lost his reason, stabbed the bull Apis, and committed various atrocities. His successor, Darius I., governed Egypt with more prudence; but Xerxes I. and Artaxerxes I. had successively to reduce it to subjection, which they did in spite of assistance rendered to it by the Athenians. The 27th dynasty of Persians was followed by another Saïte line, the 28th, who still held ground against the Persians. The 29th, Mendesian, dynasty of Nepherches and Achoris maintained a Greek alliance; and the 30th, Sebennytic, consisted of Nectanebes I. who successfully resisted Pharnabazus and Iphicrates, of Teos who employed Agesilaus, and of Nectanebes II. who fled into Ethiopia before the Persians (340 B.C.).

From this time Egypt remained a province of Persia till its conquest by Alexander the Great, who founded Alexandria (332 B.C.). Subsequently Egypt passed under Greek rule, and the language of the government, and the administration and philosophy, became essentially Greek. The court of the Ptolemies became the centre of learning and philosophy; and Ptolemy Philadelphus, successful in his external wars, built the Museum, founded the library of Alexandria, purchased the most valuable manuscripts, engaged the most celebrated professors, and had the Septuagint translation made of the Hebrew Scriptures, and the Egyptian history of Manetho drawn up. His successor, Euergetes, pushed the southern limits of his empire to Axum. Philopator (221–204 B.C.) warred with Antiochus, persecuted the Jews, and encouraged learning. Epiphanes (204–180 B.C.) encountered repeated rebellions, and was succeeded by Philometor (180–145 B.C.) and Euergetes II. (145–116 B.C.), by Soter II. and Cleopatra till 106 B.C., and by Alexander (87 B.C.), under whom Thebes rebelled; then by Cleopatra Berenice, Alexander II. (80 B.C.), and Neos Dionysus (51 B.C.), and finally by the celebrated Cleopatra. After the battle of Actium (31 B.C.) Egypt passed into the condition of a province of Rome, governed always by a Roman governor of the equestrian, not senatorial, rank.

The most important events in Egypt under the Roman rule were—the introduction of the Julian year by Augustus (24 B.C.), the visit of Vespasian to Alexandria (70 A.D.), and that of Hadrian (122), the development of the Gnostic heresy, the visit of Caracalla (211), the conquest of Egypt by Zenobia (270), the revolt of Firmus (272), the persecution of Diocletian (304), and the rise of Manicheism, the great Arian controversy in the reign of Constantine, the rise of asceticism, magic, and astrology, and the final destruction of paganism (379).

At the division of the empire (395), Egypt fell to the Eastern empire, and at its fall had become one of the great patriarchates of the Christian church; but owing to the religious feuds of the Jacobites and Melchites it became a province of Persia (616) for twelve years. The Coptic governor, John Mukowkis, governed Egypt in the name of Heraclius at the period of the Arab invasion (639), and, perceiving in the invaders a means of escape from the detested rule of the Greeks, submitted, after a perfunctory resistance, to the Arab general, 'Amr ibn el-Asi, who took Alexandria (641), and soon made the whole country a province of the calif 'Omar.

History since the Mohammedan Conquest.—Although Alexandria was retaken by Constans II., the Arabs drove him out, and Egypt remained an appanage of the califat, and was ruled by Arab governors. One of these, Ahmed ibn Tûlûn, made himself practically independent, annexed Syria, and founded the dynasty of the Tûlûnis (868–905), renowned for its luxury and noble buildings. Another governor followed his example, and established the dynasty of the Ikhshîdîs (935–969). This in turn gave place to the heretical (Shi'ah) line of the Fâtimi Califs (q.v.), who advanced from their capital at Kayrawân, conquered Egypt, and founded modern Cairo (969), with some of the principal mosques and the Azhar University (see CAIRO). One of this line, the mad calif El-Hâkim, was the founder of the sect of the Druses (q.v.), who still pay him divine honours, and expect his return to rule the world. The reign of El-Mustansir was marked by civil war, persecution of Christians, and a fearful famine which lasted seven years, and depopulated whole quarters of Cairo. The Fâtimis were deposed by the Kurd general, Salâh-ed-dîn (1169–93), son of Ayyûb, commonly called Saladin (q.v.), who fortified Cairo and built the citadel. He waged war against the Crusaders, and annexed the greater part of Syria and Mesopotamia. In 1213 the Crusaders made an attack upon Egypt and took Damietta, but the Ayyûbi sultan, El-Kâmil, nephew of Saladin, utterly defeated Jean de Brienne, and drove the invaders away. The attempt of St Louis, thirty years later, ended in the surrender of the French king and all his army to the Mamelukes (Mamlûks). It was the last of Saladin's line, Es-Sâlih Ayyûb, who introduced this famous bodyguard of Turkish Mamelukes, or white slaves, who, on his death, usurped the supreme power (1250). For more than two centuries and a half Egypt was governed by a succession of slave kings, called the Bahri or Turkish and the Burji or Circassian Mamelukes. These kings, who succeeded each other chiefly by virtue of force of arms, were distinguished for their valour, their administrative powers, their luxury, and their encouragement of the arts. They fought for the holy places of Palestine, and gallantly drove back the Mongol hordes; they exchanged embassies with France and Venice, with Persia and Abyssinia; and presented one of the most startling anomalies of history, the 'spectacle of a band of disorderly soldiers, to all appearance barbarians, prone to shed blood, tyrannous to their subjects, yet delighting in the delicate refinements which art could afford them in their home-life, lavish in the endowment of pious foundations, magnificent in their mosques and palaces, and the noblest promoters of art, of literature, and of public works, that Egypt had known since the days of Alexander the Great' (Lane-Poole, *Art of the Saracens*). Cairo (q.v.) is still full of their monuments, and Arabic literature

owes them much. In 1517, however, this brilliant series of rulers came to an end on the conquest of Egypt by the Ottoman sultan, Selîm I.

Nearly three centuries of weak and corrupt government by Turkish pashas, varied by faction and rebellion of the Mameluke chiefs, bring us to the French invasion of Bonaparte in 1798. His conquest of Alexandria, and victory near the Pyramids over the Mamelukes, led to the temporary subjection of the country, from which the French were, however, soon expelled by the British in 1801, when the country was restored to the Porte. The accession of the Albanian soldier Mohammed 'Ali to the pashalik in 1805 imparted a galvanic prosperity to Egypt, by the merciless destruction of the turbulent Mamelukes (whom a disastrous British expedition in 1807 vainly sought to restore), the formation of a regular army, the increase of security, the improvement of the irrigation, and the introduction of the elements of European civilisation. In 1816 Mohammed 'Ali reduced part of Arabia to his sway by the generalship of his son Ibrahim; in 1820 he annexed Nubia and part of the Soudan, and from 1821 to 1828 his troops, under Ibrahim, occupied various points in the Morea and Crete, to aid the Turks in their war with the insurgent Greeks. The Egyptian fleet was annihilated at Navarino, and Ibrahim remained in the Morea till forced to evacuate by the French army, under Maison, in 1828. In 1831 Ibrahim began the conquest of Syria, and in the following year totally routed the Ottoman army at Koniya, after which the Porte ceded Syria to Mohammed 'Ali on condition of tribute. War breaking out again, the victory of Nisib in 1839 would perhaps have elevated him to the throne of Constantinople; but the quadruple alliance in 1840, the fall of St Jean d'Acre to the British, and the consequent evacuation of Syria, compelled him to limit his ambition to the pashalik of Egypt. In 1848 Mohammed 'Ali became imbecile (he died in 1849), and his son Ibrahim sat on his throne for two months, when he died, and was succeeded by 'Abbâs Pasha, Mohammed 'Ali's grandson, superseded in turn by Sa'îd Pasha, youngest son of Mohammed 'Ali, in 1854. M. de Lesseps now obtained the co-operation, hitherto withheld, of the Egyptian government in his scheme of the Suez Canal (q.v.), which was opened in 1869. Sa'îd was succeeded in 1863 by his nephew, Isma'îl, son of Ibrahim, who, by a firman purchased from the Sultan, took in 1866 the hereditary title of Khedive. The same firman made the succession to the throne of Egypt direct from father to son, instead of descending, according to Turkish law, to the eldest male of the family; and in 1872 the Sultan granted to the Khedive the rights (withdrawn in 1879) of concluding treaties and of maintaining an army, and virtually gave him sovereign powers. Thus secure on an hereditary throne, Isma'îl began a series of vast internal reforms, built roads, bridges, lighthouses, laid down railways and telegraphs, reconstructed the postal service, improved the harbours at Suez, Port Sa'îd, and Alexandria, supported education, and introduced mixed courts of law. Extending his dominions southward, he annexed Dar-Fûr in 1874, and in that and the following year further conquests were made. Through Sir Samuel Baker and Charles Gordon, governors of the Soudan, the Khedive endeavoured to suppress the slave-trade in his dominions. In order to provide funds for his vast undertakings, in 1875 he sold to Great Britain 177,000 shares in the Suez Canal for £4,000,000. The condition of the Egyptian finances, however, loaded by heavy loans, was almost hopelessly involved; various distinguished financiers were sent from England to endeavour to arrange a solvent system, and after many inquiries and several failures, a dual English and French Control was established, and the finances were placed entirely under European management. A promise of constitutional government ended in 1879 in the summary dismissal of Nubar Pasha's ministry, and this brought about the peremptory interference of the European governments. The Khedive, who declined voluntarily to abdicate, was, at the instance of the western powers, deposed by his suzerain the Sultan in June 1879, and Prince Tewfik, Isma'îl's eldest son, was proclaimed Khedive.

A Law of Liquidation, for regulating the conditions of the public debt, was passed at the instance of five European powers in 1880. In the next year came the military revolt under Arâbi Pasha, who demanded from the Khedive an immediate change of ministry, and the increase of the army to 18,000 men. The Khedive yielded. Growing dislike to European interference and to the presence of European officials secured Arâbi a large measure of popular support, when, as War Minister, he dominated the Khedive, and ultimately defied his authority. He was practically a military dictator, and in 1882 British and French war-ships were despatched to Alexandria to overawe the rebels, but their appearance was followed in June by rioting and massacres of Europeans in the streets. Meanwhile Arâbi was strengthening the fortifications. The British admiral demanded that the work should be discontinued. Arâbi persisted; the French sailed away in dismay; and the British ships bombarded the fortifications (11th July). The Egyptian troops were suddenly withdrawn from Alexandria, whereupon the city was plundered and partly burned by Egyptian rioters; while the British admiral, Sir B. Seymour (Lord Alcester), was apparently unable to land a force to restore order until the third day, when he occupied the city until the arrival of troops under Sir A. Alison, who kept Arâbi in check behind his lines at Kafr Dawar. Meanwhile Sir Garnet Wolseley hurried out with more troops from England, and other regiments (some of sepoys) were despatched from India; the point of debarkation was Ismailia, on the Suez Canal; and in twenty-five days the British forces under Wolseley had traversed the desert, utterly defeated the main body of Arâbi's army at Tell-el-Kebîr, and occupied Cairo. Arâbi was tried, pleaded guilty, and was banished to Ceylon. The authority of the Khedive being thus restored, most of the British troops were withdrawn, and measures taken for the reorganisation of the country. The French, who had been associated with England in what was known as the Dual Control, took no share in the bombardment, in the military expedition, or in direct co-operation with England in the re-arrangement of Egyptian affairs on a fair basis. The aim of the English Cabinet was to secure, as soon as possible, a firm and lasting government under the Khedive, but a large measure of interference with the Egyptian government was for the time being inevitable. Lord Dufferin proceeded to Cairo after the war, and drew up a constitution which has not, so far, been severely tested; and Sir E. Baring continued the task of organisation. But the attempt to persuade the Khedive's government to rule according to British ideas, and to get British officials and their Egyptian colleagues to work smoothly together, led to repeated crises and changes of plan. A conference of the great powers in 1884 did not sanction the English scheme for managing Egyptian finance; and Britain had consequently to resume her exclusive responsibility in Egypt. Whatever good was accruing to Egypt under British rule was seriously marred by the severe visitation of cholera which occurred in the summer of 1883, when 150,000 persons perished,

and still more by the rebellion in the Soudan, of which the end even now is not to be foreseen.

The Rebellion in the Soudan.—Arâbi's revolt and its consequences loosened the hold of Egypt on the Soudan (q.v.), which by Baker's annexations in 1874 and following years had gradually extended to the shores of the Victoria Nyanza. A widespread rebellion broke out in Dar-Fûr and Kordofan under Mohammed Ahmed, calling himself the *Mahdi*, a word meaning 'the guided by God.' The doctrine of the Mahdi, a kind of Mohammedan Messiah, is explained under the article ISMAILIS; see also MOHAMMEDANISM and KARMATHIANS. The modern Mahdi, however, is not necessarily a descendant of Ali, or a resuscitated Imam; but he puts himself forward as a prophet whose mission is to free Islam from external enemies and re-establish the pure primitive faith. Mohammed Ahmed was born at Dongola about 1843, educated near Khartoum, and then spent fifteen years in fasting and retirement in the island of Aba, whence he at length sent emissaries to preach the doom of Turkish rule in the Soudan, and the advent of the true Mahdi. An attempt of Raûf, the governor-general, to suppress this propaganda was resisted with bloodshed in August 1881, and thenceforward the movement spread rapidly. In January 1883 Sennâr revolted, and the Mahdi occupied El-'Obeyd. An army now sent against him by the Egyptian government under an English officer, Hicks Pasha, was annihilated near El-'Obeyd in November 1883. The Mahdi's influence extended to the Red Sea shores. An Egyptian force under Consul Moncrieff was routed with severe loss in the same month near Suâkin, and Baker Pasha was twice disastrously defeated at Teb and Tamanieb, early in 1884; but these reverses were afterwards wiped out by the hard-won successes of a British expedition under Sir G. Graham. Meanwhile, in January 1884, General Charles George Gordon (q.v.) had gone at the request of Mr Gladstone's government as English representative to Khartoum, to secure the withdrawal of the Egyptian garrisons from the Soudan, Egypt having, on the advice of England, agreed to give up all her possessions in the Soudan save the Red Sea littoral. Gordon, though supported by only one other English officer, gallantly maintained his position in Khartoum against the Mahdi's followers, and even ventured successfully on the aggressive. He had found, however, that he had attempted an impossible task; he could not leave the garrisons to fall into the hands of the Mahdi, and he required reinforcements of British troops before he could drive the latter from the neighbourhood of Khartoum. Timidity and indecision marked the whole of the policy of the English government, both towards the Soudan and the Red Sea littoral. At last, too late, in October 1884, an English expedition under Lord Wolseley was despatched to Khartonm, and, selecting the difficult and tedious route up the Nile, arrived in touch of Khartoum only to learn that the heroic Gordon had been assassinated two days before (26th January 1885). Wady Halfa became practically the southern limit of Egyptian territory; though till 1889 Dr Schnitzer (q.v.), better known as Emin Pasha, held out nominally for Egypt in the equatorial territory. The Mahdi (q.v.) died in 1885, and since then the affairs of the Egyptian Soudan have been little known in Europe. France became jealous of the continuance of the English occupation, and has sought to thwart Britain in Egypt and elsewhere; and the question of 'scuttling' out of Egypt before the country is put into a thoroughly stable condition has become to some extent a matter of controversy in English politics.

Statistics of Modern Egypt.—The area of Egypt proper is now (its southern frontier having reverted to Wady Halfa) about 393,000 sq. m., and at the census of 1882 its population was 6,806,381 (including 3923 in the territory of El-Arish in Asia). With the territories in Central Africa, now no longer Egyptian, the area of Egyptian domains was estimated at 1,150,000 sq. m., with a population of 17,000,000. The chief towns of Egypt proper are Cairo (pop. 1882, 368,000); Alexandria (209,000); Damietta (34,000); Tantah (34,000); Mansourah (27,000); Zagazig (19,000); Rosetta (17,000); Port Sa'îd (16,500); Suez (11,000). There are in Egypt about 90,000 foreigners, including 37,000 Greeks, 19,000 Italians, 16,000 Frenchmen, and 6000 Englishmen. The Egyptian army is under the command of an English general, and officered partly by Englishmen and partly by Egyptians; its total strength in 1888 was 9400, while the English army of occupation, which, since the rebellion of 1882, had remained in Egypt, had a strength of 3490. The revenue in 1887 was £9,863,000, the expenditure £9,455,000; showing an increase of revenue and a decrease of expenditure as compared with the average for the five preceding years. In 1882 the revenue fell to £8,908,029; in 1883 the expenditure was as high as £10,382,950. The total debt of Egypt amounted at the end of 1888 to about £104,000,000, the interest on which was met by a charge of over £4,470,000 in the year's budget, exclusive of the tribute to Turkey (£696,000). The total exports in 1887 (chiefly cotton, cotton-seed, beans, sugar, and grain) were valued at £11,155,000 (of which about two-thirds went to Britain); the imports (mainly cotton goods and other textiles, machinery, and coal) at £8,346,000 (mostly from Britain). The total for 1886 was £18,438,822; the average for five years, £20,278,978. The railway system embraces over 1250 miles, connecting Alexandria and Damietta with Cairo and the Suez Canal, and extending up the Nile Valley as far south as Siout; the telegraph lines reach nearly 5200 miles, and there is a telephone between Cairo and Alexandria.

See SOUDAN, NUBIA, KORDOFAN, DAR-FÛR, BAKER, GORDON, HARAR, &c. For descriptions of some of the most important monuments, see ABU-SIMBEL, ABYDOS, ALEXANDRIA, DENDERA, EDFU, ESNÉ, FAYYÛM, MEMPHIS, OBELISK, PHILÆ, PYRAMID, THEBES.

For further information on Egypt, its history, antiquities, and present condition, see Bunsen, *Aegyptens Stelle* (1844–57); Lepsius, *Denkmäler* (1849–74) and other works; Sharpe, *History of Egypt* (1846); the works by Brugsch (q.v.); Sir Gardner Wilkinson, *Manners and Customs of the Ancient Egyptians* (1847; new ed. by Birch, 1879); Mariette, *Monuments of Upper Egypt* (1877); Maspero, *Histoire ancien des Peuples de l'Orient* (1878), and *Egyptian Archæology* (Eng. trans. 1887); A. B. Edwards, *A Thousand Miles up the Nile* (1878); Lane, *Modern Egyptians* (1836, new ed. 1871); M'Coan, *Egypt as it is* (1877); Rawlinson's *History of Ancient Egypt* (1881), and *Ancient Egypt* ('Story of the Nations' series, 1887); S. Lane-Poole's *Egypt* (1881), and *Art of the Saracens* (1886); Dicey, *England and Egypt* (1881); Ebers, *Egypt, Historical and Descriptive* (Eng. trans., new ed., 2 vols. 1887); De Leon, *Egypt under its Khedives* (1882); Villiers Stuart, *Egypt after the War* (1883); Sir Mackenzie Wallace, *Egypt and the Egyptian Question* (1883); the Memoirs of the Egypt Exploration Fund (founded 1883); Darmesteter, *The Mahdi* (1885); *Journals of General Gordon* (1885); Sir C. Wilson, *From Korti to Khartûm* (1885); C. Royle, *Egyptian Campaigns, 1882–85* (2 vols. 1886); Baedeker's *Egypt* (2d Eng. ed. 1885); Murray's *Handbook for Travellers in Upper and Lower Egypt* (7th ed. 1888); and other works cited at DEAD (BOOK OF THE), and by Prince Ibrahim Hilmy in *The Literature of Egypt and the Soudan* (2 vols. Lond. 1886–88).

Egyptian Vulture. See VULTURE.

Ehrenberg, CHRISTIAN GOTTFRIED, naturalist, was born 19th April 1795, at Delitzsch, in Prussian Saxony. He studied at Leipzig and

Berlin; in 1820–26 he visited Egypt, Syria, and Arabia; in 1827 was appointed to a medical chair at Berlin; in 1829 accompanied Humboldt on an expedition to the Ural and Altai Mountains; and in 1838 travelled in France and England. He died 27th June 1876. His twenty-four works, published between 1828 and 1876, give the fruits of his patient study of microscopic organisms, a branch of science of which he was indeed the founder. See the articles INFUSORIA, ROTIFERA, &c. There is a Life by Hanstein (Bonn, 1877).

Ehrenbreitstein, a town and fortress of Rhenish Prussia, is picturesquely situated on the right bank of the Rhine, directly opposite Coblenz, with which it is connected by a bridge of boats and an iron railway-viaduct. It has a trade in wine and corn. Pop. 5299. The fortress occupies the summit of a precipitous rock, 387 feet above the river, and inaccessible on three sides; on the north and north-west, the exposed part, it is very strongly fortified. The first regular fortification of Ehrenbreitstein was begun in 1672; sixteen years later it was vainly besieged by the French, who, however, captured it in 1799, and in 1801, on the conclusion of the peace of Lunéville, blew up the works. It was assigned to Prussia by the Congress of Vienna in 1815, and in 1816–26 was restored and thoroughly fortified.

Ehrenfeld, formerly a busy town of Prussia, 2 miles W. of Cologne, with which it has lately been united. The locality has manufactures of glass-wares, railway fittings, chemicals, bricks, flour, and machinery.

Eibenstock, a town of Saxony, 41 miles SSW. of Chemnitz by rail. It has since 1775 become a centre of lace-making industry. Pop. (1890) 7166.

Eichhorn, JOHANN GOTTFRIED, a German Orientalist and historian, was born at Dörrenzimmern, in Franconia, 16th October 1752, and studied at Göttingen (1770–74). He was professor of Oriental Languages first at Jena (from 1775) and afterwards at Göttingen (from 1788), where he died, 27th June 1827, 'an illustrious example of academic felicity,' having discharged the duties of his professorate with distinguished success for fifty-two years. His *Einleitung in das Alte Testament* (3 vols. 1780–83; 4th ed. 5 vols. Göttingen, 1823–26) and *in das Neue Testament* (2d ed. 5 vols. 1820–27) were the first attempt to treat the books of Scripture by the ordinary methods of literary criticism on the basis of a wide knowledge of oriental antiquity. His *Repertorium für biblische und morgenländische Litteratur* (18 vols. Göttingen, 1777–86) and *Allgemeine Bibliothek der biblischen Litteratur* (10 vols. Leip. 1787–1801), like all the other works of this voluminous writer, have been superseded, and Eichhorn is chiefly remembered by his hypothesis of the origin of the Gospels (q.v.), which derived each of the synoptics independently from one original Greek gospel (*Ur-Evangelium*).

Eichstätt, a town of Bavaria, is situated in a deep valley on the left bank of the Altmühl, 67 miles NNW. of Munich. Here are the palace of the Dukes of Leuchtenberg, the cathedral (1259), the town-house (1444), and, on a neighbouring eminence, the ruined Wilibaldsburg. Eichstätt became a bishopric in 745, was capital of a small principality, and became finally Bavarian in 1855. Pop. 7631.

Eichwald, CHARLES EDWARD, a Russian naturalist, was born at Mitau, in Russia, 4th July 1795, and studied the natural sciences and medicine at Berlin and Vienna, and filled successively chairs of Zoology and Midwifery at Kasan and Wilna, of Zoology and Mineralogy, and next of Palæontology, at St Petersburg. Here he died 10th November 1876. Eichwald investigated the shores of the Caspian Sea, the Caucasus, Persia, Germany, Switzerland, and France, travelled over great part of Russia and Scandinavia, and in 1840 made a geological journey through Italy, Sicily, and Algeria. His geognostic, botanical, and zoological researches were unquestionably of more service to Russia than those of any man since Pallas. Besides scientific records of his journeys, his writings include works of great value on the mineral wealth, the zoology, and the palæontology of Russia.

Eider, a river of North Germany, forming the boundary line between Sleswick on the north and Holstein on the south, rises south-west of Kiel, flows in a general westward direction, and enters the North Sea at Tönning; length 117 miles. It is navigable as far as Rendsburg, whence the Eider Canal (1777–84) stretches east to Kiel Harbour in the Baltic, and as enlarged now virtually forms the eastern section of the great North Sea and Baltic Canal (1887–95) which spans the Sleswick Holstein Peninsula.

Eider-duck (*Somateria*), a genus of birds in the duck family (Anatidæ), included under the larger division of geese or Anseres. The bill is as long as the head, laterally compressed, and bears on each side of the root an unfeathered peak extending backwards; the point of the bill bears a large hooked horny nail; the tail is short and pointed. The birds are restricted to northern regions, where they breed socially.

(1) The Common Eider-duck (*S. mollissima*) lives on the Arctic and northerly shores of the Atlantic in both hemispheres, being common, for instance, in Nova Zembla, Spitzbergen, Iceland, and Greenland; various species also are found in Alaska and the neighbouring islands. It breeds as far south as the Fern Islands off the Northumbrian coast, and the Bay of Fundy in America. In cold winters it travels farther south, for instance, to the mouth of the Elbe. The eider measures about two feet in length, but is heavy for its size. The male is slightly the larger. Of the females and young males it may be said that the colour is predominantly rusty brown, with dark streaks and spots. The adult males, however, have as usual a more complex plumage, especially in the breeding season. The crown of the head, the under surface, and tail are black; the cheeks are sea-green; while white prevails over the neck and upper surface. After breeding, the white colour almost disappears from the upper parts, and black prevails.

The nest among the rocks is formed of fine seaweeds, often matted along with mosses and twigs. The bird frequently shows a preference for low islets, where it is insulated from the hungry foxes. There are usually five eggs of a pale-green colour, and the number is said to be sometimes increased by thefts from other nests. The female does the brooding, but the male seems to take a kindly interest in preserving her peace of mind by warning off intruders. To man, who after all gives them most trouble, they are tolerably indifferent. When the brood is hatched, the mother pillages her breast for down to serve as covering. The down is often twice removed for human purposes, and then the male may pluck off his slightly inferior feathers if the mother has no more to spare. Nordenskiöld says that the bird, when frightened, tries to conceal the contents of the nest, and sometimes ejects a fetid excretion over the eggs. He also refers to the huge number of nests on a given area; they are often so close together that it is difficult to walk without trampling upon them. In the islet of Vidoë, a valuable Icelandic breeding-place, almost every little hollow between the rocks is occupied; the birds readily tenant holes cut out for them in rows on the sloping

hillside, and many even utilise garden-walls and buildings. In Scotland the young eiders are sometimes called brattocks, and in Orkney and Shetland the bird is commonly called the Dunter Duck. Another title, St Cuthbert's Duck, refers to the name of one of the Fern Islands where the eider abounds.

The eider-duck is of great economic importance. The flesh, though not without suggestion of train-oil, is much eaten by Greenlanders and others. The eggs are more esteemed, and those of the next species, the King's Eider, are still daintier. Domestication, where farinaceous food is added to the usual diet of molluscs, crustaceans, &c., is said to render the flesh more palatable. The skins are used for winter underclothing. But the down collected from the nests is most important, both for local use and for export.

The fine elastic gray down, so much used, especially on the Continent, for bed-clothes, is chiefly developed on the breast of the bird. The best quality is not taken from the bird directly, but gathered from the nest. What formed or ought naturally to have formed the blanket of the young eider-ducks becomes the quilt of the human bedstead.

Common Eider-duck (*Somateria mollissima*).

Each nest is said to furnish annually about a quarter of a pound. The common practice in Norway and Iceland is to take away the eggs and down twice, leaving the third set of eggs to continue the species. The nests are carefully protected, and are transmitted as valuable inheritances from father to son. Cattle may be removed from an islet for the eider's sake, or a promontory may be formed into an island to induce the bird to breed there, and to secure immunity from foxes and the like. The eiders appear to be singularly unaffected by the way in which they are exploited, and show little alarm on the approach of visitors. Domestication has proved successful by the seashore. The eider-duck is of course now protected in Britain by the Wild Birds Protection Act, but too little care seems to be taken of them. Nordenskiöld refers strongly to their wanton destruction in Spitzbergen regions. It seems probable that with a little care they might be both multiplied and extended on some of the Scottish islands. In Iceland, where the eider is strictly preserved, its numbers have greatly increased in recent years, and the people do all in their power to attract the bird to their property by hanging up cloths of a glaring colour, and bells worked by the wind or by water, and by keeping bright-plumaged fowls.

(2) The King's Eider (*S. spectabilis*) is another species, whose down is also collected. It lives in the far north of Asia and America, a few breed in Iceland and the Faröe Islands, and rare visitants have been seen in Britain. In size the king's eider is about equal to the more familiar species, but the bill and feet are reddish-brown instead of grayish-green, and the male is gray on the crown of its head, pale flesh-coloured on the breast, and more restrictedly white on the back. There is a large protuberance on the root of the upper part of the bill. The female is of a light reddish-brown colour, very like the female of the common eider. Much of the down from Greenland is obtained from this bird, and the skins are locally used for winter garments. There are three other species.

Eifel, THE, a barren and bleak plateau of Rhenish Prussia, between the rivers Rhine, Moselle, and Roer, showing extensive traces of volcanic activity. Its surface, which ranges at an average altitude of 1500 to 2000 feet, is for the most part broadly undulating, and diversified by crater-like depressions and volcanic peaks and ridges, whilst towards its edges it is seamed by deep, wooded, rocky ravines. Its highest and, at the same time, most inhospitable parts are in the west and north-west, whence it falls away gradually to the Rhine on the east, and to the Moselle on the south. The central portion of the plateau is crossed by a range of basaltic summits, the loftiest in the Eifel system, including the Hohe Acht (2494 feet), Nürburg (2255), and Kellberg (2211). The ridges of the north-west are connected by the Hohe Venn with the Ardennes. Geologically, the basement of the plateau belongs to the Lower Graywacke of the Devonian formation, with irruptions of Eifel limestone, parts of which are rich in fossils. Above this are deposited, with tolerable regularity in a horizontal position, strata of Triassic age, containing considerable quantities of metallic ores, especially zinc and lead. The Eifel was for a long period the scene of volcanic activity; zones and islands of basalt are frequent, as also eruptive masses of basaltic lavas, with tufa and pumice. With the exception of the vine and fruit trees on the east and south edges of the plateau, and a little agriculture (up to 1700 feet), the Eifel is uncultivated, its rocky soil being too poor, and its climate too raw and bleak for anything to grow but heather.

Eiffel, GUSTAVE, engineer, was born at Dijon in 1832, and in 1858, only three years after completing his studies at the École Centrale, was intrusted with the construction of the large iron bridge over the Garonne at Bordeaux, and was one of the first to introduce caissons worked with compressed air. The bridge over the Douro at Oporto, the great viaduct of Garabit, in Cantal (described by him in an elaborate monograph, 1889), and that over the Tardes, near Montluçon, and the gigantic locks designed and partly prepared for the Panama Canal are among later triumphs of his engineering skill; while in the huge framework erected for Bartholdi's statue of Liberty may be seen the germ of the idea which afterwards assumed the form of the colossal iron structure (1887–89) on the Champ-de-Mars in Paris with which his name is identified. The Eiffel Tower contains three stories, reached by a series of elevators or lifts, and the platform at the summit is 300 metres (985 feet) above the ground. About 7,000,000 kilogrammes (a little less than 7000 tons) of iron were employed in its construction; the estimated cost was about £200,000, of which £60,000 was voted by the state, and the remainder supplied by M. Eiffel, who expects to recoup himself out of the admission fees during the twenty years for which he holds a concession of the tower. On its completion, March 31, 1889, it was announced that M. Eiffel would be made an officer of the Legion of Honour. See Max de Nansouty, *La Tour Eiffel* (1889); also *Engineering* for May 3, 1889.

Eigg, or EGG, a Hebridean island, 7½ miles W. of the mainland of Inverness-shire, and 5 SW. of Skye. With an utmost length and breadth of 6½ and 4 miles, it is 12 sq. m. in area, and culminates in the remarkable Scuir of Eigg (1346 feet), near which are columnar cliffs like those of Staffa. Pop. (1851) 546; (1891) 233. Here in 617 St Donnan and fifty more monks from Iona were killed by the queen, though her people objected that 'that would not be a religious act;' and here, towards the close of the 16th century, 200 Macdonalds, men, women, and children, were smoked to death in a narrow-mouthed cave by Macleod.

Eight, PIECE OF. See PIASTRE.

Eikon Basilike, a work whose full title is Εἰκὼν Βασιλική: *The Portraicture of His Sacred Majestie in his Solitudes and Sufferings.* It was published immediately after the execution of Charles I. (1649), and within a twelvemonth ran through fifty editions in various languages. Written in the first person, it professes to be Charles's own composition, and if it be a forgery, it is certainly one of the cleverest of the kind. It is no blind apology, for, to take but a single example, it does not vindicate the death of Strafford: 'I,' says its author, 'am so far from excusing or denying that compliance on my part (for plenary consent it was not) to his destruction, whom in my judgment I thought not, by any clear law, guilty of death, that I never have any touch of conscience with greater regret.' Though Milton and others did at the time insinuate doubts whether the work was not by some secret coadjutor, doctor or prelate, yet generally it was accepted as the king's, until, in a fifteen months' correspondence (1660–62) with Clarendon and the Earl of Bristol, Dr John Gauden laid claim to the sole authorship: 'This book and figure [the frontispiece] was wholly and only my invention, making, and design, in order to vindicate the King's wisdom, honour, and piety.' Born at Mayland, Essex, in 1605, that trimming churchman was educated at Bury St Edmunds and St John's College, Cambridge; about 1630 became vicar of Chippenham in Cambridgeshire, and in 1641 was appointed by the parliament dean of Bocking in Essex, in 1659 master of the Temple. In November 1660, the month before he is first known to have advanced his claim, he was raised to the bishopric of Exeter, whence, in 1662, he was translated to Worcester. He died two months later, on 20th September 1662, and was buried in Worcester Cathedral, where his wife erected a statue of him, holding a copy of the *Eikon.* Gauden professed to have begun the work in or about the year 1647, and to have submitted a MS. copy of it to the king 'in the Isle of Wight, by the favour of the late Marquis of Hertford, which was delivered to the king by the now Bishop of Winchester.' On the other hand, those who maintain that the work was by Charles, assert that he had written the first six of its twenty-eight chapters before the battle of Naseby (1645). The question, one of much complexity, is not yet settled either way; to discuss it thoroughly is here impossible. Enough, that historians generally, from Lingard to Green, have pronounced against Charles; whilst those who have sifted his claims most carefully are in his favour—e.g. Dr Christopher Wordsworth, in *Who wrote Icôn Basilikè?* (1824; supplement, 1828), and Mr Edward J. L. Scott, in his edition of the work (1880). See, however, an article by W. Blake Odgers in the *Modern Review* (1880).

Eildons, a triple-crested height in Roxburghshire, due south of Melrose, whose middle and highest peak (1385 feet) commands a glorious view. 'I can stand,' said Scott, 'on the Eildon Hill, and point out forty-three places famous in war and verse.' Of an older magician, and of an older poet, the Eildons also have memories—Michael Scott and Thomas the Rhymer.

Eilenburg, a town of Prussian Saxony, on an island in the river Mulde, 15 miles by rail NE. of Leipzig, has manufactures of cloth, calico, tobacco, chemicals, beer, hardware, furniture, and agricultural implements. Pop. (1890) 12,447.

Eilethyia (hieroglyph. *Nekheb;* city of Lucina, now called El-Kâb), a city of ancient Egypt, situated on the right bank of the Nile, a little below Edfu. The present ruins consist of the remains of small temples dedicated by Rameses III. to Ra; a Ptolemaic temple dedicated to the eponymous goddess Lucina by Physcon or Euergetes II., with additions by Ptolemy Alexander I. and the elder Cleopatra; and an ancient temple dedicated by Amenophis III. to the local deities. The names of other monarchs are also found in the ruins; but the most interesting and important remains are the rock-tombs, some as early as the 13th dynasty, excavated in the hills. That of Aahmes, the 'captain of the sailors,' records his services in the wars of the early monarchs of the 18th dynasty against the Hyksos or Shepherds, and other Asiatic and Nigritic races. Another, that of Pahir, is decorated with rich and elaborate paintings representing the pursuits of agriculture, fowling, fishing, &c. The city was an outpost against the southern tribes, and its fort, a large inclosure of crude brick, was of importance as early as the Shepherd war. The goddess Suben (Eilethyia or Lucina) was a special protectress of Upper Egypt. See Brugsch, *Reiseberichte,* and *History of Egypt under the Pharaohs;* Wilkinson, *Ancient Egyptians;* Mariette, *Monuments.*

Eimeo (called by the French *Moorea*), one of the French Society Islands, in the Pacific Ocean, about 10 miles WNW. of Tahiti, the principal member of the group. Area, 51 sq. m.; pop. about 1500. It consists of deep valleys and abrupt hills—the former well cultivated, and the latter heavily timbered. Here Christianity was first introduced in Polynesia; and here the South Sea College of the London Missionary Society was established. Most of the natives are Protestants.

Einbeck, or EIMBECK, a town of Hanover, is situated on the Ilme, 23 miles N. of Göttingen by rail. Although a place of considerable importance in the 15th century, and a Hanse city, it has decayed greatly in recent times. It manufactures sugar, tobacco, carpets, &c. Einbeck was noted in the 15th century for its beer (*Eimbecker Beer,* whence 'Bock'). The town suffered severely in the Thirty Years' War; and in 1761 the French demolished its walls. Pop. 7091.

Einhard. See EGINHARD.

Einsiedeln, a town of Switzerland, in the canton of Schwyz, 27 miles SE. of Zurich by rail. Pop. 8506. In Einsiedeln great numbers of prayer-books, sacred images, wax candles, rosaries, medallions, &c. are made. The town is, however, chiefly celebrated for its Benedictine abbey, to which some 200,000 pilgrims resort annually to worship at the shrine of a black image of the Virgin, the 14th September being the principal day in the year. The abbey itself was founded in the 10th century, and after being repeatedly destroyed by fire, was rebuilt as a quadrangle in the Italian style in 1704–19. It contains a valuable library (32,000 vols.), with several incunabula and MSS., these last dating from the 8th to the 12th century; also a museum of natural science and natural history. Rudolph of Hapsburg elevated the abbot of Einsiedeln to the dignity of a prince of the empire

in 1274. Near the town the Austrians under Jellachich were defeated by the French under Masséna on 14th August 1799.

Eisenach, a town of Saxe-Weimar, is beautifully situated on the Hörsel, at the north-western verge of the Thuringian Forest, 69 miles by rail SE. of Cassel, and 49 W. of Weimar. Once the capital of a principality, Eisenach is still a thriving and industrious town, with wide, clean, and well-paved streets. It has a ducal palace (1742), now used as a court-house; a spacious market-place, and manufactures of art pottery, leather, &c. Sebastian Bach, of whom a statue was erected in 1884, was a native; and Fritz Reuter died at Eisenach in 1874. Pop. (1875) 16,163; (1885) 19,641; (1890) 21,399.

On an eminence rising 600 feet above the town, engirt by forests, stands the castle of Wartburg, founded in 1067, and till 1440 the residence of the Landgrave of Thuringia. It is famous as the spot where the Minnesingers (q.v.) assembled to hold a poetic contest ('the war of the Wartburg') about 1207; as the home of St Elizabeth (1511–27); and as the ten months' asylum to which Luther was carried by the Elector of Saxony (May 1521). The chapel in which Luther preached, as well as the chamber which he occupied, and in which he discomfited the Evil One by throwing the inkstand at his head, is still pointed out. The whole pile has been magnificently restored since 1851.

Eisenberg, a town of Germany, in the duchy of Saxe-Altenburg, on an eminence between the Saale and Elster, 36 miles SE. of Leipzig. Pop. 6901.

Eisenerz, a mining town of Austria, in the north of Styria, 20 miles NW. of Bruck. It stands in a narrow mountain-valley at the north foot of the Erzberg (5000 feet), a mountain so rich in iron ore that the miners, instead of cutting mines into it and following the metal in veins, quarry the rock from the outside; the ore is then broken small, and conveyed to the smelting-house without further preparation. In 1884 the output of ore was more than 270,000 tons, yielding 40 per cent. of metal. Aragonite (*Eisenblüte*, or *flos ferri*), resembling branching coral in form, and of the most beautiful and purest white, is found in grottoes in the interior of the mountain. Pop. 1950.

Eisenstadt, a free walled town of Hungary, 26 miles SE. of Vienna. Pop. 2972. The Esterhazy palace (1683–1805), in the centre of the town, contains a valuable library.

Eisleben, Luther's birthplace, a town of Prussian Saxony, 24 miles WNW. of Halle. Once the capital of the counts of Mansfeld, it is the centre of a rich mining district. Pop. (1885) 23,175; (1890) 23,897. The house in which Luther was born was partially consumed by fire in 1689, but was restored, as also recently have been the house in which he died, the church (Peter-Paulskirche) where he was christened, and another (Andreaskirche) in which he preached. In 1883, on the occasion of his quatercentenary, a bronze statue was unveiled of the Reformer, and a new gymnasium inaugurated, successor to the one which he founded two days before his death. See Grösler's *Geschichte Eislebens* (Halle, 1875).

Eisteddfod, the name given to a congress of Welsh bards and musicians, having for its object the preservation and cultivation of the national poetry and music, and in a secondary degree of the national customs and traditions. In very early times contests took place at Caerwys in Flintshire, and at other towns, when degrees were conferred upon the successful competitors, the honours thus won procuring the bards ready admittance into the castles of the Welsh princes and nobles. Eisteddfods are known to have been held in the reigns of Edward III. (1327–30), Henry VI. (*c.* 1451), Henry VIII. (*c.* 1525), and Elizabeth (1568). Then for a couple of centuries the contests seem to have been discontinued, but were revived in 1798, after which date they were for a time pretty frequent. In 1887 the meeting was held in London.

Ejectment (*Ejectio firmæ*) was, in English law, a form of possessory action, wherein the title to land might be tried, and the possession recovered. Under the old common law, a person dispossessed of his freehold was often obliged to have recourse to the cumbrous forms of a real action. A lessee for years, on the other hand, if dispossessed, could only claim damages for ejectment; but at an early period the courts decided that he should not only have his damages, but recover possession of the land. By means of an elaborate series of fictions, the action for ejectment was made to serve the purpose of any person claiming title to land. If Smith wished to recover land from Brown, he commenced his action with a declaration, every word of which was untrue, setting forth that Smith had made a lease to John Doe; that Doe entered on the land; that Doe was wrongfully ejected by one Richard Roe, and claimed damages accordingly. Brown, the actual possessor, was admitted to defend the action, in place of the imaginary Roe, but only on agreeing to admit the truth of the story about Doe; so that the only question in dispute was whether Smith had a right to make the lease to Doe. This curious legal comedy was abolished by the Common Law Procedure Act of 1852, and the Judicature Acts have now substituted an action for the recovery of land for the action of ejectment. But the term ejectment is still commonly used to describe the various forms of process by which a person in possession of land or house property may be turned out by his landlord or by a rival claimant. See EVICTION.

Ekaterinburg, a fortified town of Russia, on the eastern slope of the Ural Mountains, and on both banks of the Isset, 312 miles SE. of Perm by rail. It has wide, straight streets, with two cathedrals, a monastery, and a mint for copper coinage. It is the seat of administration for the Ural mines, and is in the centre of the mining districts of these mountains. Its manufactures include machinery, soap, candles, and linen, and it has large iron and copper works, besides establishments for washing gold and cutting and polishing precious stones. Industries are mining, cattle-rearing, and (among the Bashkirs of the suburbs) the keeping of bees. Pop. about 35,000.

Ekaterinodar, a town of Russia, capital of the country of the Kuban Cossacks, on the Kuban River, about 100 miles from its mouth. It is surrounded on all sides by swamp and morass; it has a cathedral and a large military hospital, but its houses are mostly of earth, with low, thatched roofs. Pop. about 42,500.

Ekaterinoslav, a government in South Russia, reaching in the south-east to the Sea of Azov, with an area of 26,050 sq. m., and a pop. of about 1,750,000, mostly engaged in agriculture and the rearing of cattle. It forms, except in the north-east, a vast plain, with stretches of steppe, although most of the land is well watered; 53 per cent. is arable, and good crops are raised, while melons, apricots, peaches, and grapes do well in spite of the night-frosts. The climate is generally mild and healthy, the mean temperature over 47° F., although it has fallen in severe winters to 22° below zero. Minerals are abundant, and include valuable beds of coal; and the manufactures and trade are of importance.—The capital, EKATERINOSLAV, on the Dnieper, 323 N. by E. of Sebastopol by rail, has a cathedral, a public library, a fine park, and large

tobacco factories. The town ('Catharine's Fame') was founded in 1784 by Prince Potemkin for the summer residence of the Empress Catharine II. Pop. 47,250.

Ekhmîm, or IKHMÎM (the ancient *Apu* or *Khemmis*, and called by the Greeks Panopolis), is a fair-sized town of Upper Egypt (pop. 15,000, chiefly Copts, but including Roman Catholics) on the east bank of the Nile near Suhâg, and was formerly the capital of the 9th nome of the south country (see EGYPT). Ruins mark the site of the temple of the local deity, Khim, the Egyptian Pan, but there are few remains of any importance. Herodotus speaks of Khemmis as a large city with a temple dedicated to Perseus, and it was still a leading place of the Thebaïd in the days of Strabo; but the Arab conquest demolished the greater part. It was once famous for linen manufacture and masonry, and is still noted for its check cotton industry.

Ekowe, the capital of the Territory of Zululand. See ZULUS.

Ekron, the northernmost of the five great cities of the Philistines (q.v.), on the borders of Judah and Dan. Beelzebub (q.v.) was its god.

Elæagnus, a genus of Elæagnaceæ, the Oleaster family, of which there are about thirty-five species, all natives of north temperate countries. *E. angustifolia*, the Oleaster, sometimes called Wild Olive, is a small spiny tree of the Mediterranean region, hoary with stellate hairs, and is frequently planted for the sake of its silvery white foliage and its fragrant flowers. The Sea Buckthorn (q.v.), or Sallowthorn, is the only British species. The Silverberry, *Shepherdia argentea*, with pleasant fruit, and *S. canadensis*, have also been introduced to English parks from North America.

Elæis. See OIL-PALM.

Elæocarpaceæ, a sub-order of Tiliaceæ, mostly East Indian trees. The fruits of some are eaten. The deeply-wrinkled seeds or stones of the fruit of *Elæocarpus ganitrus* are made into beads for necklaces and bracelets in India. They are often called Olive Nuts.

Elæococca, a genus of Euphorbiaceæ, the seeds of some of which yield useful oils, that of *E. verrucosa* being used for food in Japan, and for burning in Mauritius. That of *E. vernicia* of China is used in painting.

Elæodendron, a genus of Celastraceæ. *E. croceum* yields the useful Saffron-wood of the Cape.

Elagabalus. See HELIOGABALUS.

Elam, a district mentioned in Scripture, lying south of Assyria and east of Persia proper, apparently the same as the Susiana of Strabo. Its chief city, Susa (*Shushan*), early attained great importance in Mesopotamia. It appears that the primitive Semitic Elamites were overcome at an early period by a Hamitic or Cushite race from Babylon, called by the Greeks Cossæans.

Eland (*Oreas canna*), an antelope of Central and South Africa, the largest of the group, which has sometimes bred in Britain. It is a plump, strong, ox-like animal, stands about six feet high at the shoulders, and has a predominantly light-brown colour, varying to reddish above and yellowish below. The horns, present in both sexes, are about a foot and a half long, straight or slightly bent, and bear a spiral keel. There is a marked dewlap on the throat of the bull, and a dark short mane from the forehead backwards. The tail is ox-like, and ends in a tuft of black hair. The eland lives in small herds, especially on the treeless flats; it can attain considerable speed, and must be hunted on horseback. It is locally known as the *Impoof* or *Impoofoo*. The flesh is said to surpass beef, and the hide is also much valued. On account

Eland (*Oreas canna*).

of its value it is fast becoming scarce. See ANTELOPES.

Elanet (*Elanus*), a genus of Falconidæ, allied to the Kites, which they resemble in many of their characters; but from which they differ in having the short tarsi half covered with feathers, and the claws, except that of the middle toe, rounded beneath. The tail is very little forked. One species (*E. melanopterus*) is common in Africa from Egypt to the Cape of Good Hope, and is found also in India. Another species is the Black-shouldered Hawk (*E. dispar*) of America, the northern limit of which appears to be South Carolina. Both of these feed chiefly on insects, which they catch on the wing, but they also prey on small birds and reptiles.

Elaps. See CORAL-SNAKE.

Elasmobranchii. See CARTILAGINOUS FISHES.

Elasmosaurians, gigantic marine saurians of the cretaceous period, whose remains have been found chiefly in New Jersey, United States. See REPTILES.

Elasticity is that property of matter which enables a body, whose form or bulk has been changed by force, to support without disintegration or further yielding the continued action of that force, and to recover its original form or bulk when left to itself. Any alteration in form or bulk of a body is called a strain, and the combination of forces producing the strain is called a stress. Now when an elastic body is strained, it becomes possessed of a certain power of doing work which it had not originally. As familiar examples of this we may mention the bent bow, the wound-up mainspring of a watch, and the compressed air of an air-gun. In these cases a certain amount of energy has to be spent to bring the substances into their strained condition. Then, on being allowed to recover themselves either suddenly or gradually by an appropriate withdrawal of the supporting stresses, these substances yield back, in the form of useful work, some of the energy originally expended. Again, in the phenomena of Sound (q.v.), we have constant illustrations of the elasticity of bodies. An elastic substance—a pianoforte string for example—is strained in a particular manner and then left to itself. It at once begins vibrating about its original position of equilibrium, the energy of strain being transformed into the energy of motion, and that again into the energy of strain, and so on until gradually it degenerates into heat under the influence of the viscosity of the air, the string itself, and whatever other elastic bodies may be in the vicinity.

Physically considered, sound is in fact a sub-section of elasticity. The power of conveying sound is possessed by all substances, whether solid or fluid; for such strains, then, all substances are truly elastic.

As regards fluids—i.e. gases and liquids, the only kind of elasticity that can exist is elasticity of bulk; for no portion of a fluid can sustain the action of a deforming force. Practically the only kind of stress we can apply to fluids so as to cause a change of volume is a pressure equal in all directions. It is found that at a given temperature, the volume of a given mass of fluid is determined by the pressure; so that, after being compressed by an increase of pressure, the fluid will recover its original volume when the pressure is brought back to its original value. Thus, all fluids are perfectly elastic. To discover how, under any circumstances, the pressure and volume are related to one another is clearly an elastic problem. Thus, we must regard Boyle's Law for gases, established by the Hon. R. Boyle (q.v.) for air in 1661, as the first experimental attempt to investigate the laws of elasticity (see GASES, and HYDRODYNAMICS). To the same class of problems belongs the determination of the compressibilities of liquids. Compression being defined as the diminution produced in unit volume of the substance by the application of a given extra pressure, compressibility is measured by the ratio of the compression to the related pressure, or, in more general language, by the ratio of the strain to the stress. Through considerable ranges of stress-values, this ratio is for most liquids constant. The reciprocal of the compressibility—i.e. the ratio of the appropriate stress and strain, is called the bulk-modulus of elasticity. It is the only modulus with which we have to do when the elasticity of fluids is being considered.

When we pass to the consideration of solids, we meet with another kind of elasticity, the elasticity of form. The resistance which a solid offers to a pure change of form, not involving a change of volume, is measured by its Rigidity (q.v.); and if for this change the body is truly elastic, the rigidity is measured by the ratio of the deforming stress to the resulting strain—i.e. it is the modulus of elasticity for this kind of stress and strain. A pure twist applied to a pillar, rod, or wire, is a strain which involves no change of volume. The resistance which such a pillar offers to torsion depends on its rigidity and form, but is independent of its compressibility. In most cases, however, when an elastic solid is strained by a particular kind of stress, the appropriate modulus of elasticity involves both the rigidity and the compressibility. Thus, when a wire is stretched by a longitudinal tension, it not only increases in length but also diminishes in section. The result is that any small cubical element becomes a brick-shaped portion somewhat greater in volume. It is usual to measure this kind of strain by the elongation simply, the contraction of the section being practically unimportant. The ratio of the tension to the elongation gives what is called Young's Modulus of Elasticity, a most important quantity in engineering. It is Young's modulus which also determines the resistance a beam or bar offers to bending. See STRENGTH OF MATERIALS.

The elasticity of solids is far from perfect—i.e. a very moderate stress well within the limits of rupture will produce a permanent set in the body, so that there will not be perfect recovery of form and dimensions when the stress is removed. It is difficult to fix accurately the so-called limits of perfect elasticity, since a small stress acting for a long time will produce a permanent set, which a much more powerful stress acting for a short time would not produce. So long, however, as the strains are small, experiment shows that the stresses are proportional to the corresponding strains. In other words, the modulus of elasticity is constant through considerable ranges of stress-values. This empirical law was first clearly enunciated by Hooke in 1678 in the words *Ut Tensio sic Vis;* and upon a generalised statement of Hooke's Law the whole modern theory of elasticity is based. Sir W. Thomson's article 'Elasticity' in the *Encyclopædia Britannica*, published also in separate form, and Ibbetson's *Mathematical Theory of Elasticity* (Macmillan & Co., 1887) are the only English treatises on the subject; but the *History of the Elasticity and Strength of Materials* (Cambridge University Press, vol. i. 1886), by Todhunter and Pearson, furnishes a valuable compendium and criticism of the labours of elasticians.

Elastic Tissue. See MUSCLE, TISSUES.

Elater, a genus of beetles in the Pentamerous sub-order, type of the family Elateridæ. They are familiarly known as 'click-beetles' or 'skip-jacks,' from their habit of jerking themselves with a slight noise into the air when they land or are placed on their backs. The body is arched upwards and suddenly straightened with a violent muscular exertion, which lifts the animal from the ground. The legs are too short for the ordinary method of righting the body. The larvæ are only too familiar as 'Wireworms' (q.v.). Some tropical forms are phosphorescent. See FIREFLY.

Elaterite. See BITUMEN.

Elaterium, a drug obtained from the fruit of the Squirting Cucumber (*Ecbalium Elaterium*, formerly *Momordica Elaterium*), a native of the south of Europe, common on rubbish in the villages of Greece and the Archipelago. The fruit breaks from its stalk, and violently expels its seeds with the surrounding mucus through the opening thus made. This remarkable phenomenon is not due to any true contractility, but simply to the tension due to osmosis; much, in fact, as ripe gooseberries burst after prolonged rainy weather. It is the thick green mucus surrounding the seeds which yields the elaterium. This is simply prepared by drying the sediment which settles from the juice of the nearly ripened fruit.

Squirting Cucumber (*Ecbalium Elaterium*).

Elaterium is used in medicine as a drastic hydragogue cathartic. Its active principle is a body called Elaterin, $C_{20}H_{28}O_5$, which is probably the most powerful purgative known, the ordinary dose being only from $\frac{1}{10}$ to $\frac{1}{5}$ grain. Both elaterium and elaterin are officinal in the British Pharmacopœia. It is an exceedingly drastic purgative, used in dropsy. It acts as an irritant not only on the eyes, but even on the fingers of those who handle it. The use of elaterium was known to the ancients.

Elatma. See JELATOM.

Elba (Gr. *Æthalia*, Lat. *Ilva*), an island belonging to Italy, in the Mediterranean Sea, between

Corsica and the coast of Tuscany, from the latter of which it is separated by the channel of Piombino, a strait 6 miles in breadth. Area, 85 sq. m.; pop. (1881) 23,997. The coast is bold and precipitous, the interior traversed nearly throughout by three mountain-ranges which reach a height of 3380 feet. The island is well watered, the climate mild and healthy; on the lower ridges of the mountains, and in the valleys, the vine, olive, and mulberry flourish, fenced in with hedges of cactus and agave. The chief industry is the mining of the rich iron ore, for which Elba has been famed from antiquity; serpentine, and chalk, granite, and marble also are quarried, while considerable salt is produced from the salt-pans along the coast. Much wine is made, and the tunny-fisheries are important. Porto Ferrajo, the capital, has a pop. of 5391. Elba has been rendered famous in history as the place of Napoleon's exile from May 1814 till February 1815.

El Bassan, a town of Turkey, in central Albania, 75 miles SSE. of Scutari, with manufactures of copper and iron wares. It is the seat of a Greek bishop. Pop. 8000.

Elbe (the Roman *Albis* and the Bohemian *Labe*), an important river of northern Europe. It originates in the confluence of numerous streams which rise on the southern side of the Riesengebirge or Giants' Mountains, a range on the northern border of Bohemia, and unite near 50° 46′ N. lat., 15° 32′ E. long., at an elevation of 2230 feet above sea-level. Its total length, including windings, is estimated at 725 miles; it is navigable for 525 miles, as far as Melnik, but for sea-vessels only up to Hamburg (84 miles); and it drains an area of over 55,000 sq. m., of which two-thirds is German territory. Of its fifty and more tributaries the most important are the Moldau, Eger, Mulde, Saale, and Havel (with the Spree); and in connection with these is a fine system of canals. From the base of the Schneekoppe, the Elbe flows south to Pardubitz, whence it proceeds west to Brandeis, and afterwards in a general north-west direction past Melnik, Leitmeritz, and Herrnskretschen, where it quits the Bohemian territory and enters Saxony. At this point it is 142 yards wide. It then meanders, in a generally north-westerly course, through Saxony, Anhalt, and Hanover, passing Pirna, Dresden, Meissen, Torgau, Wittenberg, Magdeburg, Harburg, and Hamburg, until it empties itself into the North Sea at Cuxhaven, where it attains a breadth of upwards of 10 miles. The estuary is defended by five forts. At this point the tide rises about 10 feet; it is perceptible over 100 miles up the river. The Elbe is divided into several branches between Hamburg on the north, and Harburg on the south, by the numerous islands that there interrupt its course; and between Hamburg and the sea the sandbanks and shoals leave only a very narrow channel, of four to five fathoms' depth, and carefully marked. The scenery of the valley of the Elbe, although generally pleasing, is not remarkable, except in the Saxon Switzerland, above Dresden, where the river's course is generally between fantastic sandstone cliffs. Its waters are stocked with abundance of highly esteemed fish. Steamboats ply from Dresden up the river to Leitmeritz, and down as far as Riesa, as well as from Magdeburg to the sea. The navigation of the Elbe was formerly impeded by all manner of imposts and monopolies, but in 1870 all then existing tolls were abolished.

Elberfeld, one of the manufacturing capitals of Germany, is situated on both sides of the Wupper, an affluent of the Rhine, 16 miles ENE. of Düsseldorf. The old parts of the town are poorly built, straggling, and irregular, but the newer portion has numerous spacious and imposing buildings. The town is famous for its dyeing, bleaching, and calico-printing establishments, also for its extensive manufactures of cotton, silks, tapes, ribbons, thread, lace, buttons, fancy woollen goods, &c. Its Turkey-red dyeworks are especially noted. There are also manufactures of machinery, iron and steel wares, pianofortes, paper, and carpets, besides large breweries. For miles around an immense number of weavers are labouring for the Elberfeld factories. The town, which, like the rest of the Wupper valley, is notable for religious zeal, supports a Bible Society. It is connected by a tramway with the adjoining town of Barmen (q.v.). Pop. (1875) 80,599; (1885) 106,499; (1890) 125,889, three-fourths Protestant.

Elbeuf, a manufacturing town in the French department of Seine-Inférieure, on the left bank of the Seine, here crossed by two bridges to St Aubin, 14 miles S. by W. of Rouen by rail. The manufactures of cloth, flannel fabrics, billiard cloth, and light woollens of every colour and description, employ some 25,000 men here and in the neighbouring towns (Caudebec, &c.), and the annual output of the district is valued at from 85,000,000 to 95,000,000 francs. Pop. of town (1872) 22,563: (1886) 21,829; (1891) 20,644.

Elbing, a considerable trading and manufacturing town of West Prussia, is situated 48 miles by rail ESE. of Danzig, on the navigable river of the same name, which enters the Frisches Haff 5 miles to the north. The town, founded in the 13th century by colonists from Lübeck and Bremen, has a church of the 14th century, a public library with over 25,000 volumes, and a number of well-endowed hospitals. It is connected by a canal with the Dreventz, a tributary of the Vistula, and in 1877–84 a mole was constructed in the harbour, 3500 yards long and 5½ wide. Steamships and torpedo-boats are built here; and there are large iron and brass rolling-mills, and tinware, machine, and cigar factories, &c. The linen industry and the export of lampreys are also of importance. Pop. (1875) 33,572; (1885) 38,278; (1890) 41,576.

Elbow. See ARM.

Elburz, a mountain-range of Persia, running for 450 miles along the southern border of the Caspian Sea. It frequently divides itself into subordinate parallel ridges, inclosing extensive and fertile valleys; and unlike most Persian ranges, it has numerous prominent spurs, the highest peak being Mount Demavend (q.v.).—ELBURZ is also the name of the loftiest summit of the Caucasus (q.v.).

Elché, a town of Spain, 13 miles SW. of Alicante by rail, fringed by an encircling grove of nearly 100,000 palms, which gives the place an appearance half Moorish. It has a fine collegiate church, with a lofty tiled dome, and some trade in esparto, wine, dates, and palm-branches. Pop. 19,636.

Elchingen, a village of Bavaria, near the Danube, 5 miles NE. of Ulm, where on 14th October 1805 Ney defeated the Austrians under Laudon, winning thereby the title of Duke of Elchingen.

Elcho, LORD. See WEMYSS.

Elder (*Sambucus*), a genus of plants of the natural order Caprifoliaceæ, sub-order Sambuceæ, consisting chiefly of shrubs and trees, with pinnate leaves, small flowers of which the corolla is wheel-shaped and 5-cleft, and 3-seeded berries. The species are very widely distributed.—The Common Elder (*S. nigra*), the *Bourtree* of the Scotch, is a native of Europe, the north of Asia, and the north of Africa. It is found in all parts of Britain. It is a very large shrub, sometimes a small tree, with rather large leaves, and large terminal cymes of cream-coloured flowers, which are followed by small black—or rarely whitish—berries.

Its leaves and young shoots diffuse a narcotic odour, and it is said to be dangerous to sleep under its shade. The young leaf-buds are so violently purgative as to be considered dangerous. The inner bark has a bitter acrid taste. The leaves possess the

Flowering branch of Common Elder (*Sambucus nigra*): *a*, a flower; *b*, berries.

same properties in a rather milder degree. The flowers have a peculiar sweetish and rather sickening smell, but are used for making a distilled water —*Elder Flower Water*—which has a very agreeable odour, and is employed both in perfumery and confectionery. Distilled with water alone, they yield a volatile oil, which, on cooling, assumes a buttery consistence. A popular cooling ointment is made by boiling them in lard. They are also used for imparting a flavour to currant-wine and jelly. The clustered flower-buds are pickled, and used like capers. The French put layers of them in heaps or casks of apples, to which they impart an agreeable odour. A grateful wine, well known in England, especially about Christmas, is made from the berries; and in some places there are plantations of elder to supply the London market. It is generally drunk hot or *mulled*. The berries are subacid and sweetish, with a rather unpleasant flavour. A rob made from them is an agreeable domestic remedy with country-people for colds, coughs, and sore throats, and is slightly purgative; it has some reputation also in a concentrated form as a cure in rheumatic, gouty, eruptive, and syphilitic disorders. In some parts of Germany the poorer people use them as an ingredient in soups. They are said to be used to no small extent in England in the adulteration of port wine and the manufacture of spurious port wine.—The wood of the elder is yellow; that of old trees is very hard and tough, takes a fine polish, is used by turners, and as a substitute for boxwood in making mathematical instruments and other articles. Tops of fishing-rods are sometimes made of it. The pith of the young shoots being very light, is generally used to make pith-balls for electrical experiments. Toys for children are also made of it; and few boys are unacquainted with the use of elder branches, from which it has been expelled, for making popguns. A musical instrument named by the Latins *sambuca* is supposed to have been made from the wood of this tree on account of its hardness. The elder is very useful as a screen-fence near the sea and in other exposed situations, as it grows with remarkable vigour, and makes great shoots, the destruction of the more tender and less matured parts of which in winter only tends to make it more bushy and useful for shelter. It is readily propagated by portions of its shoots stuck into the ground.—The Scarlet-fruited Elder (*S. racemosa*), a native of the south of Europe and of Siberia, much resembles the common elder, but has softer and more herbaceous shoots, remarkably large buds, and racemes of greenish-white flowers, which are followed by scarlet berries. It is a frequent ornament of shrubberies in Britain.—The Dwarf Elder, or Danewort (*S. Ebulus*), is a rather rare British plant, a coarse herbaceous plant, with fetid smell. The *inner bark* has been employed in dropsical complaints as a hydragogue cathartic. The leaves are avoided by cattle, moles will not come near any place in which they are laid, and they are said to drive mice and rats from granaries if strewed plentifully about their haunts for a time. *White elder ointment* is procured by boiling equal weights of lard and elder flowers, and pressing through a cloth.—*S. canadensis* and *S. pubens* are North American species; the former, which is the common American kind, much resembles *S. nigra*, and the latter in like manner approaches *S. racemosa*. Larger than either are the *S. glauca* of the Pacific states, and the *S. mexicana* of the south-west.

The elder is very prominent in European folk-lore, and innumerable superstitions cling to the tree, its twigs and leaves. The cross was reported to have been made of this wood. Judas was said to have hanged himself on an elder-tree; lightning will not strike an elder; twigs growing from the edge of decayed hollows in an old elder will ward off teething fits from children; in Denmark a spirit called the Elder-mother protects the tree and avenges injuries offered to it; warts are removed by being rubbed with elder twig; and, generally, the tree or a twig of it protects against witches and witch-craft.

Elder, an office-bearer in Presbyterian churches. The name is an exact translation of the Greek *presbyteros*, which occurs frequently in the New Testament, and from which the English word *priest* is derived; but there remains much division of opinion as to the precise meaning of the term (see BISHOP, INDEPENDENTS, and PRESBYTERIANISM). All are agreed indeed that *bishops* and all pastors of congregations are included among *elders* in the scriptural use of the term; but the ordinary use of it is now limited to Presbyterian churches, and in them it has become the usual designation of the office-bearers associated with the minister of each congregation in the care and oversight of the flock. In some Protestant churches elders are appointed only for a certain term of office; but more generally it is until death, resignation, removal from the bounds of the congregation, or deposition. The appointment of elders takes place variously; in the Established Church of Scotland they have generally been nominated by the kirk-session (consisting of the minister and elders); in the other Presbyterian churches of Britain and America they are elected by the congregation. The ordination of elders takes place in the congregation, but usually without imposition of hands; a difference between the mode of ordination of elders and ministers for which it is not easy to account, and which has certainly tended to produce a general impression that a greater difference of office subsists than the advocates of Presbyterianism admit. In the Established Church of Scotland, the elders have very generally discharged also the functions of Deacons (q.v.). According to the *Second Book of Discipline* of the Church of Scotland, it is the duty of elders to watch over the spiritual welfare of the people, to admonish, to visit the sick, to assist in the examination of persons seeking admission to the Lord's Table, &c. Elders along with ministers compose all the courts or assemblies of the Presbyterian churches, and have equal votes in all questions.

Eldon, LORD, Lord Chancellor. John Scott, better known as Lord Eldon, was born 4th June 1751, in Love Lane, Newcastle, of obscure but respectable parentage. Lord Stowell (q.v.) was his elder brother. Leaving the Newcastle grammar-school in 1766, John Scott entered University College, Oxford, with a view to the church, and the following year he obtained a fellowship. A run-away marriage, into which he entered with a Miss Surtees in 1772, nearly ruined him; however, by the advice of his brother, he returned with his wife to the university. Here, during the year of grace after his marriage, he lived on his fellowship and gains as a private tutor; and the year expiring without a college living falling vacant, he betook himself to the study of law. In 1776 he was called to the bar. By the death of his father, in the year of his call, Eldon found himself in possession of £3000. Success soon dawned on him; and, with success in his profession, his ambition expanded, he took to politics. A silk gown and a seat in parliament were but steps towards knighthood and the post of Solicitor-general, conferred on him by Pitt in 1788. In 1793 he became Attorney-general. In 1799 the office of Chief-justice of the Court of Common Pleas became his; and in 1801, as Baron Eldon, he ascended the woolsack. From this time till 1827, with little intermission, Eldon continued to occupy the woolsack under successive governments. In 1821 he had been made an earl by George IV. In 1834 he ceased to speak in parliament. After outliving almost all his immediate relations, he died in his eighty-seventh year, January 3, 1838, leaving behind him a fortune of over half a million sterling.

Eldon was a handsome man, of very winning and courtly manners. His career amply proves that he had the greatest talent, sagacity, and power of managing men. He was undoubtedly a great lawyer, and his judgments, which have been much praised for their accuracy, fill a small library; but he took so long to arrive at them, that he has been charged with having caused more injustice by delay than worse judges by the iniquity of their decisions. For literature, as for art, he had no feeling, and the style of his decisions is generally detestable. As a public speaker he is far from estimable. He was no statesman; for forty years he was a leading enemy of reform and religious liberty, and it may be said that his whole political stock in trade was zeal against the Roman Catholics. He is said to have added parsimony to his other defects; but it is certain he was capable of generous actions, and his devotion to 'Bessy' his wife was truly beautiful. See the Life by Twiss (1846), and Campbell's *Lives of the Chancellors.*

El Dora'do ('the Golden or Gilded Land') originally existed but vaguely in the imaginations of the Spanish conquerors of America, whose insatiable avarice, feeding greedily on the marvellous accounts readily supplied by the natives—who were only anxious to get rid of their robber-guests—loved to dream of richer rewards than those of Mexico and Peru. But after Orellana's voyage down the Amazon, in 1540, the report was greatly embellished, and the locality of the fabulous region placed near the head-springs of the Orinoco. Many a soldier of fortune perished in the search, many a brave troop of adventurers brought but a fraction of their number back, before the vast Lake of Parime, with Manoa, the city of gold, on its northern shore, was reluctantly relegated to the atlas of the poets. The most famous expeditions were those of Philip von Hutten (1541-46) and Sir Walter Raleigh; the last was that of Antonio Santos, so late as 1780. See Nery, *Le Pays des Amazones* (Paris, 1885), and Von Langegg, *El Dorado* (1888).

Eleatic School. The group of ancient Greek philosophers so called begins with Xenophanes of Colophon, who settled in Elea, a Greek city of Lower Italy (whence the name), and includes Parmenides and Zeno, who both belonged to Elea, and also Melissus of Samos. In opposition to the physical philosophy of the Ionic school, and to the doctrine of Heraclitus (q.v.), who denied all being or existence, the Eleatic philosophers made the conception of pure being, unmixed with all marks or properties derived through the senses, the foundation of all their speculations. They argued the unity and immutability of all things, and, attacking the prevalent anthropomorphic mythology, they taught that God is the One, self-existent, unchangeable, and incomparable in any respect to man. Moreover, distrusting all knowledge acquired through the senses, they held that it is by thought only that we arrive at the truth; and Zeno's most subtle paradoxes were directed to prove this opposition between thought and sense. See separate articles on the principal philosophers mentioned.

Elecampane (*Inula*), a genus of Compositæ, allied to Aster. The only important species is the common Elecampane (*I. Helenium*), a native of damp meadows in the middle and south of Europe, rather rare in Britain, but not uncommon in the long-settled parts of North America. This plant was formerly much cultivated for its medicinal root, but is now comparatively neglected. The flowers are sometimes used to adulterate arnica.

Elecampane (*Inula Helenium*): a, flower.

Election, in Law, sometimes denotes the act of choosing, and sometimes the right of choosing. By the equitable doctrine of election in English law, one who accepts a benefit under an instrument, such as a deed or will, must adopt the whole deed, and conform with all its provisions. He is not entitled to take benefit under part of the deed without conforming to its other parts, and renouncing rights inconsistent with them. He must 'make his election' between the provisions of the deed and those of the common law. The analogous doctrine in the law of Scotland is that of Approbate and Reprobate (q.v.).

Election denotes in theological language the divine act by which certain individuals are chosen to salvation in Christ. It is defined in the seventeenth of the Thirty-nine Articles. See PREDESTINATION.

Election. See PARLIAMENT, and REPRESENTATION.

Electors (Ger. *Kurfürsten*), in the German empire, were those great princes who had the right of electing the emperor or king. In the earliest times, under the Carlovingians, the crown was

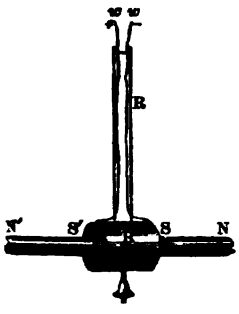
hereditary; afterwards Germany became formally an elective monarchy, but the election was practically almost limited to the reigning family. In the 13th century the right of election, for a time exercised by all the princes of the empire, became limited to the holders of the highest ecclesiastical and civil offices, some of which gradually became hereditary, and connected with territorial principalities, as in the case of the Hohenstaufens and of the Dukes of Bavaria, Saxony, Swabia, &c. Thus, there came to be seven electors, the spiritual electors of Mainz, Treves, and Cologne (as being the three chancellors of the empire), the elector of the Palatinate (as imperial steward), of Brandenburg (as chamberlain), Saxony (marshal), and Bohemia (imperial cup-bearer). During the Thirty Years' War, the right of the Palatinate was conferred on Bavaria; by the peace of Westphalia, an eighth electorate was established, Bavaria and the Palatinate being each allowed the full right; and in 1692 a ninth was added, that of Brunswick-Lüneburg (Hanover), but not without resistance by the electors and states of the empire, so that the new electorate was not fully recognised till 1710. In 1777 the number was again reduced to eight, the Bavarian electorate falling to the Elector Palatine. The electors held a very lofty position in the German empire. The Golden Bull (1356) describes them as 'the seven pillars and lamps of the holy empire.' They had many important rights, exemptions, and privileges, and royal dignity (but not the title of Majesty).

During the French ascendency great changes took place. Of the old electorates only that of Mainz was left, but three new ones—Baden, Würtemberg, and Hesse-Cassel—and later, one of Salzburg, were created. With the dissolution of the German empire the dignity of elector vanished, but the empty title continued to be used by the elector of Hesse-Cassel till 1866. See GERMANY.

Electra, daughter of Agamemnon and Clytemnestra, sister of Iphigenia and Orestes. After her father's murder by her mother, she saved the life of the young Orestes, and sent him to King Strophius to be brought up; and then helped him to avenge Agamemnon's death by slaying Clytemnestra. She was given in marriage by Orestes to his friend Pylades. Her story is the subject of a splendid tragedy by Sophocles, and was treated also by Æschylus and Euripides.

Electric Bells. See BELL.

Electric Clocks. Electric clocks may be divided into two classes—those in which the impulse is given to the pendulum directly by electric power, and those in which it is given by a weight or spring alternately liberated and restrained by electricity. Of the first kind, that invented by Bain (1840) is best known. In the ordinary clock, it is the clock that moves the pendulum; in Bain's clock, it is the pendulum that moves the clock. As the construction of the pendulum is the only part of it connected with electricity, we shall confine our notice to a general description of the pendulum action. The lower part of the pendulum arrangement is shown in the fig. The bob, B, consists of a bobbin of insulated copper wire, and is hollow in the centre; the wires *w*, *w* from both ends run along each side of the pendulum rod, R (the lower part of which alone is seen), and are in metallic connection respectively with the two springs from which the pendulum hangs. Two magnets or bundles of magnetic rods, NS, N'S', are fixed at either side of the bob, and are of such dimensions that the hollow bob in its oscillation can pass a certain way over each without touching. The magnets have their like poles turned towards each other. The two springs of the pendulum rod are in connection with the two poles of a galvanic battery. In the connection between one of these springs and the battery there is a break (not shown in the figure) worked by the pendulum rod. When the pendulum is made to move, say, towards the right, it shifts a slider, so as to complete the connection between the poles of the battery. The current thereupon descends one of the wires of the pendulum, passes through the coil of wire forming the bob, and ascends by the other. In so doing, it converts the bob into a temporary magnet, the south pole towards the right, and the north pole towards the left. In this way, the south pole of the bob is repelled by the south pole, S, of the right-hand magnet; and its north pole is attracted by the south pole, S', of the left-hand magnet, so that from this double repulsion and attraction both acting in the same direction, the bob receives an impulse towards the left. Partly, therefore, from this impulse, and partly from its own weight, the pendulum describes its left oscillation; and when it reaches the end of it, it moves the slider so as to cut off the battery current, and then returns towards the right, under the action simply of its own weight. On reaching the extreme right, as before, it receives a fresh impulse; and thus, under the electric force exerted during its left oscillation, the motion of the pendulum is maintained. So long as the electricity is supplied the pendulum will continue to move. The current required is exceedingly weak; but the imperfection of the battery originally used by Bain led to a strong prejudice against these clocks—stronger, certainly, than they merit. It has been found, however, by those who have employed them for astronomical purposes, that little dependence could be placed on them, and that the proper conditions of pendulum motion were, from the unsteady supply of electricity, interfered with. Hence the efforts of late in electric clock-making have aimed at rendering the pendulum independent of the irregularities of the motive agent.



A very important application of Bain's pendulum was made by Jones of Chester (1857). Shortly after the invention of Bain's clock, Professor Wheatstone suggested that any number of such clocks could be made to move simultaneously by the same current of electricity. Jones turned this idea to account in the following way. A standard clock of the usual construction is made, by regulating the flow of a galvanic current, to control the action of any number of copying clocks, likewise of ordinary construction. The pendulum of the standard clock, itself in no way under electric control, on passing towards the right, touches a spring placed at the side, thereby completing the battery connection, and a current is transmitted to the copying clocks in a certain direction. On passing to the left side, the same takes place, but the current this time is sent through the circuit in the opposite direction. The pendulums of the copying clocks are made on Bain's principle, but have, of course, no break to move, as the primary pendulum performs that function. Let us suppose, at first, that all the pendulums are at rest; in this case no current is transmitted. Let the standard pendulum now be moved to the right, the right spring is touched, and a current at the same instant circulates through the bobs of the copying pendulums, and they thereby receive a simultaneous impulse towards the left.

All the pendulums move then to the left; and on reaching the extremity of this oscillation, the standard pendulum touches the left spring, and the secondary pendulums are now impelled to the right. The motion of each secondary pendulum soon increases, until it reaches its proper extent. The pendulums once set a-going are, however, not intrusted solely to the stimulus of the electricity, but are moved by their own weights, as in ordinary clocks, so that if the electricity ceased to be sent to them, they would go on without it.

In the second class of electric clocks, the electricity is not charged immediately with the maintaining of the pendulum motion, but draws up the weight, or liberates the spring which discharges that function. This is the same principle as holds in what is known in horology as the 'remontoir' escapement. Ritchie of Edinburgh successfully combined the principles of Bain's and Jones's clocks, effecting the almost perfect control, by one standard clock, of a number of subordinate others. The pendulums of these controlled clocks vibrate by electro-magnetic action alone, and they consequently require no winding up.

Electric Fishes. Electric organs are found in a few fishes; peculiar structures arising from a modification of muscular tissue, and capable under nervous control of a genuine electric discharge. The degrees of development vary greatly. The organs are powerful in the Electric Eel (Gymnotus), in the African Cat-fish (Malapterurus), and in the Electric Ray (Torpedo), in order of merit. They are weakly developed, or 'pseudo-electric,' as they used to be called, in all the Rays except Torpedo, and in several species of bony fishes (Mormyrus and Gymnarchus). Professor Cossar Ewart has demonstrated a very rudimentary electric organ in the common skate.

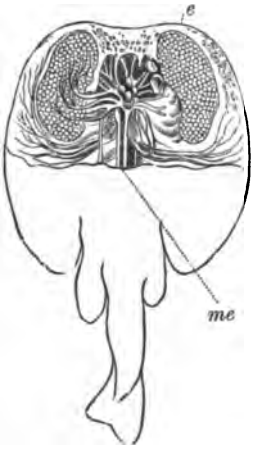


Fig. 1.—Electrical Apparatus of Torpedo (dissected): *e*, electric organs; *me*, spinal cord.

Structure.—It may now be regarded as demonstrated that all these electric organs are modified muscle-tracts. The associated nerve-endings are comparable to the ordinary terminations of a motor nerve on a muscle. The organs consist of a large number of rounded chambers or prismatic columns, separated by longitudinal and transverse partitions of fibrous connective tissue. In these partitions there are blood-vessels and nerves with very thick sheaths. The nerves lose their thickness, branch greatly, and finally fuse with 'electric plates,' or discs of modified muscular substance. Besides the essential electric plate, the compartment may contain a jelly-like substance or a fluid. Partitions, nerves, and the 'electric plate' form in all cases the principal structures.

Arrangement.—The electric organs not only occur in a well-developed state in three very widely separated fishes, but the arrangement in each case is different. (*a*) In the Gymnotus, which is abundant in the fresh water of Brazil and the Guianas, they replace the lower muscles along the sides of the tail. This is also the position of the weakly developed organs in the Rays (except Torpedo) and in the bony fishes already mentioned. As Gymnotus may measure 6 feet in length, and has a very long tail, there is little wonder that its electric discharge is emphatically dangerous. The whole apparatus is supplied with more than 200 spinal nerves; one inch in length contains over 200 chambers (Günther). (*b*) In the African catfish, which is not uncommon in tropical Africa, and is represented by *M. electricus* in the Nile, the organ is more diffuse. It forms a sheath almost round the body, lying between the skin and muscles, but is thickest along the lower sides. The innervation is remarkable, for there is but one enormous nerve for each side. This arises from a giant cell high up on the spinal cord, and distributes branches throughout the body. The fish is again very long, measuring about 4 feet, and ranks second in the series. (*c*) In the Electric Rays (Torpedo), which occur in the Atlantic and Indian oceans and in the Mediterranean, the organs are broad, bounded by the gills, the pectoral fins, and the head. The prisms, of which there are many hundreds in each battery, lie vertically, not longitudinally as in the two preceding cases; and the nerves, instead of coming from the spinal cord, arise directly from the brain. Four of the five principal nerves on each side 'are each as thick as the spinal cord.' It is noteworthy that the above electric fishes have all smooth skins.

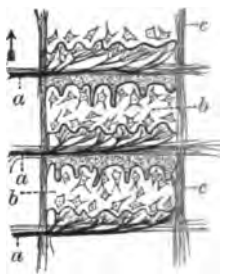


Fig. 2.—Section through Electric Chambers (greatly enlarged and semi-diagrammatic, from Wiedersheim and Parker): *a*, nerve breaking up into fibres; *b*, electric plates; *c*, connective-tissue walls of compartments.

Fig. 3.—Electric Prisms of Torpedo.

Function.—How the 'electric plates' come to be charged with electricity is not yet elucidated. The currents have all the usual characteristics of electricity: 'they render the needle magnetic, decompose chemical compounds, and emit the spark' (Günther). 'The side of the electric plate on which the nerve branches out is negative at the moment of discharge, while the opposite side is positive, and from the different arrangements of the parts the electric shock passes in different directions in the three fishes—in Malapterurus from the head to the tail, in Gymnotus in the contrary direction, in Torpedo from below upwards' (Wiedersheim and Parker). The activity of the organ is wholly dependent (*a*) upon nerve stimulus from the brain, and (*b*) upon a certain degree of freshness in the structure itself. If the connection with the brain be severed, no discharge can be produced, except of course by the artificial stimulus of the severed nerves. Or if numerous rapidly repeated discharges have been already evoked, the organ is exhausted, and requires rest and recuperation before it becomes again functional. Humboldt's graphic story of the capture of electric eels by letting them first exhaust themselves in attacking horses has never been confirmed. In natural life the strength of the shock varies with the degree of development reached by the organ, with the size, health, and humour of the fish, and with the amount of reserve energy within the structure. A ray measuring 2 to 3 feet in width is 'able to disable by a single discharge a full-grown man,' and yet the ray is the least powerful of the three. To receive the shock the

object must complete the circuit by a double contact with the fish either directly or through some intervening substance. When well developed, the organ may be useful to the fish in two ways—in paralysing or killing other fishes used as food, and in warding off the attacks of enemies.

The electric ray and eel were known to the ancients, and were used for curative purposes, 'the earliest electric machines employed by mankind.' Scientific research on the electric organs really began with Walsh's demonstration (1772) of the genuinely electrical character of the discharge. The subject has been much worked at by some of the ablest anatomists and physiologists, and certainly is not yet finished. The origin of the organs, useless when incipient, and the connection between this peculiar development and the ordinary electrical properties of muscle and nerve are unsolved problems.

See GYMNOTUS, MUSCLE, NERVE, RAY, TORPEDO; Batuchin in the *Arch. f. Anat. und Physiol.* (1876), for recent researches; Coldstream, article 'Animal Electricity' in Todd's *Cyclo. of Anat. and Physiol.* (1836-39), for old observations and stories; C. Gegenbaur, *Comparative Anatomy* (trans. by F. Jeffrey Bell, 1878); Günther, *Introduction to the Study of Fishes* (1880); Du Bois Reymond, *Gesammelte Abhandl. z. allg. Muskel- und Nerven-physik*, bd. ii.; R. Wiedersheim, *Comparative Anatomy* (trans. by W. Newton Parker, 1886).

Electricity.* If a stick of sealing-wax is rubbed vigorously with woollen cloth it will be found capable of attracting small shreds of paper. This is the simplest experiment in electricity. Many other substances, such as resin, vulcanite, glass, &c., can be made to show the same phenomenon. To obtain the best effect with any given substance, a particular rubber must be chosen. For example, a cat's fur, slightly warmed, is very efficient in electrifying vulcanite or resin; while silk, amongst simple substances, should be used to excite glass. It is now known, however, that any two different substances, which can be rubbed together, become electrified by the friction. Thus, if wax and glass are rubbed together, they will both become electrified—i.e. capable of attracting light objects. And so, in the other instances, it can be shown by experiment that the cloth is electrified as well as the wax, the cat's fur as well as the vulcanite, the silk as well as the glass. Moreover, the two substances so electrified by mutual rubbing are found to attract one another, being indeed *oppositely* electrified—a term which the following experiment will elucidate.

Let two pieces of glass be electrified by rubbing each with a distinct piece of resin. The pieces of resin will also be electrified, and it will be found (1) that the pieces of glass repel each other; (2) that the pieces of resin repel each other; (3) that each piece of glass attracts each piece of resin. Exactly the same phenomena of attraction and repulsion will be shown—only much more powerfully because of the greater efficiency of the rubbing—if the pieces of resin are rubbed with cat's fur and the pieces of glass with silk.

Again, let a small light body, a pith-ball for example, be suspended at the end of a silk thread. This will be attracted by either the resin or the glass. But if it is allowed to come into contact with, say, the resin, it will immediately be repelled by the resin and strongly attracted by the glass. And if it should be allowed to touch the glass, it will at once be repelled by the glass and strongly attracted by the resin. By such contact the pith-ball itself becomes electrified; for it will repel a second pith-ball similarly treated. We are thus led to the following conclusions. Repulsion exists between bodies which are similarly electrified, and attraction between bodies which are oppositely electrified. Bodies, electrified by mutual rubbing, become oppositely electrified. A body, electrified by contact with an electrified body, becomes electrified similarly to that body. Substances which like silk-rubbed glass repel silk-rubbed glass and attract wool-rubbed resin are vitreously or *positively* electrified, while bodies which attract silk-rubbed glass and repel wool-rubbed resin are resinously or *negatively* electrified. The indication of the two kinds of electrification by opposite signs is very appropriate, but the application of the positive sign to one rather than to the other is a matter of convention and purely arbitrary.

To study electrical phenomena by means of metallic substances, it is necessary first of all to *insulate* them—i.e. to support them on glass, vulcanite, paraffin, &c., or to hang them by silk threads. The significance of the term insulation will appear from the following experiment. Hang two metal balls, one by a silk thread and the other by a wire, and touch them with a piece of wax strongly electrified by friction. On trial, the silk-suspended ball will be found electrified; but not so the wire-suspended ball. Or, again, set a metal ball on a glass support, but let a wire connect it with the table or the hand. It will be found impossible to electrify it by contact with an electrified body. But remove the connecting wire, and immediately a single contact will suffice to electrify the ball. Thus we recognise two kinds of substances—viz. *insulators* and *non-insulators*. The latter are usually called *conductors*, and include all ordinary metals. Such conductors can be electrified only when they are insulated.

When a body is sufficiently strongly electrified and brought very near another body originally unelectrified, a spark will pass between them even before they are made to touch. If this second body is the finger or knuckle, the spark will be accompanied by a peculiar sensation called an electric shock. Now let us take such a highly electrified conductor A, and bring pretty near to it a second insulated conductor B, but not so near as to cause a spark to pass. If, then, the finger be brought near enough to B a shock will be felt, a spark will pass between B and the finger, although B was originally not electrified. Thus B has become electrified by being brought into the neighbourhood of A. This mode of electrification is called electrification by *induction*. As Faraday clearly pointed out, it 'has the character of a first, essential, and fundamental principle,' and its thorough comprehension is of prime importance.

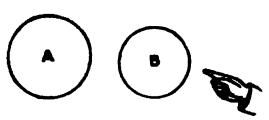


Fig. 1.

As it is our purpose to regard the whole subject from the Faraday point of view, it will be convenient to define certain useful terms. The *electric field* is any region of air, glass, vulcanite, or other non-conducting substance surrounding or containing electrified bodies. In it and through it the electric forces act; hence it is convenient to call such insulating substances *dielectrics*, especially when attention is being drawn to the rôle they play as transmitters of electric action. To investigate the properties of an electric field it is generally necessary to bring into it a conductor, as in the experiment just described. In that experiment the induced electrical condition of B was studied by means of a physiological sensation, partly optical, partly muscular. A far better way, how-

* For the plan and distribution of the following article, see the epitome in the concluding paragraph. The word *electric* was coined in the 16th century by William Gilbert from the Gr. ἤλεκτρον, 'amber.' See AMBER.

ever, of studying the phenomena of induction is to make use of the fundamental laws of attraction and repulsion between electrified bodies, as they are mechanically applied in such instruments as the gold-leaf electroscope, Coulomb's torsion balance, Thomson's quadrant electrometer, &c.

In the gold-leaf electroscope (invented by Bennet in 1787), two light stripe of gold-leaf hang from the lower end of a metal rod, which passes vertically through an opening in the top of a glass bottle and expands above into a plate. If a piece of rubbed sealing-wax or other electrified body be brought near the plate, the gold leaves will repel each other and diverge. In other words, the conductor, consisting of the plate, rod, and gold leaves, has been introduced into an electric field, and has in consequence become electrified by induction. This is shown by the repulsion between the similarly electrified gold leaves. The nearer the electrified body is brought, the stronger is the electric field surrounding the electroscope, the wider do the gold leaves diverge. Here evidently the repulsion tends to lift the centre of gravity of each gold leaf, and is finally balanced by the action of gravity. A cylinder of wire gauze, placed just inside the glass case, improves the action of the instrument. The other two instruments mentioned above depend for their action upon the same general principle—viz. the equilibrium of a body under the action of the electrical and what, for distinction, might be called the material forces.

Fig. 2.

Coulomb's torsion balance is historically the first true electrometer—i.e. the first instrument whose indications were capable of quantitative interpretation. In it the force with which one small charged sphere is repelled by another similarly charged is balanced by the torsion of a wire, which acts as suspension to a horizontal insulating rod bearing the one sphere at one of its ends. By rotation of the upper end of the wire this sphere can be made to move in a horizontal circle; and at some point in the circumference of the circle the other sphere is fixed. If the spheres are charged, the rod bearing the movable sphere will take up a position of equilibrium under the combined action of the electrical force and the torsion of the suspension; and these, as regards their rotatory effect upon the rod, must be equal. But by the laws of elasticity, the force of torsion is proportional to the twist of the wire, and the twist itself is as easily measured as the distance between the spheres. Hence to the degree of accuracy to which the geometrical configuration of the system is known, the electric force can be calculated in terms of the elastic constants of the wire. In this way Coulomb proved, in 1785, that two small charged balls repelled each other with a force which diminished as the square of the distance increased.

Sir William Thomson's quadrant electrometer is, in a certain sense, a development of Coulomb's torsion balance. Its many nice electrical and mechanical devices render it a peculiarly delicate and accurate instrument for measuring minute differences in electrification. Essentially it consists of four hollow brass quadrants, which when fitted close together form a squat hollow cylinder bounded above and below by parallel plane faces. For electrical purposes they must, however, be drawn a little apart, so that when looked at from above or from below they have the appearance as shown in the figure—viz. that of a circular disc with two mutually perpendicular diametral clefts. Each quadrant is insulated on its own glass support; but each is joined to its opposite by a wire, so that electrically they go in pairs. From one of each pair a vertical rod leads to the outside of the case in which the whole is inclosed. These rods are called the *electrodes*, and their function is to bring the pairs of quadrants into electrical connection with external bodies. The inside corner of the top and bottom of each quadrant is cut away, so that at the centre a small circular space is left concentric with the external cylindrical surface of the quadrants. In the hollow space inclosed by the quadrants a light charged body (E in fig. 3, *u* in fig. 4) of a convenient shape hangs, its axis of suspension passing up through the circular central space just mentioned. The light body can rotate about this vertical axis only, and its motion is controlled by the torsion of the suspension. If the four quadrants are all connected together, the suspension makes the light body hang so as to lie with its longer axis of symmetry parallel to one of the diametral clefts separating the quadrants. If, however, the pairs of quadrants are disconnected, and by connection with external bodies brought into different electric conditions, electrical forces will at once act upon the charged body and rotate it until they are balanced by the resisting torsion of the suspension. Thus let the charged body *u* (fig. 4) be positively charged; and let the pairs of quadrants be charged differently, so that the ones marked AA′ have a higher positive charge than the ones marked BB′. Then the charged body will move so as to come more within the quadrants BB′. If the relative electrifications of the pairs of quadrants is reversed, the charged body will move the other way. The motion is shown and measured by means of a beam of light reflected from a small mirror fixed to the vertical axis of suspension of the body and moving with it.

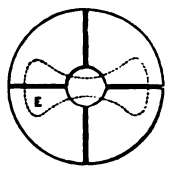


Fig. 3.

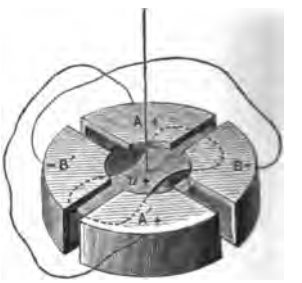


Fig. 4.

Henceforth we shall use the unqualified words electroscope and electrometer as meaning the gold-leaf electroscope and quadrant electrometer respectively.

We are now in a position to make an accurate study of the phenomena of induction. We shall suppose, when nothing is said to the contrary, that all our conductors are of one metal, say brass; that they are at the beginning of every experiment insulated and unelectrified; that the electroscope and electrometer quadrants are likewise unelectrified at the beginning of each experiment; and that the dielectric is air.

Experiment I.—Set a cylindrical brass vessel on the electroscope; and let down into it, without coming into contact with it, a positively charged conductor A. It is convenient to hang this charged ball at the end of a short silk thread from the lid

e lid itself being lowered or raised
r means of a silk thread. As
on as the ball is brought inside
e vessel the gold leaves will
verge, as shown in fig. 5; and
e vessel B, as regards outside
jects, will behave as if positively
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e hand or with any non-insulat-
g material connected to earth—
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sel to earth—and the gold
ves will fall together, and all
pearance of electrification will
destroyed. Remove the earth
nection so as to insulate B
e more, and lift away the lid
the attached ball, care being
en to prevent A coming in
tact with B. The gold leaves
again diverge, and the vessel
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electroscope, even though, as in the former experiment, A should be removed. Thus the charge on A has been completely destroyed; hence, there must have been on B, just before the contact was made, an equal but opposite charge. This is, in fact, the very charge which made its presence evident when, in Experiment I., the ball A was removed.

Thus, if a charged body A be completely surrounded by a closed vessel B, which is put to earth and then insulated, the charge induced on B is equal and opposite to the charge on A. To make this induced charge apparent we must remove A.

Experiment III.—Repeat Experiment I., and after having charged B negatively by induction, introduce A into another conductor C, initially without charge and insulated. If C is resting on a gold-leaf electroscope, the gold leaves will diverge with positive electrification as in the earlier stage of Experiment I. Bring now A into metallic connection with C. If C *completely* surrounds A, no change will be observed on the electroscope, although a spark may be heard at the instant the contact is made. The ball A, if removed without again coming in contact with C, will be found to have lost all its charge; and if B and C are brought into metallic connection, all appearance of electrification on them also will be destroyed. In other words, the negative charge induced on B has been quite destroyed by union with the positive charge transferred to C. These charges therefore must be equal and opposite. Thus, the charge originally on A has been wholly transferred to C.

We conclude, then, that when a conductor is electrified, its electrification resides wholly on the surface. Any portion of it removed from the inside will be found unelectrified if taken quite out of the influence of other electrified bodies.

This experiment, or one very similar to it, was first performed in 1772 by Henry Cavendish, who deduced from it by rigorous mathematical reasoning that 'electric attraction and repulsion must be inversely as the square of the distance.' He inclosed a metal globe within a hollow conducting shell which was built up of two hemispheres. The globe and shell were connected by a wire and charged. The globe was then disconnected from the shell, and immediately thereafter the hemispheres forming the shell were drawn asunder. The globe, now left exposed, was tested for electrification; and, to the degree of accuracy of the experiment, none was found.

Maxwell repeated the experiment in a much more delicate manner than was possible before the invention of the quadrant electrometer. During the charging of the shell and inclosed globe, these were connected by a short wire 'fastened to a small metal disc hinged to the shell, and acting as a lid to a small hole in it.' After the charging, this lid was lifted up by means of a silk thread, and the communication between the shell and the globe done away with. The shell was then discharged and kept connected to earth. Through the small hole in the shell a wire was led connecting the globe with one electrode of the quadrant electrometer. Not the slightest deflection could be observed.

It is impossible then to charge a body by placing it inside a charged conductor. In other words, there is no electric field within any region bounded by a conducting surface, however much that surface may itself be charged, unless there be within that region other insulated and independently charged bodies. It matters not what electrical phenomena may be taking place in the region outside such a conducting surface, such external electrical phenomena have absolutely no internal electrical effect; and *vice versâ*, any purely internal electrical change can produce no external electric effect. In short, any closed conducting surface divides space into two regions, which are electrically independent the one of the other—i.e. so far as electrical action through either is concerned. This principle is taken advantage of in the construction of the quadrant electrometer, the essential internal arrangements of the instrument being inclosed as far as possible within a conducting vessel, the quadrants communicating with external space only by means of their electrodes.

Experiment IV.—The conclusions just stated may be easily illustrated by use of the quadrant electrometer. Thus, as in Experiment I., let the positively charged body A be introduced into an insulated and initially unelectrified closed conductor B. Then, as we know, B becomes electrified, and the region round B becomes an electric field. The condition of this electric field may be studied by means of a small sphere C, joined by a long thin wire to one electrode—i.e. to one pair of quadrants—of the electrometer E. The other electrode is supposed to be kept connected to earth. Before A was introduced into B, the electrometer showed no sign of electrification. But as soon as A is introduced into B, C and its connected quadrants become electrified. The deflection produced on the electrometer will depend upon the position of C with regard to B and upon the original charge of A. It is quite independent, however, of the particular position of A, which may be moved about inside B without in any way affecting the

deflection on the electrometer. A may even be brought into contact with B (as in Experiment III.) so as completely to lose its charge; and yet the electrification of C, as shown on the electrometer,

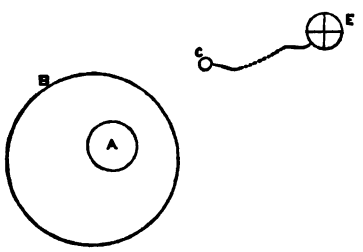


Fig. 6.

is in no way altered—in other words, the electric field outside B is independent altogether of any purely internal changes which may take place inside B.

Suppose, now, that when A has been introduced into B, and a corresponding deflection obtained on the electrometer, B is put to earth. At once the electric field around B is destroyed, C and its connected quadrants recover their original unelectrified condition, and the electrometer gives zero deflection on its scale. Thus the charge on A is completely masked by being surrounded by a closed conductor put to earth.

Further, let B be insulated again and A removed with its charge—then, as we already know, B will be left negatively electrified. The region round B will again become an electric field, and C and its connected quadrants once more electrified. But the deflection on the electrometer, though equal to that first obtained, will be in the opposite direction, opposite because of the opposite character of B's electrification.

This experiment may be taken as an illustration of one of the most fundamental facts in electrostatics—viz. that the generation of so much positive electrification implies the generation of as much negative electrification. Here is a conductor B apparently without charge. Remove from it by any process a positive charge, and an equal negative charge is left behind. The same is true when bodies are electrified by friction, as may be proved by operating inside a closed insulated conductor joined to one electrode of the electrometer. The most energetic rubbing of the two bodies, and their subsequent separation, each in a highly electrified condition, produce no effect whatever on the electrometer—thus showing that their inductive effects on the inclosing conductor are equal and opposite—i.e. their charges are equal and opposite.

Experiment V.—To study in greater detail the properties of the electric field around a given charged conductor B, take two small insulated spheres and connect them by thin wires to the electrodes of the electrometer, each to one. Suppose these spheres to be at first in close contact at some part of the field; then, since the pairs of quadrants are in the same electrical condition, the electrometer will show zero deflection. Now gently separate the spheres, both insulated of course, and in general a deflection to the right or to the left will be obtained on the electrometer. By trial we may find the unique direction of separation which, for a given distance of separation, gives the maximum deflection. This will be to the right or to the left according to the relative position of the two spheres. It will be found, however, that a separation of the spheres in directions at right angles to this unique direction does not cause any deflection on the electrometer. It is far easier indeed to find these directions of separation for which there is no deflection than to find the direction of maximum deflection for a given separation. Suppose in fact that the one small sphere is fixed in position, and that the other, which we may call the exploring sphere, is moved away from contact with it in such a manner that the electrometer always shows zero deflection. The centre of the exploring sphere will describe a curve, and can be made by successive trials to describe an infinity of curves, all lying on a certain surface which passes through the centre of the fixed sphere. We shall call this the surface S. Now with the exploring sphere lying anywhere on this surface, let the fixed sphere be shifted in towards B till the electrometer deflection is unity. Then shift the exploring sphere correspondingly until the deflection is brought back to zero again, and proceed as in the first position to trace out a second surface, which we shall call S + 1, and which will pass through the centre of the fixed sphere in its second position. Shift the fixed sphere once more till unit deflection is obtained, follow up with the exploring sphere, and trace out the third surface S + 2. In this way, step by step, the electric field may be supposed to be mapped out by a series of surfaces, differing in value by unity as measured on the electrometer scale. We may pass out to the surfaces S − 1, S − 2, S − 3, &c., as well as in to the surfaces S + 1, S + 2, S + 3, &c. These surfaces are all closed, and cannot cut each other. For suppose two did cut each other; then, by putting the fixed sphere in the supposed line of intersection, we could move the exploring sphere from the position S to the position S + 1, and produce no change on the electrometer; which is a manifest absurdity, as S + 1 is defined in terms of S *and a change*. If the electrodes of the electrometer terminate on any one of these surfaces there is no deflection; if they terminate on different surfaces the deflection is the difference of the name-values of the surfaces. Evidently the conductor B is such a surface, for if the electrodes terminate on it, all the quadrants, being in metallic connection, will be in the same electrical condition, and the electrometer will show no deflection.

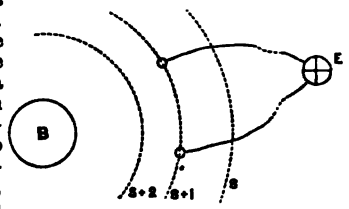


Fig. 7.

The surfaces we have just described are called *equipotential* surfaces, the term potential having in electricity much the same import as temperature has in heat or pressure in hydrodynamics. When a channel exists between two masses of fluid at different pressures, fluid will flow from where the pressure is higher to where it is lower. Similarly if we have two charged conductors whose electrical conditions as tested by electroscope or electrometer become changed after they have been connected by a wire and disconnected again, these two conductors are said to have been at first at different potentials. If they had been connected to the electrodes of the electrometer, each to one, the electrometer would have shown a deflection; and this deflection would have been a measure of the difference of potential. If the difference of potential is great, then the contact of the two conductors is evidenced by an obvious electrical discharge in the form of a visible audible spark.

If we directed our attention to conductors only, we should not find any special advantage in using

the phrase 'difference of potential' instead of 'differently electrified;' but when we follow Faraday in regarding the dielectric as of at least equal importance as the conductor, the conception of the potential is found to be one of peculiar value. Thus any conductor or any system of connected conductors must have all points at the same potential; whereas, in a dielectric, the potential may vary from point to point, and indeed must vary if the dielectric is separating two conductors at different potentials.

Within such a dielectric we may suppose traced out, after the manner of the last experiment, a series of equipotential surfaces. To fix our ideas, let the one conductor be completely inclosed within the other—say, a spherical globe within a concentric spherical shell—and let this outer shell be put to earth, and let us call its potential zero. Then we know by Experiments II. and IV. that the electric field exists only in the region between the shell and the globe, which we shall suppose to be at a high potential V. The symmetry of the system requires that the other equipotential surfaces will all be spheres concentric with the globe and shell. Now we may compare this electrical system of globe, shell, and intermediate equipotential surfaces to a

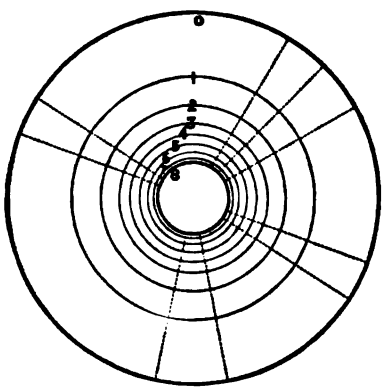


Fig. 8.

system of Contour (q.v.) lines representing a hill with a flat top rising up from the sea-level—the successive equipotential surfaces in the electrical system corresponding to successive equal-level lines in the geographical system. If the substance of the hill were to become fluid, the whole would be reduced to the sea-level, and the contour lines would be effaced. So, if the dielectric were to become conducting, the equal and opposite charges (see Experiments II. and IV.) on the globe and shell would combine and destroy each other, and the electric field with its imaginary equipotential surfaces would cease to exist. Again, to carry one pound of matter from the sea-level up to the top of the hill requires so much work to be done against gravity (see ENERGY), and this amount of work is proportional to the height lifted through—i.e. to the number of contours crossed. So, in the electrical system, to carry a small positive charge from the shell to the globe will require so much work to be done against the electrical forces, and this amount of work will be proportional to the number of equipotential surfaces crossed. Further, exactly as the pound of matter taken to the top of the hill will add to the height of the hill, so will the addition of this small extra charge to the globe increase its potential. We must not, however, push the analogy too far, since in the one case the force of gravity overcome is constant and acts downwards, whereas in the other the electric force varies inversely as the square of the distance from the centre and acts outwards.

We have assumed in the above discussion that the successive equipotential surfaces, experimentally determined by means of the quadrant electrometer, are really such that the work done in carrying a given small charge over the interval separating any two contiguous surfaces is the same. It is usual in treatises on the subject to begin with the dynamical definition of the potential at a point as the work done in carrying a unit of positive electricity from infinity to that point. It is then shown that the quadrant electrometer is an instrument so constructed as to fit in to this definition.

Assuming then that our equipotential surfaces have the property just mentioned, we are in a position to study the energy relations of the electric field.

Coulomb established by experiment that the force of repulsion between two similarly charged bodies was directly as the product of the charges. Hence, as the charge of the globe inclosed in the shell is increased, the electric forces in the field increase in the same proportion. Hence the work done in carrying a given charge from the shell to the globe against the electric forces increases in the same ratio. In other words, the number of equipotential surfaces in the field grows uniformly with the charge. If the potential of the globe is V, we may write the charge CV, C being a constant so long as the geometrical dimensions of the system remain unchanged. Since the shell is always kept connected to earth—i.e. at zero potential, there is a charge – CV distributed over the inside of the shell. To add a small extra charge to the globe may be regarded as equivalent to taking this small charge from the shell, carrying it across the dielectric, and distributing it over the globe. The work done in effecting this is evidently proportional to the charge taken and to the number of equipotential surfaces crossed. But as the extra charge is added, let us suppose, at a steady rate, the potential of the globe is increased at a proportional steady rate. Hence the whole work done in adding a given charge is equal to the product of the charge and the mean potential of the globe during the operation. Thus, in charging the globe from zero potential to potential V, we do an amount of work equal to half the product of the final potential V into the final charge CV—in symbols $\frac{1}{2}CV^2$ or $\frac{1}{2}QV$ or $\frac{1}{2}Q^2/C$, where Q is the charge, and C the constant which depends on the geometrical dimensions of the system.

We have already seen that positive and negative electrifications always co-exist—that it is impossible to generate so much positive charge without at the same time generating as much negative charge. Faraday took implicit account of this truth in his conception of lines of electric force traversing the dielectric. Since no work is done against the electric forces in passing along an equipotential surface, we readily see that the electric force at any point is perpendicular to the equipotential surface there. This direction is, in fact, the unique direction of separation of the two terminal spheres in Experiment V., which, for a given distance of separation, gave the maximum deflection. If, starting from any point, we move always perpendicular to the equipotential surface through which we are for the moment passing, we shall describe a curve which at every point of it is tangential to the direction of the electric force there. Such a curve is called a Line of Force. Take any small area on an equipotential surface, and draw lines of force through its perimeter. These lines of force will form a so-called Tube of Force, whose section in general will vary as we pass along it. Following this tube of force backwards to its source, we shall finally come to a

positively charged conductor; and following it forwards we shall ultimately come to a negatively charged conductor. Every such tube of force has, in short, two ends. It springs perpendicularly from a positively charged area, and terminates, also perpendicularly, on a negatively charged area. According to Faraday's view, and to the view now generally accepted, it is along these tubes of force that electric induction takes place; so that the negative charge on the terminal area is exactly equal to the positive charge on the area from which the tube springs.

In the symmetrical system of globe and shell the lines of force are obviously straight radial lines, the tubes of force portions of cones terminated by the spherical surfaces. Some of them are indicated by the dotted lines in fig. 8. If we take each tube as springing from an area bearing unit charge, then there will be in the region as many tubes of force as there are units of charge—i.e. there will be $Q(=CV)$ unit tubes of force. These Q unit tubes of force with the V equipotential surfaces will cut up the dielectric into QV imaginary cells, each of which may be regarded as containing half a unit of energy. In fact, exactly as a stretched piece of india-rubber contains in every element of it so much energy in virtue of the elastic stresses acting throughout it, so we are to regard an electric field as a kind of strain existing in the dielectric, so that in every element of the dielectric so much electrical energy is stored up in virtue of the electric stresses. Every complete unit tube of force contains $\frac{1}{2}V$ units of energy; and between any two complete equipotential surfaces differing by unity there are $\frac{1}{2}Q$ units of energy stored up. Clearly the electric strain will be greatest where the unit tubes of force are narrowest and where the equipotential surfaces are closest.

Suppose, now, that in the region between the globe and shell an insulated conductor originally unelectrified is introduced; or, what comes to the same thing, suppose a marked off region in the electric field to become conducting, this region will at once be reduced throughout to the same potential, and its surface will form part of an equipotential surface. But, since originally the potential in this region fell steadily as we passed outwards from the globe, a transference of charge must have taken place also outwards in order that the potential should become equalised throughout. The introduced conductor in fact acts as a channel along which electrification is transferred; so that, if tested, the end facing the globe will be found negatively electrified, and the farther end positively electrified.

Now it is evident that the introduction of this conductor into the field has very much changed the configuration of the equipotential surfaces in its vicinity, the new configuration being something like what is indicated in the diagram (fig. 9). As a consequence, the tubes of force, which are necessarily perpendicular to the equipotential surfaces, must also suffer a corresponding change of configuration. A certain number, springing from the globe, will fall perpendicularly on the nearer part of the introduced conductor, while from the farther part an equal number of tubes of force will spring and continue outwards to the shell. Where the tube ends on a conducting surface, there we find unit negative charge; and where it springs from a conducting surface, there we find unit positive charge. Thus, by consideration of the equipotential surfaces and tubes of force, we are led to a conclusion in strict accordance with the experimental truth that an uncharged conductor brought near a charged conductor becomes electrified by induction, so that the nearer end shows an opposite charge, and the farther end shows a similar charge, to that which exists on the charged conductor.

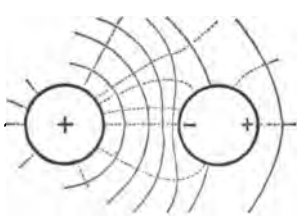


Fig. 9.

Generally speaking, the effect of the presence of the introduced conductor is to crush the tubes of force in the neighbourhood closer together, and therefore (since this number remains constant) to compel an expansion of them elsewhere. The terminals of the tubes on the globe will obey the same tendency towards concentration and expansion. In other words, the charge Q, at first distributed uniformly over the globe, becomes redistributed and tends to accumulate on the side facing the conductor. The nearer the conductor and globe are brought, the greater will this tendency be; and at last, when they are near enough, the dielectric is unable to sustain the high electric tension along the ever-shrinking tube of force. It yields, a more or less sudden transference of charge takes place in the form usually of a spark, the potentials of the globe and conductor are practically equalised, and the tubes of force between them are annihilated. This is the phenomenon which is exhibited on a large scale in every lightning-flash, and on a small scale in every spark between electrified bodies.

Suppose, however, that before this catastrophe has taken place, the conductor is joined by a wire to the surrounding shell, and consequently brought to zero potential. All those equipotential surfaces which at first inclosed the conductor—i.e. lay between it and the inclosing shell, will be shifted so as to lie between it and the globe. The tubes of force will shift correspondingly; and as no tube can now pass from the conductor to the shell, none will spring from it. Hence the charge on the conductor will be wholly negative. Now experiment shows that when the conductor is brought to zero potential in the way just described, a spark always passes at the instant the connection is made. This spark means so much energy in the form of light, sound, and heat, and must therefore mean a disappearance of energy in some other form. This cannot be other than electrical energy. Consequently the number of unit cells in the dielectric must be diminished. But the charge on A has not changed, so that the number of tubes of force is exactly as before. The change must therefore be in the number of equipotential surfaces; and since the shell and the conductor are at zero potential, the diminution must take place in the potential of A. Thus we see that the potential of a positively charged body is diminished if a conductor at zero potential is brought near it.

This result leads naturally to the discussion of *capacity*. The capacity of a conductor is measured by the ratio of its charge to its potential. Hence if, as in the experiment just described, we have a diminution of potential with constant charge, this is equivalent to an increase of capacity. The greater the capacity of a conductor, the greater the charge it can hold at a given potential. Hence if a number of conductors are at the same potential, the charges must be distributed amongst them directly as the capacities. The experiment just described shows how we may arrange matters so as greatly to increase the capacity of a given conductor. It is sufficient to have close to it another conductor at zero potential. Such an arrangement of conductors is called an *accumulator* or *condenser*; and the most familiar form of accumulator used in electrostatic experiments is the Leyden jar, so called

from the city where, in 1745, its properties were accidentally discovered by Cunæus. About the same time, possibly a month or two earlier, almost exactly the same discovery was made by Kleist at Kammin in Pomerania. In its modern form, a Leyden jar is a cylindrical glass bottle, lined inside and outside with metal foil up to within a short distance from the top. A brass rod connected below with the inside coating passes upward through the cork or stopper, and terminates generally in a ball or knob. A Leyden jar then consists essentially of two conductors, the one almost completely inclosed in the other, and separated from it only by the thickness of the dielectric. If either conductor is put to earth, and the other insulated and charged, an opposite and nearly equal charge is induced on the former. If we could completely surround the one conductor by the other, the induced charge would, as we have seen, be exactly equal but opposite to the inducing charge. Leyden jars are indispensable for carrying out illustrative experiments in electricity. When used in combination, they are said to form an electric battery.

Fig. 10.

The essential nature of the mode of action of an accumulator or condenser may be illustrated as follows: Take any charged conductor with its associated electric field. Let Q be its charge, V_0 its potential, so that $\frac{1}{2}QV_0$ is the measure of the electric energy stored up in the field. Having fixed our attention upon any equipotential surface V_1 inclosing the conductor, let us suppose this surface to become conducting. There will be no transference of charge over this surface, because it is from the very beginning an equipotential surface. There will be no change of the electric field either inside or outside the surface V_1; but these two regions will now be separated by a conducting surface. So far as the outside region is concerned, we may regard the charge Q as distributed over a conductor co-extensive with the conducting surface V_1 (see Experiments III. and IV.), and may quite disregard the existence of the original conductor at potential V_0. The electrical energy stored up in this outside region is therefore a $\frac{1}{2}QV_1$. Let us now connect this newformed conductor to earth so as to reduce it to zero potential.

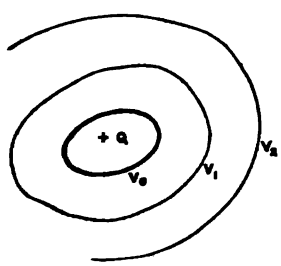


Fig. 11.

By so doing, we discharge the conductor, completely destroying the electric field outside of it and the $\frac{1}{2}QV_1$ units of electric energy stored up in it. This therefore is energy lost to the original system; and the energy stored up in the dielectric separating the two conductors becomes a $\frac{1}{2}Q(V_0 - V_1)$. Now, since the inclosing conductor has been reduced to zero potential, the quantity $(V_0 - V_1)$ must represent the new potential of the inclosed conductor.

In short, the bringing of the inclosing conductor to zero potential, being a purely external electrical change, has in no way altered the *configuration* of the equipotential surfaces and tubes of force inside; it has simply *reduced the potential values* throughout by the same amount—viz. the potential of the inclosing conductor before it was put to earth. The potential of the inclosed conductor has fallen from V_0 to $V_0 - V_1$; and hence, as the charge Q has remained unchanged, the capacity has increased in the ratio $V_0 - V_1 : V_0$. Thus, with either conductor fixed in size, the capacity of the system grows greater and greater as the thickness of the separating dielectric is diminished. If, as in almost all practical cases, the dielectric is very thin compared to the size of the conductors, we may assume that the successive equipotential surfaces come at sensibly equal intervals, so that the surface halfway between the conducting surfaces will have approximately a potential value half-way between the potentials of the conductors. Thus it is easily seen that for a condenser built up of closely opposed surfaces, whether plates or cylinders, separated by a given dielectric, the capacity varies inversely as the thickness of the dielectric.

Take, for example, two concentric spheres, one slightly larger than the other, and let the inner one have a charge Q, and the outer one be at zero potential. The negative charge on the outer sphere will, by a well-known proposition in attractions, exert no electric force throughout its interior. Hence, if a is the mean of the radii of the spheres, we may write Q/a^2 as a very approximate value for the mean electric force acting in the region separating the spheres. If t is the small distance between the two surfaces, the work done in carrying unit charge from the outer to the inner surface is Qt/a^2, the product of the distance into the mean force. This therefore measures the difference of potential of the two spheres, so that a^2/t is the capacity. Now, we shall suppose that t is kept constant, and that a is made to grow indefinitely; then if we write $Q = 4\pi a^2\sigma$, the quantity σ will be the charge on unit area of the inner surface. Hence, ultimately, when the concentric spheres become two parallel planes, the difference of potential between them is measured by the quantity $4\pi\sigma t$, where σ is the charge on unit surface of the one plane, $-\sigma$ the charge on the opposing surface of the other, t the distance between the planes, and π the ratio of the circumference of a circle to its diameter. The force is measured by the rate at which the potential changes, in this case simply $4\pi\sigma$, and is therefore the same not only at every point between the planes, but also for all values of t.

Now we may calculate the electric force very close to any charged surface on the supposition that the contiguous surface element is part of an infinite plane having the same charge per unit area—in other words, the same surface density. By surface density at any point of a charged conductor we mean the limit of the ratio of the charge on a small element containing the point to the area of the element, as the element is taken smaller and smaller. Such is the quantity σ just discussed. Thus the electric force just outside a charged conductor is equal to $4\pi\sigma$, where σ is the surface density at the contiguous point of the conductor. It is a repulsion when σ is positive, an attraction when σ is negative.

We may use the result just obtained for finding the force acting on an element of the charged surface itself. Consider the two parallel planes at distance t and difference of potential $4\pi\sigma t$, σ being as above the charge on unit area.

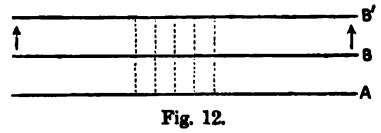


Fig. 12.

Hence the energy stored up in a tube of force stretching from the unit area on B to that on A is $\frac{1}{2}\sigma \times 4\pi\sigma t = 2\pi\sigma^2 t$. Now, with A at zero potential, let B be moved away to double its original distance from A—i.e. through a distance t to B'. If the charge on unit area

remains constant, the energy stored up in the corresponding tube of force has become simply doubled, so that there has been an increase in electrical energy represented by the quantity $2\pi\sigma^2 t$. But this must be equivalent to the work done in removing the charge σ through the distance t against the electrical force; hence, the value of this force estimated per unit charge must be $2\pi\sigma$. Thus the force per unit charge acting *on the surface* is just half the electric force acting on unit charge at a point in the field just outside the surface. Otherwise, if F is the electric force at a point just outside a charged surface, $F/4\pi$ is the measure of the surface density at the contiguous surface element, and $\frac{1}{2}F$ is the force per unit charge acting on the surface.

The importance of this result is that it gives us a simple method of measuring electric force in terms of weight. It is the principle of Thomson's absolute electrometer, which is essentially two parallel plates at different potentials, one of which is made so that a small area at its centre is movable under the action of the electrical force. Where this small area is, the electrical system does not differ appreciably from what would be the case if the plates were really infinite.

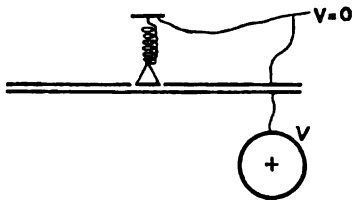


Fig. 13.

We may suppose the small area suspended by a spiral spring, and that, when the plates are at the same potential, W grammes must be laid on the small area to bring it so that its lower surface is flush with the lower surface of the rest of the upper plate. Let the weight W be removed, and the lower plate be put in connection with the conductor whose potential is to be measured. Now raise or lower this plate until the small area, which with the rest of the upper plate is kept at zero potential, is brought again to be flush with the upper plate. Then we know that the suspension is stretched by a force equal to the weight of W grammes. Now, if the potential of the lower plate is V, and t the distance between the opposed surfaces, V/t is the electric force in the region between the surfaces, and $V/4\pi t$ the measure of the charge on unit area. Hence the force acting on unit area is $\frac{1}{2}V/t \times V/4\pi t$; and finally, if A be the area of the small suspended portion, we have

$$W = \frac{V^2 A}{8\pi t^2}.$$

In this equation W, A, t are all known, nence V is measured in terms of definite units. In the universally adopted system of scientific dynamic units, we must multiply W by the quantity g, which measures the number of units of force equivalent to the weight of one gramme. Then we find

$$V = t\sqrt{\frac{8\pi g W}{A}}.$$

As a special case, suppose that W is 50 grammes, and A one square centimetre; then, with $g = 981$, we find $V = 1110\,t$, and 88·3 units of charge on the unit area. The unit of charge here referred to is that quantity which when placed at 1 centimetre from an equal quantity will repel it with a force of 1 dyne—i.e. a force which, acting on 1 gramme for 1 second, will increase its velocity by 1 centimetre per second. This quantity is called the electrostatic unit of quantity; and the electrostatic unit of potential is the potential of a sphere of radius 1 centimetre, and charged with this unit quantity.

Generally speaking, except in such obviously symmetrical cases as concentric spheres, infinite co-axial right cylinders, and infinite planes, the surface density will vary from point to point of a conductor, and where it is numerically greatest there also will the electric force close to the surface be greatest. In the case of a simple elongated conductor, the surface density is greatest at the ends. This may be proved very easily by experiment, by, for example, measuring the charge which a very small disc carries away after contact with the conductor. The following reasoning will lead to the same conclusion. Take a uniformly charged sphere in wide space, so that the equipotential surfaces are concentric spheres, and the tubes of force radial cones. If this sphere, by appropriate expansion at right angles to a given diameter, becomes changed into an oblate spheroid, what is the nature of the accompanying change in the surrounding electric field? Let OY be the given diameter, and consider a tube of force symmetrical about any axis OX perpendicular to OY. Let APQB represent this tube of force for the sphere. Along this tube induction takes place, so that the positive charge on PQ would induce an equal negative charge on AXB, if the equipotential surface, of which AXB is a part, were

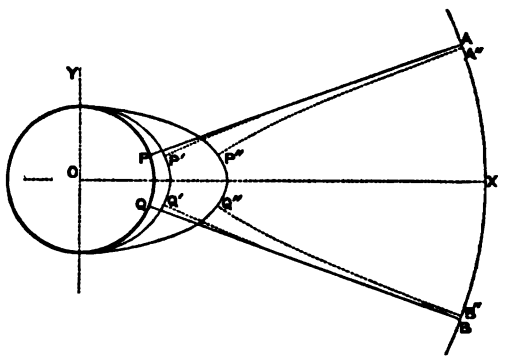


Fig. 14.

to become a conducting surface. We may express this by saying that the electric displacement across any section AXB of a tube of force is equal to the charge on PQ, the area from which the tube springs. Now let the sphere change form in the manner described, but to such a small extent that no appreciable change is produced at the distance OA. The electric displacement across AXB is therefore the same as before; and, if we follow back the tube of force to the conductor, we shall find the corresponding charge distributed over the area from which the tube springs. But, the conductor being itself an equipotential surface, the lines of force must meet it perpendicularly. Hence, near the deformed conductor, each line of force will suffer a displacement as shown in the figure, where AP′ represents the new position of what was originally the line of force AP. Similarly the line BQ will bend inwards to the position BQ′. In other words, the tube of force as it springs from the spheroidal surface P′Q′ lies wholly within the tube of equal strength which sprang at first from the spherical area PQ. The unit tubes of force which compose the tube which passes through AB are, therefore, more concentrated in the region P′Q′ than they were in the region PQ. Hence, the remaining unit tubes of force which spring from the rest of the conducting surface are, taken as a whole, more expanded over the rest of

the spheroid than they were over the rest of the sphere. Thus, the average density over P′Q′ is greater than the average density over the rest of the spheroid. Now we may suppose this almost spherical spheroid to become elongated little by little. At every step a readjustment of the lines of force will take place, until at length for a pronounced ellipticity they come into the positions P″A″, Q″B″. At a far enough distance, however, these lines of force will be indistinguishable from the original positions PA, QB. Hence, the electric displacement across a far-away section of the tube being as before, the charge on P″Q″ will be the same as that originally borne by PQ. Thus, the more elongated the ellipsoid becomes, the greater is the relative concentration of charge towards the ends. It may be easily shown that the lines of force springing from P″Q″ are branches of a hyperbola confocal with the spheroid, and having PA, QB for asymptotes.

This accumulation of electric charge towards the ends of a pointed conductor is well exemplified in the lightning-conductor, which is simply a very elongated piece of metal in contact with the earth. A charged body of air, such as we have accompanying a thunder-cloud, passes near it. The tubes of inductive force are at once concentrated on the elongated conductor; the electric force at the point becomes so intense that the air can no longer act as a perfect insulator; electrical discharge takes place along these very tense tubes of force; and in a more or less gradual manner the cloud is robbed of its charge, and the evil effects of a sudden lightning-flash minimised. On the same principle, electric discharge through air is facilitated by the use of pointed conductors, such as the combs which are so important a detail in machines for generating electricity by means of friction.

We have seen that the capacity of a condenser depends upon the distance between the surfaces or plates which compose it; it also, however, depends very materially on the nature of the dielectric. Suppose, for example, that we have a series of condensers, made of the same conducting material, and all exactly equal as regards their geometrical and space relations, but all differing as regards the dielectric which separates their plates. Thus let one have air as its dielectric, another plate-glass, another paraffin, another mica, and so on. Let them now all be brought to the same potential, then disconnected and tested as to charge. The charges will be found to be all different—being, in the four cases we have mentioned, approximately proportional to the numbers 1, 6, 2, 6·6. These four numbers are the values of what is termed the *specific inductive capacity* of air, glass, paraffin, and mica. Thus by merely inserting a plate of mica between two plates of an air condenser, we increase the capacity by as much as if we had approached the plates in air through a distance equal to ·85 (= 5·6/6·6) of the thickness of the mica. Otherwise, let there be two metal plates, A, B, separated by a thin plate of mica, and on the other side of A let a third equal-sized plate C be so adjusted that when A is charged, the potentials of B and C shall be equal. This can be readily done by severally connecting B and C to the electrodes of the electrometer, as indicated in the figure. Then it will be found necessary to adjust C so that the distance between A and B is about 6·6 times the distance between A and C.

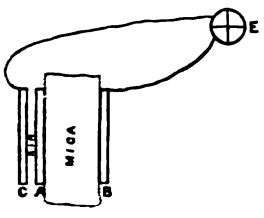


Fig. 15.

We may now fitly consider the principles of action of the various machines that are used for generating electricity. The rubbed pieces of resin, sulphur, glass, &c. were gradually succeeded by spheres, cylinders, and circular plates of these materials, which, as they revolved against prepared rubbers, were kept in a constant state of electrification. Any insulated conductor brought near enough to a portion of such a cylinder or plate at a distance from the rubber will become charged, the dielectric strength of the air breaking down exactly as in the case of the lightning-conductor and the thunder-cloud. Such is the action of the ordinary frictional machine; obviously the conductor acquires a charge similar to that on the revolving cylinder or plate. The opposite charge on the rubber may be transferred to another conductor, which is usually put to earth. Le Roy's or Winter's plate machine is shown in the diagram (fig. 16).

Fig. 16.

Essentially different in its action is the electrophorus, invented by Volta in 1771. In its most improved modern form it consists of two plates, one of metal, and the other of resin, vulcanite, or ebonite backed with metal. Insulating handles can be screwed on to the backs of the plates; and one plate at least must be so insulated. The surface of the ebonite is first electrified by friction, and the metal plate is brought into close contact with it. The metal plate, from its greater proximity to the negatively charged surface of the ebonite, will be at a lower potential than the metal back to the ebonite. If these are then brought into contact—conveniently effected by means of a metal pin passing through the ebonite—a transference of charge will take place, so that the metal plate when lifted away will be found positively charged, while the metal back is left negatively charged. In this machine, the original negative electrification on the rubbed surface of the solid dielectric is used again and again, in accordance with the principles of electrostatic induction and convection, to produce a practically unlimited amount of either kind of electrification.

In Nicholson's 'revolving doubler' we have the parent form of a number of rotatory machines which, like the electrophorus, depend for their action upon induction and convection. They make direct use of the principle of 'doubling' discovered by Bennet, by which the difference of potential between two conductors is indefinitely increased. Thomson's replenisher, which is an important part of the quadrant electrometer in its perfected form, is perhaps the simplest and most compact of these machines. In it, a turning vertical shaft of ebonite bears, at the ends of a horizontal cross-piece of ebonite, two metal pieces called carriers (*cc* in the diagram, which represents a horizontal section). These carriers rotate in the region between two insulated metal inductors (*a*, *b*) in the form of cylindrical segments. When the carriers are in

position AB, they come into momentary contact with delicate springs attached to the neighbouring inductors; and when they are in position CD, they come into momentary contact with delicate springs connected by a metallic arc which is quite insulated from the inductors. Suppose *a* to be at a higher potential than *b*, and consider what takes place as *cc* rotates counter-clockwise, as shown by the arrows in the figure. In the position AB, the carriers are well surrounded by the metal shields, and will part with nearly all the charge that may chance to be upon them. Just before they come into contact with the springs in position CD, the two carriers are at different potentials. Hence at the moment of contact with the connecting springs, a transference of charge will take place from the carrier near *a* to the carrier near *b*. The former will thus acquire a negative charge, and will move on till it comes within the inductor *b*, to which it will give up nearly all its negative charge; while the latter will simultaneously give up nearly all its positive charge to *a*. Thus every complete revolution each carrier becomes once negatively charged and once positively charged, giving up its negative charge to the one inductor, and its positive charge to the other. The inductors therefore steadily increase in positive and negative charges, or in other words, their difference of potential steadily grows. If the carriers are rotated clockwise, the opposite effect will take place, *a* acquiring so much negative charge every revolution, and *b* so much positive charge. In the electrometer, *a* is in connection with the charged body, which is suspended inside the quadrants. A very elegant contrivance enables the operator at once to tell if this body is charged to its normal condition. If it is undercharged, a few turns of the replenisher in the proper direction will bring the potential up to its proper magnitude; if it is overcharged, a few turns in the reverse direction will bring the potential down to its required value.

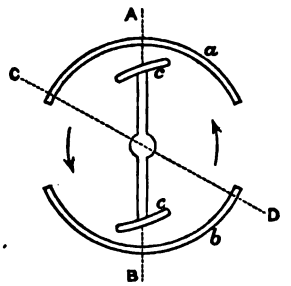


Fig. 17.

The same principles of induction and convection are made use of in the so-called influence machines, which in recent years have quite eclipsed the older frictional machine. These are generally known by the name of their inventors, such as Töpler, Holtz, Bertsch, Voss, and Wimshurst. Of these, the Wimshurst is the latest, and apparently the most satisfactory. It consists of two circular glass plates, mounted on a common spindle, and capable of rotation in opposite directions with equal speeds. Each plate carries twelve or sixteen strips of thin sheet-metal, fixed radially at regular intervals apart. These strips lie on the outside of the closely opposed glass plates. At the extremities of the horizontal diameter of the plates the main conductors are placed, insulated on glass or vulcanite pillars. Horizontal arms with the usual combs project inwards, embracing both plates as far as the inner ends of the metal strips. In front is fixed a diagonal conductor, called a 'neutralising rod;' and a similar rod is fixed behind at right angles to the one in front. These neutralising rods terminate at both ends in a small metal brush, which touches the metal strips or carriers as they pass. By this contact of brushes and strips, every strip on either plate is, very soon after it has passed under the collecting combs, brought into metallic connection for a moment with the strip diametrically opposite it on the same plate.

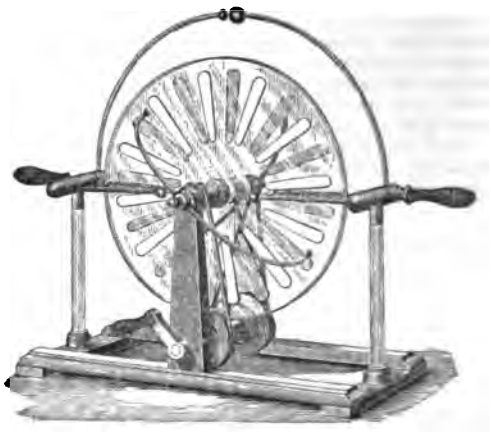


Fig. 18.

Suppose the principal conductors to be at different potentials, then — exactly as in Thomson's replenisher—the carriers as they leave the brushes of the neutralising rod will acquire a charge, negative or positive, according as they are nearer the positively or negatively charged main conductor. But, evidently, each carrier on the one plate will act as inductor to the carriers on the other plate; and a moment's consideration will show that this inductive action will everywhere accentuate the inductive action of the main conductors. Thus the positive conductor is being fed by the positive charges brought by the strips on the upper half of the one plate and on the lower half of the other; while the negative conductor is being fed by the negative charges brought by the strips on the lower half of the one plate and the upper half of the other. The main conductors are provided with arms, which reach out towards each other, and between whose terminal knobs discharge takes place. Sparks, 3 to 5 inches in length, can easily be obtained with this machine.

So far we have confined our attention almost entirely to electrostatic phenomena—i.e. to phenomena connected with the existence of a steady electric strain in dielectrics. When compelled to deal with the transference of so-called charge from conductor to conductor, we had regard rather to the initial and final equilibrium conditions than to the intermediate condition of change. This condition of change, however, has clearly very important energy relations. In all cases of electrical discharge there is, in the language of Faraday, a concentration of the lines of force in a certain region of the dielectric, until that becomes, as it were, overstrained, and yields with a more or less evident appearance of part of the energy of strain in the form of light, sound, and heat. The particular manner of transformation into these commoner forms of energy depends on a variety of circumstances, such as the pressure and temperature of the dielectric, the form and relative size of the conductors, and so on. Even if there be no such energy transformations apparent to our senses, it can be shown that any equalisation of potential without increase of total charge necessarily results in a loss of electric energy to the system.

Thus, let there be two insulated conductors of capacities C and C′, originally at different potentials. If they are brought to the same potential V by being connected by a thin wire of

comparatively insignificant capacity, the original charges on the conductors will become redistributed, and the final charges will be CV and C′V. Whatever charge the one conductor has lost, the other has gained. Hence we may write the original charges as $CV + q$, $C'V - q$, where q is the charge which has been transferred from C to C′. Now the energy of any charged conductor is measured by half the charge into the potential or half the square of the charge divided by the capacity. Thus the final energy, after equalisation of potentials, is:

$$\tfrac{1}{2}CV^2 + \tfrac{1}{2}C'V^2,$$

while the initial energy was

$$\tfrac{1}{2}\frac{(CV+q)^2}{C} + \tfrac{1}{2}\frac{(C'V-q)^2}{C'} = \tfrac{1}{2}CV^2 + \tfrac{1}{2}C'V^2 + \tfrac{1}{2}q^2\left(\frac{1}{C}+\frac{1}{C'}\right).$$

Hence, since $\frac{1}{2}q^2\left(\frac{1}{C}+\frac{1}{C'}\right)$ is always positive, we see that the initial energy is necessarily greater than the final energy. The loss of energy is represented by a quantity which is proportional to the square of the charge that has been transferred. If we look more closely into the significance of this quantity, we see that it represents the electrical energy of the system of two conductors of capacities C and C′ when they are charged each with q units of either positive or negative electricity; or, more particularly, it represents the work which must be done in carrying q units from the one to the other. This is an example of the general principle that the work done by the electric field in compelling a transference or flow of electricity from one region to another is exactly equal to the work which must be done against the electrical forces in carrying an equal quantity of electricity back again.

It is convenient, especially when the flow of electricity is the subject of consideration, to use the term Electromotive Force instead of Difference of Potential. We may suppose it measured by means of the quadrant electrometer. Thus if the regions A and B are connected severally to the electrodes of the electrometer, the deflection will measure the electromotive force acting along any conducting channel which may be supposed to bring A and B into communication. The flow of electricity which this electromotive force compels will tend to bring A and B to the same potential; and in the ultimate vanishing of the deflection on the electrometer we have the evidence of such a flow having taken place. But we may suppose that, by some means, notwithstanding the conducting channel between A and B, their difference of potential is sustained, so that the electromotive force acting along the channel is kept constant. Then the electrometer will show a steady deflection; while at the same time a steady flow of electricity will take place along the channel. This flow, whose existence is indicated only indirectly by the electrometer, must be measured by some one of its direct effects.

These effects are conveniently grouped into physiological, thermal, chemical, and magnetic.

The electric 'shock,' experienced when the experimenter uses himself as a discharging conductor, is a familiar example of the physiological effect of an electric current. The electric discharge causes a muscular contraction. In 1790 Galvani observed that the limb of a frog, when touched simultaneously by two different metals in contact, was convulsed exactly as if subjected to an electric shock; and Volta, following up this observation, discovered in 1800 a new source of electromotive force which could sustain an electric current through a conductor for a lengthened period of time. From this dates the development of Galvanic or Voltaic electricity, or, as it is now more commonly called, current electricity. The electric shock, however, depends upon *variations* in the amount of flow; a steady current produces no shock, except when it is beginning or ending.

In the electric spark there are of course thermal effects; and generally, since, as we have seen, a transference of charge or flow of electricity means a loss of electric energy, an evolution of heat is a necessary consequence.

Towards the close of last century the decomposition of water by an electric discharge was observed by Van Troostwijk and Deiman; while with Volta's electrical discoveries a new era in chemistry as well as in electricity was inaugurated.

None of these effects, however, give a ready method for measuring a steady electric current—i.e. the amount of electricity which is transferred across any section of the conductor in a second, or in any other chosen unit of time. For this we must go to the fourth group—viz. the magnetic effects of currents. This branch of the subject, which includes electro-magnetism, and as a consequence much of electro-dynamics, dates from 1820, when Oersted of Copenhagen discovered the action of a current upon a magnet suspended near it. As a matter of history, the discovery was made by means of voltaic electricity; but that there was some close relation between magnetism and electricity had long been recognised by experimentalists. Lightning had been known to destroy and even reverse the polarity of ships' compasses. Steel and iron had been magnetised by discharging electricity through them; but the effects of such sudden discharges were extremely capricious, and quite baffled all attempts to co-ordinate them. We may, however, by discharging a Leyden jar through a carefully insulated wire suitably coiled round a magnet, show that at the instant of discharge the magnet is displaced.

The broad fact established by Oersted was that every electric current tends to make a magnet set itself perpendicular to the direction of the current. To make the effect specially apparent, the wire conveying the current should be coiled again and again round the region in which the magnet is placed. The same current is thus brought again and again into the vicinity of the magnet, and has a proportionately greater effect. An instrument consisting in this way of a coil of wire surrounding a magnet, free to rotate in some plane passing through the axis of the coil, is called a *galvanometer*. The coiled wire must be covered with gutta-percha, silk, or cotton thread, so that the contiguous coils may be insulated from each other; and, for ordinary purposes, the plane of the coil should contain the magnet when no current is flowing. We may suppose the magnet to be suspended horizontally under the influence of the earth's magnetic field; then the plane of the coil should contain the magnetic meridian (see MAGNETISM). The ends of the coiled wire are called the terminals of the galvanometer. When they are connected to conductors at different potentials, a current will flow round the coil of wire, and will indicate its presence by compelling the magnet to move out of its normal position of equilibrium. The tendency of the current in the coil is to make the magnet turn itself at right angles to the plane of the coil—i.e. to set itself along the axis of the coil, magnetic east and west. But this is resisted by the steady action of the earth's magnetic field. The result is a compromise, and the magnet is deflected from its normal position in the magnetic meridian through an angle which depends on the relative values of the current and

the earth's magnetic force. Since the latter is practically constant, the angle of deflection will depend on the value of the current, being greater for the greater current. It is not our purpose under this heading to enter into the magnetic relations of currents. For that we refer to MAGNETISM. It is sufficient at present to know that in the galvanometer we have an instrument which can measure current, exactly as in the electrometer we have an instrument which can measure difference of potential or electromotive force.

In discussing the equalisation of potential in electrostatics, we purposely confined our attention to one metal only. The reason was simply because, in general, two different metals, or in fact any two different conductors, can never when in direct contact be at the same potential. The discovery of this fact we owe to Volta. Take, for instance, any four conductors BAXB, put them in series as in the figure, and connect the terminal members, which are of the same material, to the electrometer. According to the character of the conductors AXB, there may be, or there may not be, a deflection on the electrometer.

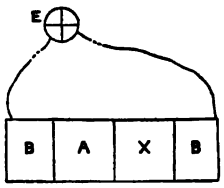


Fig. 19.

(1) If there is no deflection, the two B's are at the same potential; and yet, according to Volta's discovery, the three different substances are at different potentials. This may be shown at once by breaking the chain at any of the separating surfaces, when a deflection on the electrometer will be observed. During this act of separation, the separating surfaces, one of which must of course be kept insulated, act like a condenser with a constant charge, the difference of potential changing because the capacity is changing. The reason why the B's are at the same potential is that, whatever be the differences of potential between B and A and between A and X, the difference of potential between X and B is always such as to restore B to its original value. Thus if the separation of B and A gives a deflection of 20 to the right on the electrometer, and the separation of A and X gives a deflection of 8 to the left, the separation of X and B is found to give a deflection of 12 to the left.

(2) If, however, there is a deflection produced on the electrometer, then we know that the two B's must be at different potentials, so that, if we connect them by wires to the terminals of the galvanometer, a current will be observed to flow. Such a combination of materials, in which two conductors of the same material are kept at different potentials by being linked together by at least two other and different materials, is called a voltaic or galvanic cell. If we join the two terminals either directly or by means of any other simple conductor, a current will necessarily flow round the circuit. But this current means a transference of charge from one conductor to another at a lower potential —i.e. a loss of electrical energy which is proportional to the square of the quantity transferred. Hence, if, as is practically the case, the electromotive force or difference of potential remains fairly steady, it must be because electrical energy is supplied as fast as it is being lost. Consequently there must be in the circuit somewhere an original source of energy. In fact it is found that a permanent electromotive force of the kind just described is always associated with a tendency to chemical action between two at least of the members of the chain; and that, when the circuit is complete and the current is flowing, chemical changes are going on within the cell. In this case, also, we may, by separating the chain at its various surfaces, show that at every surface there is an electromotive force of contact sustaining a difference of potential. But whereas, in the former case, the algebraic sum of all the differences of potential between the successive pairs of materials as we pass along the chain from B to B vanishes identically, in the present case it has a finite value, which is the total electromotive force of the combination as measured on the electrometer. A combination of two or more voltaic cells is commonly called a voltaic or galvanic battery.

There are innumerable forms of voltaic cells, built up in different ways of different materials. Copper and zinc dipping into dilute sulphuric acid is one of the simplest forms. When the cell is *closed*—i.e. when the copper and zinc are joined externally by a wire, a current will be obtained flowing in the wire from the copper to the zinc. At the same time the zinc will be dissolved in the acid; and it is from the energy set free by this chemical action that the electrical energy is derived. Such a single fluid cell is not, however, very steady in its action. We shall therefore take as a type of a good cell one of the class known as two-fluid cells; and of these we shall choose the Daniell cell. In its best form, the Daniell cell consists of copper and zinc plates dipping into saturated solution of sulphate of copper and semi-saturated solution of sulphate of zinc respectively—the liquids being also in contact but prevented from mixing by a porous septum. Connect the copper and zinc plates, or *poles* as they are technically called, to the electrometer. A deflection will be produced which will measure the electromotive force of a Daniell cell when it is not being used for the production of currents—i.e. when it is *open*. We shall take this, provisionally, as our unit electromotive force, and we may suppose the electrometer scale graduated so as to show unit deflection when the poles of a Daniell cell are connected to the electrodes of the electrometer. The deflection is such as to indicate that the electrode connected to the copper is at the higher potential. Hence the copper is spoken of as the positive pole, and the zinc as the negative pole.

Take now a second Daniell cell, connect its zinc to the copper of the first one, and connect the free poles to the electrometer. The electromotive force of the two cells so joined will be double that of one —i.e. equal to 2. And generally, when a number of cells are arranged in series (i.e. with the zinc of the first joined to the copper of the second, the zinc of the second to the copper of the third, and so on), the electromotive force of this battery, in terms of the electromotive force of one cell, is just the number of cells composing it. Theoretically there is no limit to the electromotive force obtainable by means of cells; practically the difficulty consists in keeping a large number of cells in good condition. With a large enough battery we can obtain effects in every way analogous to the effects produced with frictional electricity. The electric light in its earliest form was obtained between carbon terminals joined to the poles of a large battery of cells. Generally speaking, however, the differences of potential in electrostatic experiments are much greater than the electromotive forces commonly used in experiments with electric currents. Thus, the electromotive force of a Daniell cell is very much smaller than the electrostatic unit of potential as measured on Thomson's absolute electrometer in the manner previously described. It would require a battery of about 278 Daniell cells set in series before the electrostatic unit of potential could be obtained; and it would require the use of about 10,400 cells in series to compel a spark to pass directly between two parallel plates connected to the poles and distant one-third

of a centimetre from each other. With such comparatively small electromotive forces many substances can be used as insulators in current electricity which are fairly good conductors in electrostatics.

If, at the same time that the poles of a cell are connected to the electrometer, they are connected by stout short wires to the terminals of the galvanometer, the galvanometer needle will be deflected, while the electrometer deflection will be unchanged, or at the most diminished slightly. If thin long wires are substituted for the thick short connections, a very great diminution will be observed in the galvanometer reading, and perhaps a very slight increase in the electrometer reading, the apparent electromotive force of the closed cell approximating more closely to the electromotive force of the open cell. Thus, we may alter the current at will by employing different lengths and different thicknesses of wires for transmitting the current; and yet the electromotive force between the poles of the cell is but slightly if at all affected. In other words, the current, as measured on a galvanometer, depends not only on the electromotive force acting along the channel, but upon some property of the channel itself—some property independent altogether of electromotive force.

This property we may indicate by either of two words—viz. Conductivity or Resistance. These words denote contraries. Thus, a body of small conductivity has a great resistance; and a body of low resistance has a high conductivity. Quantitatively, the one is the reciprocal of the other; and they are measured in terms of current and electromotive force by what is known as Ohm's Law. We now know (see *The Electrical Researches of the Hon. Henry Cavendish*, edited by Maxwell, 1879) that Cavendish had in 1781 established this law, and compared the resistances of iron wire and various saline solutions to electric discharge through them. He acted as his own galvanometer, and compared discharges by their 'shocks.' As regards the historical development of the science, however, it is to Ohm that we owe the full statement of the Law (1827). Since his day it has been subjected to the severest experimental tests that the scientific mind could imagine, and has stood them all. It is really the basis of our whole system of electrical measurements; and is to electric currents what the law of gravitation is to planetary motions. Ohm's Law asserts that the resistance of a conductor is measured by the ratio of the electromotive force between its two ends to the current flowing through it. Thus, if E is the electromotive force as measured on the electrometer, and I the current as measured on the galvanometer, and if K, R measure the conductivity and resistance respectively, Ohm's Law gives us these relations:

$$EK = I,\ E = IR.$$

The Law is purely empirical. Assuming its truth, we shall here deduce from it certain relations, which experiment accurately verifies.

The peculiar value of Ohm's Law lies in the fact that the property designated resistance, though measured in terms of electromotive force and current, is absolutely independent of them. Hence so long as the physical condition, and therefore the resistance, of each conductor remains unaltered, the currents in any system of conductors are proportional to the electromotive forces; steady currents imply steady electromotive forces; steady electromotive forces imply steady currents. And thus, if the potential at one point is steady, the potentials at all other points will be steady; and this means that whatever quantity of electricity flows into a point must flow out again—for otherwise there would be a gain or loss of charge at that point, and therefore a change of potential, which is not contemplated. In the particular case of a single circuit, it follows that the current is the same at every part of it, and must therefore be regarded as flowing through the Daniell cell from the zinc to the copper, as well as through the rest of the circuit from the copper to the zinc.

If a steady current is flowing along a conductor of one kind of material, say a copper wire, the potential will fall off continuously as we pass along in the direction of the current. Let AB be the wire, and suppose the current to be flowing from A to B. Join B to one electrode of the electrometer; and let a wire from the other electrode be led to any point P on the wire. Then as the point of contact P is moved up towards A, the electrometer deflection will increase continuously. Even though AB is not all of one material, the same steady growth of the electrometer deflection will be shown as the point P is made to travel from B to A. Thus suppose AC to be zinc, and CB to be copper, and no current to be flowing; then according to Volta's discovery the potential, otherwise constant, will undergo an abrupt change at the surface of separation at C. But, as we have seen, the brass quadrants of the electrometer will not on this account be at different potentials, even though P lies in AC. Hence, if any difference of potential *shows itself on the electrometer*, it must be because a current is flowing along AB. Thus we may extend Ohm's Law to heterogeneous circuits.

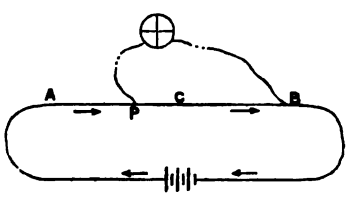


Fig. 20.

The measurement or, more strictly, comparison of resistances is one of the most important operations in the modern science of electricity. For this purpose we first choose a certain standard, say a particular length of a particular piece of wire at a certain temperature. It is obviously convenient to have a standard which can be exactly reproduced should the first standard be lost or in any way damaged. Hence scientific men of all nations have agreed to use as the unit of resistance the resistance of a column of pure mercury 106 millimetres long, 1 square millimetre in cross-section, at the temperature of melting ice. This is called the *legal ohm*. It differs very slightly from the theoretic ohm, which is defined in terms of what are called the electro-magnetic units of current and electromotive force. See MAGNETISM.

Such a mercury standard, though fulfilling the very necessary condition of accurate reproduction, is not convenient for practical use. For this purpose copies of the ohm must be made in solid wires of some metal or alloy. German silver has long been a favourite substance for making such practical standards; and of late a somewhat similar alloy called *platinoid* has come into use. Ohm's Law at once suggests a method for copying the standard mercury ohm. First, let the mercury column be included in a circuit with a given battery and galvanometer, and the deflection on the galvanometer noted. Second, let the mercury column be replaced by a wire, and the length of the wire adjusted till the galvanometer shows the same current. Then, provided that the electromotive force of the battery is the same in the two cases, the resistance of the substituted length of wire is 1 ohm. We may obviously construct an indefinite number of such copied standards.

If we put any number of these single ohms end

to end in series, we shall get a whole resistance equal to as many ohms as there are conductors. This is an immediate consequence of Ohm's Law. For since it is the same current that is flowing through all the single ohms, the fall of potential as we pass from beginning to end of any one is the same for all; hence, the fall of potential as we pass along, say, three is three times the fall as we pass along one; hence, the current being the same for the three as for the one, the resistance of the three must be 3 ohms. A special case of this is that the resistance of a wire, otherwise constant in its physical relations, is directly as the length. The completely general statement is that the resistance of any single continuous channel is the sum of the resistances of its parts.

Suppose, however, that the single ohms are so arranged that they all begin at one point, A, in the circuit, and end at another point, B. Then it is clear that they must all be traversed not by the same current, but by equal currents. Hence, there will flow into A and out of B a current equal to the sum of all these equal currents. Thus, if there are, say, three single ohms connecting A and B, the total current flowing into A and out of B must be three times the current flowing in any one of the branches. But for constant electromotive force the current is directly as the conductivity, or inversely as the resistance. Hence, the conductivity of the threefold conductor between A and B is three times the conductivity of any one of its components; or, otherwise, the resistance between A and B is one-third of an ohm. Here, again, as a special case, we find that the resistance of a wire, otherwise constant in its physical relations, is inversely as the area of its cross-section. The completely general statement is that the conductivity of a multiple channel whose branches all begin at one point and end at another, is the sum of the conductivities of the branches. These multiple-arc arrangements, as they are technically called, are of peculiar value in all electrical investigations and applications. Cavendish, who states the law of the double-branch circuit with particular accuracy, was the first experimenter who used the arrangement. By discharging a Leyden jar through a branch circuit consisting of an iron wire and his own body he obtained a certain sensation, which he compared with the sensation produced when a column of salt water was substituted for the iron wire. By adjusting the length of the salt-water column until the two shocks felt equally intense, he had data from which a comparison of the resistances of iron and salt water could be made. This comparison Cavendish gave in a paper published in 1776, without, however, giving his method of experiment, which lay hidden in the unpublished manuscripts for fully a century. His result was that iron conducts 555,555 times better than saturated solution of salt, a result in remarkable agreement with modern galvanometer measurements. In comparing resistances of *materials*, we must find the resistances of portions which have the same length and the same cross-section. The results given above, connecting the measured resistance of a conductor with its dimensions, enable us to effect this comparison without difficulty. Thus, if r is the resistance of a wire of length l, and cross-section s, the quantity rs/l evidently measures the resistance of a wire of unit length and unit cross-section. If the unit length is a centimetre, and the unit area a square centimetre, the quantity which measures this resistance is called the *specific resistance* of the material. The substance which has the smallest specific resistance is the best conductor of electricity. The best conductor is silver; but copper is nearly as good. The specific resistance of iron is nearly six times that of copper, and that of mercury nearly sixty times.

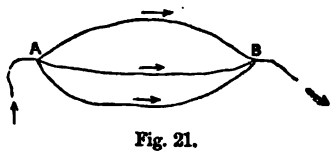


Fig. 21.

In Cavendish's experiment just described, the iron wire acted as a *shunt* in the circuit of jar and body; for the resistance of the iron wire was much less than the resistance of the body. Hence, the discharge through the wire was proportionately greater than the discharge through the body. In a double-branch circuit the current divides itself into two parts, which by Ohm's Law must be directly as the conductivities of the branches. If we put the galvanometer in one of the branches, we may, by adjusting the resistance in the other branch, vary the current in the galvanometer through a very large range, while the total current supplied by the battery remains constant. Let AB be a wire of unit resistance, forming part of a circuit; and let the points AB be connected to the terminals of the galvanometer, whose resistance we shall suppose to be very great compared to the resistance of the wire AB, say, 5000 ohms. If i is the current as measured on the galvanometer, 5000 i is the electromotive force acting along AB; and this multiplied by the conductivity of the double-branch portion lying between A and B will give the total current entering at A and leaving at B. The conductivities are 1 and $\frac{1}{5000}$ respectively, so that $\frac{5001}{5000}$ is the conductivity of the whole; and, hence, 5001 i is the total current supplied by the battery. Suppose, now, that instead of connecting the galvanometer terminal with B, we connect it with B′, where BB′ represents another ohm of resistance. Then if i' is the current in the galvanometer, we have 5000 i' as the electromotive force between A and B′. The conductivity of the double-branch portion is now $\frac{1}{2} + \frac{1}{5000}$, i.e. $\frac{5002}{10000}$; hence, the current supplied by the battery is 2501 i'. But in almost all cases of importance—except when extremely accurate results are wanted—the fourth significant figure in any number is negligible. Indeed, very few galvanometers can be trusted to measure currents to such an extreme of accuracy. Hence, the resistance of the whole circuit is practically the same so far as the possible measurement of current is concerned—i.e. the currents 5001 i and 2501 i' are equal; and, hence, to the degree of approximation stated $i' = 2i$. In short, the galvanometer of high resistance used in the way just described, in which the main current is shunted through a comparatively small resistance, really measures the electromotive force between the ends of the shunt. For many purposes we may use such a high-resistance galvanometer instead of the electrometer.

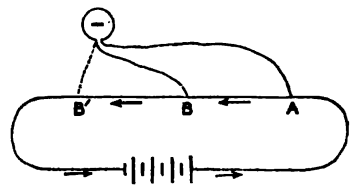


Fig. 22.

From what has just been said regarding the accuracy to which a galvanometer deflection may be read, it is evident that if the comparison of resistances depended on the *measurement* of current, it would be impossible to compare resistances to any very great degree of accuracy. The comparison of resistances may, however, be effected by the method known as the Wheatstone bridge, without so much as a single measurement of either electromotive force or current.

Consider the case represented in fig. 23, in which the current from a battery is made to flow along two distinct channels from A to B. Along each the potential falls from its value a at A to its value b at B. Hence, for any point P in the one branch there must be a corresponding point Q in the other which has the same potential, v, say. Let the points P and Q be joined to the terminals of the galvanometer, G. Because of the equality of the potentials at P and Q, no current will flow through the galvanometer, however strong the currents may be in APB and AQB. Thus, as no current flows between P and Q, the current in AP must be the same as the current in PB, and the current in AQ must be the same as the current in QB. Hence, by Ohm's Law, the resistances of AP and PB must be proportional to the electromotive forces acting along them—i.e. in the ratio $(a-v)/(v-b)$. Similarly the same ratio expresses the ratio of the resistances of AQ and QB. Thus the existence of no current in the galvanometer circuit—a condition which admits of the most delicate of tests—implies that the resistances of the four branches AP, AQ, PB, QB form a simple proportion, any one forming the fourth proportional to the other three properly taken. Two equal lengths cut off from a fairly uniform wire may be assumed to have approximately equal resistances. Let them be the branches AP, AQ. Let PB be the standard ohm. Then, by adjusting the length QB of a given wire till no current flows through the galvanometer, we obtain a copy of the ohm, accurate if the resistances AP and AQ are really equal to each other. Suppose, however, that they are not quite equal, but that AP/AQ is equal to $1+\omega$, where ω is usually a small quantity, and that therefore $AQ/AP = 1/(1+\omega)$. Let l be the length of wire required in QB when the standard ohm is in PB, so as to satisfy the condition of no current in PQ; and let l' be the length of the same wire required in PB when the standard ohm is in QB, so as to fulfil the same condition. The lengths l and l' will differ so slightly that we may assume them to be accurately proportional to their resistances. If L is the length of wire whose resistance is accurately 1 ohm, then evidently

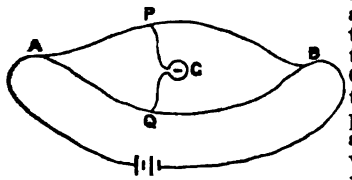


Fig. 23.

$$l = L(1+\omega)^{-1},\ l' = L(1+\omega);$$

and hence, multiplying we find

$$ll' = L^2;$$

or the length of wire whose resistance is 1 ohm is the geometric mean between the lengths whose resistances balanced the standard ohm in the two cases described. This discussion is an illustration how, from a first approximation, a second and much closer approximation can be obtained.

To facilitate operations in the measurement of resistance, it is expedient to construct a series of graded resistances, which are multiples and occasionally submultiples of the chosen unit of resistance. We may obtain, in the manner just described, any number of copies of the ohm. Then, by putting two in series in the one arm of the Wheatstone bridge, we can measure off a piece of wire having a resistance of 2 ohms; and so on, step by step, we can measure off lengths of suitable wires whose resistances will be any imaginable number of ohms. Again, by putting in the arms AP, AQ very different resistances, say 10 ohms and 1 ohm, we can construct resistances of fractions of an ohm —e.g. if PB is 1 ohm, QB will be the tenth of an ohm. For such fractional resistances thick wires or many strands of thin wires in multiple arc must be used. For the higher resistances thin wires are convenient. Suppose we have, in this way, constructed resistances having the values 1, 2, 3, 4, 10, 20, 30, 40, 100, 200, 300, 400, 1000, 2000, 3000, 4000, 10,000, 20,000, 30,000, 40,000; then we may by proper combination express any integral number of ohms from 1 up to 100,000. Thus, the resistance 7956 is built up of 4000, 3000, 400, 300, 200, 40, 10, 4, 2. There are several ways in which these twenty resistances can be arranged so as to admit of rapid combination of any required number. Such an arrangement is called a box of resistance coils, or simply a resistance box. It is an indispensable part of the apparatus of a physical laboratory.

We have already seen that the passage of an electric current means a loss of electric energy. What becomes of this energy—i.e. into what other form is it transformed—is a question which requires to be answered. The answer was fully given by Joule of Manchester in a magnificent series of experiments on the heating effects of electric currents. It was early recognised that the electric current and electric discharge had a heating effect on the conductor along which the current flowed or the discharge took place. As early as 1801, very soon after the discovery of voltaic electricity, Wollaston exhibited before the Royal Society the glowing of a thin wire joining the poles of a cell. To Joule, however, we owe the complete statement of the irreversible heating effects of currents. In 1840 he published the important result that 'when a current of voltaic electricity is propagated along a metallic conductor, the heat evolved in a given time is proportional to the resistance of the conductor multiplied by the square of the electric intensity.' The heat so evolved fully accounts for the electric energy lost. Suppose we have an electromotive force E driving a current I through a resistance R. E is the measure of the work done in transferring unit of electricity along the channel. Now I is the amount of electricity transferred in a second of time. Hence the product EI measures the work done per second by the electromotive force in driving the current I. But by Ohm's Law

$$EI = RI^2;$$

and this is the very quantity which Joule showed appeared as heat in the wire. Here evidently we have a thermal method for comparing resistances. Set the various conductors in series, so that they are traversed by the same current. Then the resistances are proportional to the heats developed in them. To measure the heats so evolved we must know the rise of temperature and the thermal capacity of each conductor.

If a very thin wire forms a part of a circuit, it is there that we shall best observe the effect of the heating. For the heat evolved per unit length of any conductor is directly as the resistance—i.e. inversely as the cross-section. But, with the circuit all of one material, the rise of temperature is directly as the heat evolved and inversely as the mass heated; and the mass per unit length is directly as the cross-section. Thus the rise of temperature is inversely as the square of the cross-section—i.e. inversely as the fourth power of the diameter.

This is the principle of construction of the incandescent electric lamp, now so common a source of illumination (see ELECTRIC LIGHT). A thin filament of carbon is made to glow by the passage of a powerful current along it. To prevent the 'burning' away of the carbon in air, it is inclosed in a hermetically sealed glass vessel quite empty of oxygen.

As an example of the magnitude of the Joule effect in a conductor of given resistance traversed by a given current, let us take a resistance of 10 ohms, along which the electromotive force is equal to that of one Daniell cell, then the heat evolved in an hour will be about 100 gramme-degree units of heat—i.e. an amount of heat capable of raising the temperature of 100 grammes of water by 1° centigrade.

So long as we are dealing with metals or simple conductors like carbon, the currents derived from the Daniell cells in the circuit do not appreciably change in value from the first instant onwards for several hours. If the currents are powerful enough, there will be slight diminution during the first few minutes, due to the heating of the conductors; for the resistance of nearly all metals increases with rise of temperature. But this effect will not in general be appreciable.

A very different set of phenomena confronts us when we introduce into the circuit a conductor like a solution of sulphuric acid, or of any sulphate, or indeed any ordinary chemical compound, either in solution or in a state of fusion. Such conductors can transmit currents only at the expense of their constitution; or, in the words of Faraday, in them 'the power of transmitting the electricity across the substance is dependent upon their capability of suffering decomposition.' Such substances—the whole terminology of the subject was introduced in 1834 by Faraday—are called *electrolytes;* the conductors by which the current enters and leaves the electrolyte, the *electrodes;* and the whole process by which chemical compounds are decomposed by means of electric currents is named *electrolysis.*

Take, for example, a dilute solution of sulphuric acid nearly filling a glass vessel. Dip into this electrolyte two platinum strips, some little distance apart and not touching. These are the electrodes; and it is important in such an experiment to choose as electrodes materials for which the electrolyte has no chemical affinity. In this respect platinum is, over all, by far the most satisfactory. Now connect the one platinum strip to one pole of a Daniell cell, and the other to one of the terminals of the galvanometer. The other terminal of the galvanometer and the other pole of the cell may be connected at will, so as to complete the circuit. When in this way the circuit is completed, a current will be observed flowing through the galvanometer; but this current will very soon become extremely feeble, and, even though it may not altogether vanish, will produce no continuous decomposition of the fluid. Let now a second Daniell cell be added as shown in fig. 24, where B is the battery of two Daniell cells, G is the galvanometer, and C is the electrolyte. Then the galvanometer will indicate the existence of a pronounced current, which during the first few moments will fall considerably below its original intensity, but will ultimately reach a steady value. At the same time small bubbles of gas will appear at the surfaces of both electrodes, and will form steady ascending streams in the electrolyte. These products, or *ions* as Faraday called them, may be collected in separate vessels, as shown in fig. 27, where the gases accumulate at the top of test-tubes inverted over the electrodes, gradually pushing out the liquid which at first filled these tubes. It will be noticed that the volume of gas given off from the one electrode is twice that given off from the other; so that if the test-tubes are exactly the same size, the one will become quite emptied of liquid when the other is only half-emptied. The greater volume of gas accumulates over the electrode by which the current leaves the electrolyte. When tested, the gas which comes off in greater quantity will be found to be hydrogen, and the other oxygen. In fact we have here separated from one another the constituents of water—H_2O. We may therefore say that, whatever the intermediate stages of the process may be, the final result of passing a current through dilute sulphuric acid is to decompose water.

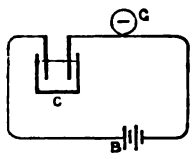


Fig. 24.

The characteristic points to be noticed here are that one Daniell cell cannot decompose water; that when two or more are used, the current markedly falls off in intensity during the first few moments; and that, when the current has become constant, steady streams of bubbles of gas ascend through the liquid from the surfaces of the electrodes, and from them only. These are some of the characteristics peculiar to electrolytic conduction; and, when present, any one of them is sufficient to distinguish an electrolyte from a simple conductor. We shall discuss them more fully in order.

(1) Exactly as one Daniell cell cannot decompose one electrolytic cell of dilute acid, so two Daniell cells cannot decompose two electrolytic cells. Take, for example, a trough filled with dilute acid, and forming with its platinum electrodes one long electrolytic cell, C, which is traversed by a current from two Daniell cells, B. A distinct deflection will be observed on the galvanometer, G, and the ions will be given off at the electrodes. Now, let a platinum plate, P (shown dotted in fig. 25), of exactly the breadth of the trough be inserted somewhere between the electrodes, and pushed down till it comes into close contact with the bottom of the cell. Very soon the current will die away, or only a very feeble one will remain, which Von Helmholtz has shown to be due to the presence of free gases dissolved in the electrolyte. There will, however, be no continuous production of ions at the electrodes, even in cases in which this feeble current has not been eliminated. The reason is simply that by so partitioning an electrolytic cell we really make it into two. To obtain distinct decomposition in these two cells we must use four Daniell cells in series; and then we should observe the ions given off not only at the terminal platinum plates, but on both sides of the partition plate. Thus it appears that the process of electrolysis is not merely a question of current, but also a question of electromotive force.

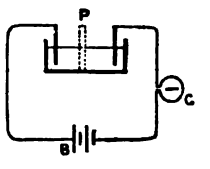


Fig. 25.

(2) To study more closely the second point indicated, take two platinum strips *p*, *q*, thoroughly cleaned by heating in a flame to bright redness, dip them into the electrolyte, and connect them to the electrometer. The electrodes being both clean, platinum will have the same contact electromotive force with the electrolyte, so that they will be at the same potential. Hence the electrometer will show zero deflection. Now put the electrolytic cell in

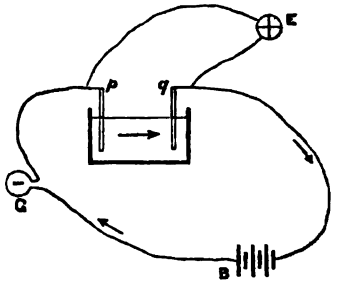


Fig 26.

circuit with the galvanometer and a battery of two or more Daniell cells; and suppose the current to flow from p to q through the electrolyte. Then it may be observed that, as the current through the galvanometer falls off during the first stages, the difference of potential between p and q as measured on the electrometer increases. If we apply Ohm's Law to the portion between p and q, we see at once that the ratio E/I has considerably increased. This ratio, which for simple conductors measures the resistance, we shall speak of as measuring the Impedance. Impedance in fact is a more general term, synonymous with resistance for steady currents through metals and simple conductors, but including other quite distinguishable properties when electrolytes are the conductors, or when the current is variable. It should be mentioned that during these early changes in current and distribution of potential the temperature of the circuit has not appreciably altered, so that we are precluded from explaining the effect as due to increase of resistance in virtue of rise of temperature.

After the current has become steady, let the circuit be broken. The galvanometer needle will swing back to zero; but the electrometer needle will swing back only a certain distance, and then continue slowly and more slowly back towards zero. Thus, after the current from the battery has ceased to flow, the electrodes in the electrolytic cell remain at different potentials, and will remain so for an indefinite period. This phenomenon is called the Polarisation of the Electrodes. From being in a state of electrical identity these electrodes have been brought, simply through the agency of a current, into a condition of electrical dissimilarity. In other words, the electrolytic cell has virtually become a voltaic cell; the electrodes have become poles at different potentials.

Let now the polarised cell be joined up in circuit with the galvanometer—i.e. let a wire be set in where the battery at first was. The electrode p being at a higher potential than the electrode q, a current will flow from p to q through the galvanometer, and from q to p through the cell—i.e. in a direction contrary to the direction of the current which first circulated in the circuit. As this current flows, the deflection on the electrometer will rapidly fall off, until very soon the potentials of p and q will be practically equalised, and the current will disappear. Thus although, because of the polarisation of the electrodes, the electrolytic cell has at first all the virtue of a voltaic cell, this virtue is rapidly lost when it is used as a source of current, for there is nothing to sustain it.

In this polarisation of the electrodes we have one explanation of the increased impedance of the cell. As soon as the current from an external source begins to pass through, decomposition begins in the electrolyte. The ions accumulate on the platinum electrodes, which become coated with oxygen and hydrogen gases. They are no longer platinum, platinum, dipping in an electrolyte; but oxygenised platinum, hydrogenised platinum, dipping in the same. Of these the latter is eminently oxidisable, just as the zinc is in, say, a simple platinum zinc voltaic cell. Hence the hydrogenised platinum, which is that by which the original current left the electrolyte (q in fig. 26), behaves like the zinc in an ordinary cell, but behaves like the zinc only so long as it is hydrogenised. When, then, the polarised electrolytic cell is included in a circuit otherwise free of electromotive force, a short-lived current will flow at the expense of the electromotive force of polarisation, its energy being derived from the reunion with their appropriate associates in the water molecule of the oxygen and hydrogen clinging to the platinum electrodes. We may express the result very simply in symbols, thus: Let E be the electromotive force acting round the circuit, r the resistance of the electrolytic cell *when there is no polarisation*, s the resistance of the rest of the circuit (galvanometer, battery, and connections). Then if I be the initial value of the current before polarisation sets in, we have, by Ohm's Law,

$$I(r + s) = E.$$

But at once polarisation begins, and the reversed electromotive force due to it more or less quickly attains its maximum value e. If J is the final value of the current, we have, by Ohm's Law,

$$J(r + s) = E - e,$$

in which E and r are supposed to be the same as before. Evidently J is less than I. Again, if we write the quantity e in the form Jk, where k measures something of the nature of resistance, we may at once transform the equation thus:

$$J(k + r + s) = E.$$

The quantity $(k + r)$ measures the impedance.

The unavoidable production of this reversed electromotive force due to the polarisation of the electrodes is a great hindrance in the way of measuring the true resistance of electrolytes. If we put an electrolytic cell into one arm of a Wheatstone bridge, and operate as we do in the case of simple conductors, we should measure the impedance, not the resistance. Suppose, however, that we have in some thoroughly satisfactory manner measured the true resistance, which perhaps might be best defined by Joule's Law in terms of the heating effect of a given current in a portion of the electrolyte far removed from the electrodes, even then we should be in doubt as to the true significance of the rest of the so-called impedance. We see that the electromotive force of polarisation explains a part; but does it explain all? Its existence depends on the accumulation of the ions at the electrodes, and it is quite conceivable that the existence of such accumulations may mean an extra resistance in the true sense of the word.

(3) We pass now to the consideration of the ions themselves. As we have seen, the electrolysis of dilute sulphuric acid results in the appearance at the electrodes of oxygen and hydrogen. The oxygen is given off where the current enters the electrolyte, and the hydrogen is given off where the current leaves the electrolyte. A very simple experiment will show that the amount of water decomposed in a given time is proportional to the current as measured on the galvanometer. Suppose, for instance, that with two Daniell cells in the circuit, the test-tube over the negative electrode in the electrolyte fills with hydrogen in 20 minutes. Then, if four Daniell cells are put in circuit, and the external resistances slightly adjusted so as to make the galvanometer indicate double the former current, the test-tube will be filled with hydrogen in 10 minutes. With six cells, and three times the original current, the tube will be filled in 6⅔ minutes, and so on. Thus we may compare currents by the quantities of a given electrolyte which they decompose in a given time. Faraday's voltameter, as shown in fig. 27, is intended for this purpose. As compared with a galvanometer, the voltameter has the obvious disadvantage that it cannot measure a current at once, but only after the current has been flowing for some time. Hence it measures only the average current during this time; so that unless we know the current to be very constant we cannot draw sure conclusions from the indications of the voltameter. Then, again, there are other sources of error which must be guarded against if anything like accurate results are desired. Thus, in Faraday's voltameter, the gases, as they collect in the test-tubes, are at

somewhat diminished pressures in the early stages, so that their volumes do not grow quite proportionately with their masses. But a greater source of error lies in the fact that all the gas given off does not collect in the tubes. Some remains dissolved in the fluid, and this is specially true of the oxygen, which, besides, comes off partly in the denser form of ozone; and some (as the phenomenon of polarisation shows) remains clinging to the electrodes. For ordinary purposes, however, the volume of hydrogen given off in a given tube is a fairly accurate measure of the current effecting the decomposition, and may be used for gauging galvanometers—i.e. for finding what deflection corresponds to the chosen unit of current. For that purpose we must know how much water a unit current can decompose. Now, as proved by Faraday, equal currents decompose equal quantities of a given electrolyte in equal times—i.e. wherever and whenever one milligramme of water is decomposed in one minute by a particular current, that current has a definite absolute value. The numerical measure of it will depend of course on the particular units of length, time, and mass which are adopted as the fundamental units (see UNITS). It is evident, then, that electrolysis gives us a means of measuring a current in terms of a quantity of matter decomposed. To obtain absolute measurements of currents with a galvanometer we require to know the magnetic field in which the galvanometer needle hangs, and the dimensions and arrangement of the coils of wire constituting the galvanometer; but for absolute measurements of currents by means of electrolysis we have to do only with measurements of mass.

Fig. 27.

Now, not only is the amount of any electrolyte decomposed proportional to the strength of current used, but the amounts of different electrolytes decomposed by the same current have a definite numerical relation to one another—a relation which Faraday showed to have a most essential connection with the known laws of chemical combination.

Let us take, for example, three electrolytic cells—the first, an ordinary voltameter with dilute sulphuric acid as electrolyte; the second, a V-shaped tube containing fused silver chloride with a silver wire for negative electrode and a piece of carbon for positive electrode; and the third, a solution of sulphate of copper with copper electrodes. Let these electrolytic cells be put in series, and a sufficiently strong current passed through them. In the first—the voltameter—oxygen and hydrogen will collect; in the second, chlorine will appear at the carbon, and may be collected, while silver will be deposited on the silver wire; and in the third, copper will be deposited on the negative electrode, while the positive electrode will gradually dissolve away. After the current has flowed for some time, measure the amounts of gases collected, and the amounts of silver and copper deposited. The last two are easily measured by simply weighing the electrodes before and after the process—the increments of mass of the silver and copper which acted as the negative electrodes in the silver and copper salts respectively giving at once the amounts deposited on them. Suppose, for example, that 2 milligrammes of hydrogen and 16 milligrammes of oxygen have collected in the voltameter; then it will be found that 70·8 milligrammes of chlorine have collected over and on the carbon, 216 milligrammes of silver have been deposited on the silver, and 63 milligrammes of copper on the copper electrode. Now these numbers measure what are called the chemical equivalents of these substances—they are proportional to the quantities which enter into similar combinations. Thus, in hydrochloric acid, for every 2 grammes of hydrogen there are 70·8 grammes of chlorine; in cupric chloride, for every 70·8 grammes of chlorine there are 63 grammes of copper; and so on, right through all the related compounds of these substances. See ATOMIC THEORY.

Maxwell has thrown Faraday's fundamental laws of electrolysis into a suggestive form by first defining the electro-chemical equivalent of a substance as that quantity 'which is electrolysed by a unit of current passing through the substance for a unit of time, or, in other words, by the passage of a unit of electricity.' Then the law of electrolysis is that 'the number of electro-chemical equivalents of an electrolyte which are decomposed by the passage of an electric current during a given time is equal to the number of units of electricity which are transferred by the current in the same time.' Now during electrolysis the products of decomposition appear only at the electrodes, and nowhere else. The electrolyte consists in fact of two groups of components, chemically bound together everywhere throughout the liquid. But the steady appearance of the ions at the electrodes shows that the two groups of components must be steadily travelling in opposite directions through the electrolyte. Hence it follows that although these molecular groups are chemically bound together everywhere throughout the liquid, the individual component groups are constantly changing their associates. For example, in the case of the electrolysis of fused silver chloride any individual silver molecule is handed on, so to speak, from chlorine molecule to chlorine molecule till it reaches the negative electrode and is deposited there. At the same time, each individual chlorine molecule passes in the other direction from union with one silver molecule to union with the next, until finally it reaches the positive electrode and becomes free—i.e. there is constant dissociation and recombination going on in the substance of the electrolyte. Clausius (1857) supposes that this process is going on in the liquid at all times; but that, when an electromotive force acts upon it, a direction of motion is given to the component molecules in their momentarily free condition, so that they drift, the one set of components with the electric current, the other set against it. The feeblest electromotive force is sufficient to compel a certain drift of ions, which we may suppose to be conveying the current of electricity by a kind of convection through the liquid. When the ions reach the electrodes, they no longer find ions of the opposite kind to combine with, and begin to accumulate on the electrodes. But for this a finite electromotive force is necessary; for with the accumulation of ions on the electrodes a reversed electromotive force—the so-called electromotive force of polarisation—begins to show itself. This grows with the accumulation of the ions up to a certain point; and if the external electromotive force is not greater than the electromotive force of polarisation so produced, the current will cease to flow, or at least be so enfeebled as to be practically useless in causing electrolysis.

The ions, as they appear at the electrodes, may not be the real components of the electrolyte which are being urged in opposite directions through

the liquid. In the case of fused silver chloride, the ions are no doubt these very components; but, in the case of dilute sulphuric acid, we have no right to regard hydrogen and oxygen as the real original products of electrolysis. Indeed, we know by experiment that the purer the water the greater its resistance; so that we have every reason to believe that absolutely pure water is a non-conductor and cannot be electrolysed. Probably the secondary actions which in the case of dilute acid transform the real original ions into oxygen and hydrogen may be somewhat similar to what is certainly part of the action when a solution of sulphate of soda is electrolysed. The components of the molecule Na_2SO_4 are Na_2 and SO_4—i.e. sodium and what is called sulphion. The sodium molecules drift with the current, the sulphion molecules against it. But the sodium, when it appears at the negative electrode, at once acts chemically on the water, forming soda, Na_2O, and liberating hydrogen, H_2. Again at the positive electrode, the sulphion not being able to exist in the free state, breaks up into SO_3 and O; and then the sulphuric acid is dissolved up in the water, and oxygen is given off. Thus, again, the constituents of water, H_2O, appear as the ions, exactly as in the case of the dilute acid. Here, however, the molecule of the electrolyte is not really Na_2SO_4, but has so much water united with it. Thus there may be a direct decomposition of water, as well as of the sulphate of soda. Whatever the real process of electrolysis, it is certain that in many cases secondary chemical actions quite mask it. These secondary actions do not, however, affect the accuracy of the law of electrolysis. Whatever be the apparent products of decomposition, these, if they can be caught and measured, will appear in quantities proportional to their chemical equivalents. It is further evident that if one electro-chemical equivalent of an electrolyte is decomposed, it must be decomposed into components chemically equivalent to one another and to it. Hence it is enough to measure carefully the electro-chemical equivalent of one of the ions or products of decomposition. By means of a table of chemical equivalents we shall then be able to calculate the electro-chemical equivalents of given electrolytes. So many are the causes, both physical and chemical, which tend to disturb the perfect accumulation of the ions on or over the electrodes, that the accurate experimental determination of the electro-chemical equivalent is a matter of great difficulty. Large copper electrodes in copper sulphate yield fairly good results; but the only completely satisfactory combination is a particular solution of nitrate of silver with pure silver electrodes. The electrolysis of this electrolyte by means of a current, whose strength should be adjusted to the size of the electrodes, so as to give a particular amount of current per unit area, is accompanied by an accurate transference of so much silver from one electrode to the other. In other words, the one electrode loses as much as the other gains, a degree of perfection which is hardly ever attained in other cases. Recent independent determinations by Kohlrausch and Rayleigh agree to the fourth significant figure; so that we may safely say that the unit of current known as the ampère will reduce out of a solution of nitrate of silver 1·118 milligrammes of silver per second. This therefore is the electro-chemical equivalent of silver. Now in chemical combinations 216 grammes of silver correspond to 18 grammes of water and to 65 grammes of zinc. Hence a simple calculation gives ·0932 milligrammes as the electro-chemical equivalent of water, and ·336 milligrammes as the electro-chemical equivalent of zinc.

The unit of current which has just been mentioned, the ampère namely, is one-tenth of the electro-magnetic unit of current, which may be defined in several ways (see MAGNETISM). For our present purpose, however, it will be sufficient to indicate experimentally what magnitude of current the ampère is. If an ampère is passing along a conductor of 1 ohm resistance—say, a column of mercury 106 centimetres long and 1 square millimetre cross-section—the electromotive force along the conductor—i.e. the difference of potential of its ends—will be the quantity known as 1 volt; and the volt is such that the electromotive force of a Daniell cell is about 1·08 volts. In connection with electric lighting, these units—the volt, the ampère, and the ohm—are in universal use.

Intimately connected with electrolysis is the theory of action of the ordinary galvanic or voltaic cell. For, whenever such cells are being used for the production of electric currents, there is going on within them chemical actions essentially electrolytic. Take, for example, the Daniell cell with its copper and zinc plates dipping respectively in solutions of copper and zinc sulphates. When the cell is closed, the current flows externally from the copper to the zinc, and internally from the zinc through the zinc and copper sulphates to the copper. The electrolysis of these electrolytes is a necessity, with the result that the zinc is gradually dissolved away, and copper deposited on the copper electrode. The net chemical result is the removal of copper from the sulphate and the substitution of an equivalent of zinc. But this chemical reaction is accompanied by the evolution of heat—i.e. the liberation of so much energy available for transformations. It is this energy which is the source of the electric energy when the replacement of copper by zinc in the sulphate is effected in the particular arrangement known as the Daniell cell. Now, according to Thomson's determinations of heats of combination, the consumption of 1 gramme of zinc in a Daniell cell means the evolution of 8053 gramme-degrees, that is, an amount of heat that would raise 8053 grammes of water 1° C. in temperature. Hence the consumption of an electro-chemical equivalent of zinc—i.e. ·336 milligrammes—means the evolution of 2·706 gramme-degrees of heat. This then is the energy which is associated with the production of one unit of electricity. To reduce it to dynamic units we must multiply by the factor $4·2 \times 10^7$, which is the number of units of energy equivalent to the heat required to raise the temperature of 1 gramme of water 1° C. Thus we find $1·14 \times 10^8$ as the energy which a Daniell cell liberates per second when it produces a current of 1 ampère. If E is the electromotive force associated with this unit current, then E measures the work done per second by the current; and assuming that this is the energy liberated in the cell, we find $E = 1·14 \times 10^8$ electro-magnetic (C. G. S.) units of electromotive force—i.e. 1·14 volts, according to the definition of a volt. This is slightly higher than the real value of the electromotive force of a Daniell cell, but it is close enough to warrant the conclusion, first enunciated by Sir William Thomson (1851), that the electromotive force of any electro-chemical apparatus is, in absolute measure, equal to the dynamical equivalent of the chemical action that takes place during the passage of unit current for unit time. There are many cases of galvanic combinations for which this principle fails to a degree which cannot be even approximately referred to errors of experiment. Some other principles, either chemical or physical, must be involved. There is no question, however, as to the general application of the law enunciated by Thomson.

We are now able to see why it is that one Daniell cell cannot effect an electrolysis in which the constituents of water appear as the ions. It is simply because the heat developed in the formation of an equivalent of water by direct union of its

constituents is about half as great again as the heat evolved in the combustion of an equivalent of zinc in a Daniell cell. Hence to decompose an electro-chemical equivalent of water requires more energy than is supplied by the combustion of an electro-chemical equivalent of zinc in the cell.

The general principle here indicated may be stated thus: A current i flowing through a given electrolyte decomposes i electro-chemical equivalents in unit time. But this requires a definite amount of work done, which we may write ie, where e measures the work which must be done to decompose one electro-chemical equivalent. Hence the energy of the current must be *at least* ei, or in other words, e measures in absolute measure the smallest electromotive force with which distinct electrolysis can be effected.

All the phenomena which accompany simple electrolysis are encountered in the action of galvanic cells. The poles, like the electrodes, become, or tend to become, polarised. This is especially the case in single fluid cells, in which the apparent electromotive force very markedly diminishes during the first few moments of action, due to the reversed electromotive force of polarisation produced by the accumulation of the ions on the poles. In the so-called constant elements, such as the Daniell, the Bunsen, or the Grove, all of which are double-fluid cells, the ion is either of the same nature as the pole at which it appears, or is dissolved in the fluid so as not to accumulate. By such means the electromotive force is kept fairly constant so long as the strengths or characters of the solutions do not greatly alter. The chief conditions to be fulfilled by cells which are to yield strong steady currents are (1) small polarisation, (2) a plentiful supply of electrolyte, (3) a small resistance. This last condition is obtained by using large surfaces for the electrodes, which are opposed to each other as closely as the arrangements of the cell will permit.

The difficulties of measuring the true resistance of electrolytes, and therefore of galvanic cells, have already been touched upon. We must here confine ourselves to the chief results which experiment has established. As compared with metallic conductors, the specific resistance of electrolytes is very great. Then, again, rise of temperature diminishes the resistance of electrolytes, whereas, except for selenium, phosphorus, and carbon, it increases the resistance of simple conductors. Finally, in the case of solutions in water of such compounds as sulphuric acid, nitric acid, sulphates, chlorides, nitrates, and so on, there is in general a definite solution which conducts better than any other solution of the same substance—i.e. a definite percentage composition which is associated with a minimum specific resistance. In all cases a condition of infinite resistance is approximated to as the solution is taken weaker and weaker; and in some instances (sulphuric acid, for example) the same condition of infinite resistance is hinted at for infinitely strong solutions—i.e. for the pure non-hydrated substance. Kohlrausch, who has probably worked most extensively at this subject, speculates upon the necessity of solution or of mixture of stable chemical compounds before conduction can take place. In other words, such compounds, if absolutely pure, would be non-conductors.

We cannot hope to understand the true nature of resistance till we know what an electric current really is. The fact that electrolytes obey Ohm's Law as accurately as simple conductors suggests that the process of conduction is essentially the same in both, notwithstanding the many differences that exist in the accompanying phenomena. The view that an electric current is intermittent—i.e. is a succession of distinct discharges at extremely short intervals of time, is one which seems to be involved in all the best theories of electrolysis that have been elaborated. Maxwell has shown that a rapid intermittent charging and discharging can give rise to all the effects of a true resistance. Suppose we have a condenser of capacity C, whose plates are, by means of a tuning-fork interrupter, alternately brought into contact with the poles of a battery and with each other, so that the condenser is charged and discharged n times a second. If E is the electromotive force of the battery, EC is the electricity which passes at each discharge. Hence in one second ECn units of electricity pass; and this is the current I. Thus

$$I = ECn,$$

so that Cn measures the conductivity. The greater n is, the greater the conductivity, the less the resistance. Hence, if the electric current is of the nature of intermolecular discharge, we see that greater closeness of the molecules, being in all probability associated with more rapid charging and discharging, will give rise to less resistance. This would so far explain the much greater resistance of electrolytes as compared with metallic conductors. For a very complete statement of this view, consult Professor J. J. Thomson's *Applications of Dynamics to Physics and Chemistry* (1888).

The hypothesis just given of the intermittent character of electric conduction obviously suggests that the mode by which electric transference takes place in simple conductors, electrolytes, and dielectrics is fundamentally the same. In many dielectrics the phenomenon of 'leakage'—the name given to the gradual loss in charge of a conductor in contact with the dielectric—presents characteristics very similar to true ohmic conduction. Then dry glass, although a very good insulator at ordinary temperatures, becomes distinctly conducting at temperatures above 200° C.—a fact first noticed by Cavendish. Later experiments indicate that the conduction of hot glass is electrolytic, the electrodes becoming polarised. In the case of gases, electrical discharge seems always to be of an intermittent character. A certain electromotive force, depending on the shape and size of the electrodes, on their distance apart, and on the density, temperature, and nature of the gas, is necessary before discharge takes place. For smaller electromotive forces, the gas, if free from convection currents, seems to insulate perfectly. The insulating power of the gas under given conditions is measured by its dielectric strength, which varies as the square of the electric force. The dielectric strength increases markedly for very small distances between the electrodes, a very remarkable fact which may possibly be due to a greater density of gas close to the surfaces of the electrodes. For smaller and smaller distances such condensed layers would of course play a more pronounced rôle. This explanation agrees with the fact that the dielectric strength of gases diminishes as the density is diminished. This, however, does not go on indefinitely, but it reaches a minimum for a certain low density, which has a different value for each gas, and which is also a function of the diameter of the tube in which the rarefied gas is contained. A pressure of 2 or 3 millimetres of mercury gives the density for which the dielectric strength of air reaches its minimum. Further rarefaction beyond the point of minimum dielectric strength is accompanied by a rapid increase of insulating power, until at length it is impossible to make a discharge pass through the extremely attenuated gas. It thus appears that electricity cannot pass from electrode to electrode in a perfect vacuum—i.e. a region void of ordinary matter. Whether this is due to an

infinite passage resistance between the electrodes and the so-called vacuum, or to the absolute non-conducting power of the vacuum, is a point not yet settled. Electric discharge through rarefied gases is accompanied by very beautiful luminous effects, which are often enhanced by the phosphorescence of the glass forming the vacuum tubes. These tubes are usually called Geissler tubes, after the first great maker of them (the glass-blower and mechanician, Heinrich Geissler, 1814–79). Into their many curious properties we cannot here enter.

The polarisation of the electrodes during electrolysis has within the last ten years acquired a great practical importance in connection with the construction of secondary batteries or accumulators. An accumulator is simply a polarised electrolytic cell capable of supplying a steady current for a lengthened time. Theoretically of course, all polarised electrolytic cells are accumulators; but usually the currents they supply are short-lived and feeble. It was not till 1860 that Planté constructed an accumulator which could supply a really efficient current. The Planté secondary cell is formed by the electrolysis of dilute acid with lead electrodes. With sufficiently strong currents, the result of the electrolysis is that the positive electrode becomes covered with peroxide of lead (PbO_2), while lead accumulates in a spongy form on the negative electrode. When the polarisation has been carried on to a sufficient extent, the cell is said to be charged, and it will be found to have all the properties of a true galvanic cell of low resistance and fairly high electromotive force (about 2 volts). On being closed, it will supply a current sufficient to keep a thin wire glowing for several hours. At the same time, the peroxide of lead will become reduced to a lower oxide, and the spongy lead will be oxidised, while the sulphuric acid present gives rise to other reactions. During the greater part of the discharge of the cell, the electromotive force remains very constant, and only begins to diminish as the depolarisation approaches completion. When the charged cell has thus, through use, lost nearly all its accumulated electrical energy, it is put into circuit with a primary source of current energy and re-charged. The modifications of construction introduced by Faure in 1881 gave a great impulse to the development of accumulators as a practical source of electrical energy. Instead of using merely lead sheets as electrodes, Faure covers them first with a layer of minium or red lead. With these as electrodes the electrolysis of dilute sulphuric acid is effected, the result being, as before, the formation of peroxide of lead at the positive electrode and spongy lead at the negative electrode. What chemical reactions take place as the accumulator discharges itself are not fully understood. The final result, however, seems to be the formation of sulphate of lead on both electrodes. Re-charging from a prime source restores the peroxide of lead and the spongy lead as in the first charging. As part of the recent development in electric lighting, the efficiency of accumulators has been greatly increased; and they are now largely used as the direct source of power. They must, of course, be charged and re-charged at intervals depending upon the particular rate at which they are made to give off their stored-up energy. A battery of Bunsen or other cells may be used for charging purposes; but if the wasteful voltaic cell had been our only prime source of electric energy, the secondary cell could never have assumed the practical importance it has. It is because we can generate electric energy dynamically and economically (see MAGNETISM) that we find a use for the accumulator, which is simply an arrangement for the storage of so much electrical energy in a form convenient for future purposes.

Of all the thermal effects produced by currents, the Joule Effect is the most conspicuous and by far the most important. But there are other thermal effects which are associated with the transference of electricity, and which are readily distinguished from the Joule effect by what is known as their reversible character. Thus the Joule effect always means a rise of temperature in the conductor whatever the direction of the current through it; whereas these so-called reversible effects mean a rise of temperature when the current passes in the one direction, and a fall when it passes in the other. If at any part of a circuit, in which a current is flowing, a fall of temperature is observed, we are probably safe in regarding this cooling effect as one of these reversible effects. We may test this directly by reversing the current; but occasionally the conditions of the experiment may prevent the application of this test. Thus, in some cases, a galvanic cell, in circuit with a large external resistance, is found to cool. Since the current due to a given galvanic combination must always flow in the same direction through the cell, it is impossible of course to apply the test of reversal. Other galvanic cells, again, when similarly joined up with a high external resistance, are found to rise in temperature under conditions in which the true Joule effect is inappreciable. Such thermal effects seem to be true reversible effects; and upon them Von Helmholtz bases his explanation of the apparent failure, in many instances, of Thomson's dynamical theory of the electromotive force of a battery (see above). In most cases, the electromotive force is smaller than what the chemical reactions imply; but in some it is greater. In the former there is intrinsic heating in the cell; in the latter there is cooling—exactly the relations which the principles of energy require. For, as in the latter case, if the electrical energy generated is greater than the *chemical* energy supplied, it must borrow heat from the surrounding substances to make up its surplus energy. The further fact that those cells, which either heat or cool of themselves, have electromotive forces which vary with temperature, points to these being truly reversible thermal effects. An electromotive force which grows with temperature is associated with a cooling effect in the cell as the current is flowing, while an electromotive force which diminishes with rise of temperature is associated with a heating effect. This must be so; for in all cases of transformations of energy, the final effects react so as to resist the changes that lead to them. In the present case, if a heating effect coexisted with an electromotive force which increased with temperature, this heating effect would raise the temperature still further, increase the electromotive force still more, and cause a stronger current to flow, which in its turn would cause a further rise of temperature, and so on indefinitely —an obvious contradiction of all experience. We shall find some simple applications of the same dynamic principle of reaction in the other reversible thermal effects of electric currents. These are intimately connected with the whole subject of thermo-electricity, which we shall now discuss.

Thermo-electricity dates from 1821, when Seebeck discovered that a current was generated in a circuit composed of copper and antimony, when the junctions were at different temperatures. With a sufficiently delicate galvanometer, the same phenomenon may be shown not only with any two different metals, but also with the same metal in two different conditions. Thus, a stretched, twisted, or (if possible) magnetised wire will give thermo-electric currents with a piece of the same wire which has not been so treated. Slight

impurities cause distinct changes in thermo-electric properties; indeed, thermo-electric currents may often be obtained in a circuit of two wires, which no other physical test can differentiate. The fundamental fact of thermo-electricity is that, in a circuit built of two or more different conductors, a current is in general generated when one junction at least differs in temperature from the others. For the sake of definiteness, consider a circuit of the two metals iron and copper, with their junctions at A and B, and with a delicate galvanometer included for the measurement of current. If A and B are at different temperatures, a current will in general be set up in the circuit; and for moderate temperatures up to 250° C. or so, this current will flow from copper to iron through the warmer junction, and from iron to copper through the colder junction. Now this current i must derive its energy, ei, from some source; and the only source that exists is the heat which is available in virtue of the unequal distribution of temperature. In virtue of thermal conduction and radiation, the tendency is towards an equalisation of temperature, the warmer junction losing heat, and perhaps the colder junction gaining heat. But if this heat is also being partly drawn upon to sustain an electric current, the equalisation of temperature will be hastened because of this transformation into electric energy. Hence, we should expect the thermo-electric current to be associated with, at anyrate, a cooling effect at the warmer junction. That such an effect really does exist was established experimentally in 1834 by Peltier—hence the name Peltier Effect. He showed that heat is absorbed or evolved at the junction of two different metals, across which any current is made to pass; and that if the direction of this current is the same as that of the thermo-electric current that would be produced by heating the junction, the effect is absorption of heat—i.e. cooling; and *vice versâ*. Thus, in a copper-iron circuit at moderate temperatures, the thermo-electric current is associated with a cooling effect at the warmer junction, and a heating effect at the colder junction. Icilius proved by experiment (1853) that the Peltier effect is proportional to the strength of the current. It is also known to vary with the temperature, sometimes increasing with rise of temperature, sometimes diminishing, according to the particular kinds of metals used.

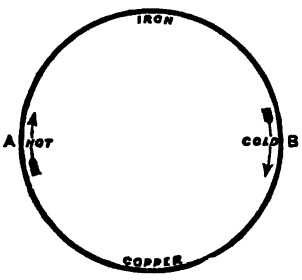


Fig. 28.

The Peltier effect is defined as the heat absorbed by the passage of unit of electricity in the proper direction across the junction; or otherwise, the heat absorbed per second by the passage of unit current. Let p be the Peltier effect at the warmer junction of a thermo-electric circuit, and p' its value at the other junction. Assuming that the Joule and Peltier effects are the only thermal accompaniments of a thermo-electric current i, we find for the whole amount of heat absorbed the quantity pi, and for the whole amount of heat evolved $p'i + ri^2$, where r is the resistance of the circuit, and where the heats are estimated in dynamic units. If we suppose these to be the only transformations of energy involved, we have at once

$$pi = p'i + ri^2 \text{ or } p - p' = ri.$$

In the latter equation, the difference of the Peltier effects appears as the electromotive force associated with the current i. From this point of view the Peltier effect is to be regarded as an abrupt change of potential at the junction of the two metals. It must not be confused, however, with the electromotive force of contact discovered by Volta, compared with which it is extremely small, and frequently of opposite sign.

Thus we may suppose thermo-electric currents to be explained in terms of the Peltier effects, regarded as electromotive forces at the junctions. But the striking phenomenon of thermo-electric inversion, discovered by Cumming in 1823, necessitates the supposition of other than Peltier effects for a satisfactory explanation of thermo-electric currents. Take, for example, the copper-iron circuit, keep the one junction B at a steady temperature of, say, 10° C., and raise the temperature of the other junction A steadily and indefinitely from 10° C. to about a dull red heat. As the temperature of A rises, the current setting from copper to iron through A will increase to a maximum, then decrease to zero, and finally become reversed. The temperature at which this maximum current is obtained is a definite temperature for a given pair of metals, being quite independent of the temperature of the other junction. It is called the Neutral Point. If the temperature of the one junction is as much above the neutral temperature as the temperature of the other junction is below it, there is no current; and the mean of these two temperatures is the neutral temperature. For copper-iron the neutral point is about 275° C.; for zinc-iron, about 210° C.; for cadmium-iron, about 160° C.; and so on. In the majority of cases, the neutral point, occurring either above or below ordinary ranges of temperature, cannot be easily observed directly; but its position is usually indicated by the manner in which the electromotive force is found to vary with temperature. Now suppose that the one junction A in the copper-iron circuit is kept at the neutral temperature (275° say); then whatever be the temperature of the other junction, whether it is higher or lower than 275°,

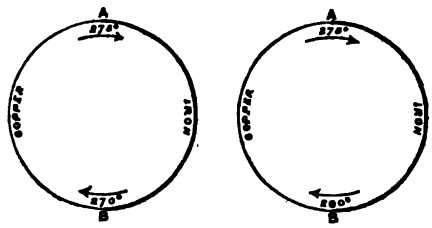


Fig. 29.

the direction of the current will always be the same—viz. from copper to iron through the junction A. Consider the two cases: (1) B at temperature 270°; (2) B at temperature 280°. In the first case, if the only reversible thermal effects existing are the Peltier effects at the junctions, then there must be absorption of heat at A (copper to iron), and (if anything) evolution of heat at B (iron to copper). But in the second case, the same assumption requires that there must be absorption of heat at B (iron to copper), and (if anything) evolution of heat at A (copper to iron). Now these two statements are incompatible unless there be neither absorption nor evolution of heat at A—i.e. unless the Peltier effect vanish at the neutral point. But this being so, it is at once evident that in the first case there is no absorption of heat at all. Heat is evolved at B, and heat is evolved because of the Joule effect; but there is no evidence of any absorption of heat to account for the energy of

the current. Hence the original assumption must be wrong—i.e. there must be other reversible effects in the circuit besides the Peltier effects at the junctions. There must be a cooling effect either in the copper wire, or in the iron wire, or possibly in both. This theoretical conclusion was first obtained by Sir William Thomson (1851), who proceeded at once to test it by an appeal to experiment. It was found that both of these predicted effects take place. A current passing from cold to hot in copper is associated with an absorption of heat; while heat is evolved if the current passes from hot to cold. On the other hand, for iron, things are just reversed; cooling is associated with the current that flows from hot to cold, and heating with the current that flows from cold to hot. This reversible thermal effect which accompanies the passage of a current in an unequally heated conductor is called the Thomson Effect. It is said to be positive in copper; and is therefore negative in iron. Cadmium, zinc, silver, gold, nickel between the temperatures of 250° C. and 310° C., and iron above a dull red heat, have, according to Professor Tait's experiments, their Thomson effects also positive. Platinum, palladium, potassium, sodium, cobalt, nickel below 200° and above 320°, and probably iron again above a bright red heat, are examples of metals having negative Thomson effects. The Thomson effect has been measured directly in a very few cases; but it may be calculated from thermo-electric constants, if Tait's hypothesis be true (and recent direct experiments go far to verify it) that the Thomson effect is for most metals directly as the mean absolute temperature. The extraordinary change of sign in the Thomson effect, which Tait discovered to exist both in nickel and iron at certain temperatures, is an extremely interesting phenomenon, and seems to be connected with other properties peculiar to these magnetic metals—such as their loss of magnetic susceptibility and the manner in which their electrical resistances change with temperature.

In comparison with the electromotive forces of voltaic cells, the electromotive forces that can be obtained with thermo-electric circuits are usually very small. Thus copper-iron with one junction at 275° C., and the other at 0° C., has an electromotive force of only ·0022 volts. The electromotive force of an iron-nickel pair with junctions at temperatures 0° C. and 200° C. is ·008 volts; and the electromotive force of a bismuth-antimony pair with a difference of temperature of 50° C. is about ·005 volts. Bismuth and antimony are, because of their high mutual thermo-electromotive force, ordinarily employed in the construction of the thermopile, a valuable instrument for indicating and measuring small variations of temperature. It consists of alternate strips of bismuth and antimony forming a continuous zigzag chain, as indicated in fig. 30. They are arranged in compact form so that the successive junctions alternate, now on this side, now on that side, forming two plane faces looking opposite ways. If a source of heat is brought opposite to the one face, the junctions ending there are heated by radiation, while the alternating junctions on the other face remain at the temperature of the air. Each pair of junctions gives rise to a thermo-electromotive force e, and therefore the n pairs to ne. If s is the resistance of each pair of strips, and r the resistance of the galvanometer and connecting wires, the current i is given by the equation

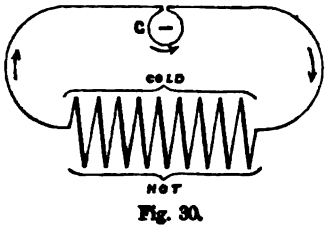


Fig. 30.

$$i\,(r + ns) = ne.$$

Thus r is always greater the greater n is; and if, as is usually the case, the resistance of the thermopile (ns) is small compared with the resistance of the galvanometer, the current due to the n pairs is very nearly n times the current that one pair would give. Thus a thermopile of thirty-six pairs of junctions will give an electromotive of nearly one-tenth of a volt for a difference of temperature between the faces of 25° C.

The Peltier effect between bismuth and antimony at the ordinary temperature of the air is about $3{\cdot}14 \times 10^8$ per ampère per second, estimated in dynamic units—i.e. about ·0075 in gramme-degree units of heat. Hence in one minute, a current of one ampère passing from antimony to bismuth will evolve a quantity of heat sufficient to raise a gramme of water nearly half a degree centigrade in temperature. For other ordinary pairs of metals, the Peltier effect is considerably smaller than that just given. Thus for iron-copper at the ordinary temperature of the air, the Peltier effect is about one-seventh of its value for bismuth and antimony.

The Thomson effects are extremely difficult to measure directly. We may, however, get an idea of their magnitudes by calculating them according to Tait's theory from the thermo-electric constants. Suppose, for example, that a current of ten ampères is flowing along an iron or copper wire, whose ends are at 0° C. and 100° C. Then the amounts of heat in gramme-degrees evolved or absorbed per minute are, in iron ·224, in copper ·044. These numbers are calculated on the assumption that the Thomson effect in lead is nil, an assumption based on the direct experiments of Le Roux.

In recent years an extensive literature bearing on electricity has sprung up. Of elementary text-books fitted for the use of students, we may mention Fleeming Jenkins' *Electricity and Magnetism* (Longmans, Green, and Co.), specially good in the practical experimental part of the subject; Ferguson's *Electricity* (W. & R. Chambers, new edition by Professor Blyth, 1882), perhaps the most consistent of elementary treatises in its adherence to the Faraday conception of electric and magnetic action; Cumming's *Theory of Electricity* (Macmillan & Co., 1876); and Maxwell's *Elementary Treatise on Electricity* (Clarendon Press, 1881), unfortunately only a fragment. Of complete treatises, Maxwell's *Electricity and Magnetism* (Clarendon Press, 1873; 2d ed. 1881) is the great modern classic on the subject. Professor Chrystal's article 'Electricity' in the *Encyclopædia Britannica* is an admirable and compact exposition of the science up to the date of publication. Wiedemann's *Die Lehre von der Electricität* (4 vols. 1882–85) is invaluable as a book of reference to any one desirous of knowing what has been done on any electrical subject. Mascart and Joubert's *L'Electricité et le Magnetisme* (2 vols. 1882–86), translated into English by Dr Atkinson, has many excellent features which give it a place of its own amongst other similar works. The development of the modern theory of electricity is to be traced chiefly through the original writings of Poisson, Ampère, Gauss, Joule, Green, Faraday, Thomson, Maxwell, and Helmholtz; and of these the *Experimental Researches* of Faraday (3 vols. 1839–44–55) will always hold an altogether unique position.

In the preceding article the aim has been to present the science as a unity, especially in relation to the modern doctrine of Energy; only in this way can justice be done to such important subdivisions as Electrolysis and Thermo-electricity. It has been found convenient, however, to omit the whole of Electro-kinetics and Electro-magnetism, as these are in reality best discussed under MAGNETISM. In the presentation of the facts and theories of what is commonly called Frictional Electricity or Electrostatics, the conceptions of Faraday, as interpreted and extended by Thomson and Maxwell, have been closely followed. In no case has the ordinary two-fluid

theory been made explicit use of; although it is quite impossible to escape altogether from its implication in the nomenclature which has survived the theory that gave it birth. The history of the science will be found treated incidentally, as the successive points are taken up in order. For convenience of reference, we give an epitome of the arrangement of the article. Electrostatics takes up nearly the half of the article, and is followed by Electro-kinematics, Electrolysis, and Thermo-electricity in order, thus:

Electrification, page 255.
Electroscope, electrometer, page 256.
Fundamental experiments, page 256.
Potential; equipotential surfaces, lines of force, page 258.
Capacity; concentric spheres, parallel planes, page 260.
Absolute measurement of electric quantities, page 262.
Specific inductive capacity, page 263.
Instruments for generating electricity, page 263.
Loss of energy at discharge, page 264.
Transference of charge, current, page 264.
Galvanometer, page 265.
Electromotive force, page 266.
Resistance. Ohm's Law, page 267.
Joule's Law, page 269.
Electrolysis, page 270.
Energy relations of voltaic cells, page 272.
Conduction and discharge compared, page 274.
Secondary batteries, page 275.
Reversible thermal effects of currents, page 275.
Thermo-electricity, page 275.

Electricity, ANIMAL. See ELECTRIC FISHES.

Electricity, ATMOSPHERIC. That the atmosphere, occasionally at least, is in a state of electrification is readily shown by the well-known phenomena of thunder-storms, and that the electrical conditions found on such occasions are the same as that obtained in any laboratory experiment with electrical apparatus was proved by Franklin in 1752 by his famous kite experiment. But since then it has been shown by numerous observations that the atmosphere is constantly in a state of greater or less electrification; that it is sensibly electrified not only during thunder-storms, but also during the prevalence of calm, clear weather. The observations made on the electrical condition of the atmosphere have mainly been the determination of the potential (see ELECTRICITY) of the earth's surface at a given time and place, or of the difference between the potential at a point in the air and that at the nearest point on the earth's surface. The distinction between these two determinations may be made clear by an example. If, for instance, a spherical ball be placed on the top of a rod of conducting material in connection with the earth, and having been lifted from that position by an insulated handle or carrier, be taken to an electrometer, with which to measure its potential, we would get by the latter an estimate of the potential of the earth's surface at the place formerly occupied by the rod and ball. If, on the other hand, we imagine a conductor placed at a given point in the air to become insulated, and then to throw from its surface portions of its mass, it would soon be reduced in potential so as to be in electrical equilibrium with the surrounding air—i.e. it will assume the potential of the air at the point. By afterwards finding the potential of this conductor we obtain a determination of the potential of the air at the point, or, what comes to the same thing, of the difference between the potential of the earth and that of the air at the given point.

The first of these methods was employed by Delmann in an extensive series of observations, but it has been by the second that more accurate observations have recently been made. It is, moreover, capable of being so adapted that a continuous record by means of photography may be obtained. Sir William Thomson, in his experiments in the island of Arran, employed two forms of this second mode of experiment. In one he used a burning match or spirit flame on the end of a long vertical insulated conducting rod; the products of combustion continually carry off electricity so long as the potential of the rod is different from that of the air surrounding the flame. The potential of the conductor is thus quickly brought to be the same as the air at the flame. To the lower end of the rod a small portable electrometer is usually attached, from the readings of which the difference between the potential of the earth and that of the air at the flame may be deduced. The other method depends on the same principle. It consists in insulating a can of water which has a long tube projecting from the lower part of its side. The can is usually placed near to and inside the window of a room, while the projecting tube passes through the window. Water is allowed to trickle slowly from the end of the tube at a nozzle, usually a few feet from the window-sill. As each drop falls it carries with it a small charge of electricity, and this goes on until the potential of the can is reduced to that of the air at the nozzle of the tube; this potential is afterwards found by means of the electrometer.

By such means Sir W. Thomson found that the difference of potential for a point 9 feet from the ground was equivalent to that of from 200 to 400 Daniell's cells. This represents a resultant force perpendicular to the earth's surface of from about 22 to 44 Daniell's cells per foot. He also found that the electrical conditions were subject to much variation, due no doubt to the motion overhead of electrified cloud-masses, at no great distance from the ground. But generally in calm clear weather the electrometer readings indicated a high positive potential, increasing so markedly before and during east and north-east winds as to be of some value in forecasting the weather. Other observations, chiefly in Europe, show that the potential of the air reaches two maxima and two minima each day, and that the hours of these maxima and minima are different for different seasons of the year. For instance, at Brussels, the two maxima in summer were found to be at 8 A.M. and 9 P.M.; in winter, at 10 A.M. and 6 P.M.

As to the causes of atmospheric electricity, many theories have been propounded, but most of them assume to begin with either some small initial charge of electricity in each vapour particle in a cloud, or some charge of electricity more or less permanent, on the earth's surface. We have only space to mention one or two of the more notable speculations. One which has held a place for some time past is that in which the evaporation going on at the surface of the sea and lakes is made the origin of atmospheric electricity—that in the formation of vapour the particles assume an opposite charge to the mass of liquid which they leave. But it has recently been shown that a much higher temperature is required for such electrification than that which ordinarily is found in large masses of water on the earth's surface. Again, in the condensation of vapour has been sought the source of the phenomena; but that it should be so is difficult to believe, for the very reasons which make the previous speculation somewhat plausible. Some physicists have assumed that the earth has a permanent negative electric charge, and that clouds coming in contact with mountains become charged. That this may be so in special localities is highly probable, yet the original earth's charge is not explained. Sir W. Thomson assumes to begin with, that the lower layers of the atmosphere have a permanent positive charge, which is diffused by convection currents into the upper layers. Atmospheric electricity has also been set down as the result of the friction of dry air against moist air; or, again, by some to the friction of the air in passing over the earth's surface. But this

theory is discredited by the general observation that thunder-storms are more frequent in calm than in windy weather.

The true cause of atmospheric electricity has therefore not yet been discovered. But if any theory can rationally explain a mode by which each small vapour particle in a cloud may become electrified, even with an excessively small charge, the main difficulty would be got over, and the rest would be comparatively easy. The potential of each spherical particle is directly proportional to the quantity of electricity with which it is charged; and when several spheres unite together to form one sphere, the potential of the single sphere is proportional to its surface, compared with the smaller particles of which it is composed. When it is remembered that the number of particles in a drop of water is reckoned at many thousands of billions, it is easy to conceive how a thunder-cloud may have a very high potential, even although the particles may originally have had an extremely small charge.

Meanwhile, it would appear that a widely extended series of observations on the electrical conditions of the atmosphere, together with experiments on a much larger scale than is usual in a laboratory, are necessary requisites before much more light can be thrown on the subject. See LIGHTNING, THUNDER.

Electricity, MEDICAL. The three forms of electricity — Static, Galvanic, and Faradic — are employed in medicine.

(1) *Static.*—This form has been little used of late years, chiefly owing to the inconvenience and uncertainty of the apparatus required for its production. The old frictional and even the Holtz machines were most uncertain in their action, and depended for their efficiency on various conditions of the atmosphere, &c. The recent invention of the Wimshurst machine is increasing the interest in the use of static electricity for medicinal purposes. This instrument being independent of atmospheric conditions is specially well adapted for occasional use.

(2) *Galvanic.*—The current derived from the galvanic battery is largely employed in medicine. As in almost all cases the current requires to traverse the skin, the electrical resistance of which is high, a battery of a considerable number of elements is required to yield sufficient electric pressure. The elements usually employed are some form of the Leclanché or the bichromate element, and batteries containing from 30 to 50 of these are found most convenient. These should yield an electric pressure of from 40 to 70 volts when in good working order. As portability is a consideration, the cells are usually made small, and as the external resistance is considerable and the circuit closed for a comparatively short time, the smallness of the elements is not an objection. When, however, the external resistance is reduced by special appliances, and the current passed for a considerable period, as in the electrolysis of tumours, larger elements must be used, and those of pint or even quart capacity are found convenient. The battery should possess a *collector* by which the cells may be added to the circuit one by one; and the larger-celled batteries should also possess a *rheostat*, by which the external resistance may be varied with perfect gradations so as to avoid the transmission of shocks while the current is being increased or diminished. Until recently the only measure of the amount of electricity employed was the number of cells in the circuit. This is obviously an unreliable guide. The electromotive force of the cells varies with the exhaustion of the fluid and polarisation of the plates, and the resistance of the external circuit varies with the condition of the skin as to moisture, vascularity, and locality, the size, distance between, and the polarisation of the electrodes. And as the amount of current passing depends on an absolute relation between the electromotive force and the resistance of the current, neither of which under these conditions can be known, this method is quite useless. The unit of current strength in ordinary electric measurement is the *ampère*. This is, however, much too large a unit for medical purposes, and the thousandth part of this, termed the *milliampère*, is employed. Galvanometers calibrated in milliampères are now largely made for medical purposes, so that when one of these is introduced into the circuit the exact amount of current passing at a given time can be read directly. As currents varying from 1 to 300 milliampères are now regularly employed, the instrument should be capable of indicating between those limits. Further, the instrument should be as near as possible aperiodic (dead-beat). Such an instrument should therefore be included in the circuit whenever it is advisable to estimate the current strength employed. Effects can only be compared provided we know the amount of current producing them, and this can only be determined by the milliampère-meter. The efficiency of the current depends, however, not only on its amount, but also on its *density*. This character depends on the diameter of the conductors which bring it in contact with the body. The current-density varies inversely as the sectional area of the conductor. Thus a current of 200 milliampères, conveyed to the body by two conductors whose terminals are 10 inches in diameter, may be borne with little inconvenience and produce little appreciable effect, but if one of the conductors be reduced to, say, 1 inch in diameter while the same current is passing, the density of the current at the electrode is greatly increased, the pain would be intense, and vesication and tissue destruction would follow in a very short time. Currents of large amount and of great density are thus employed in the electrolysis of tumours, &c.

Well-insulated flexible wires of suitable length are employed for conveying the current. These terminate in electrodes of various kinds and sizes according to the object in view. For ordinary purposes (galvanisation of muscle, nerve, &c.) discs, plates, or cones of brass or carbon covered with flannel or wash-leather are employed. For conveyance of large currents large pads of moist clay, flannel, sponge, &c., 10 or 12 or more inches in diameter, are employed externally, while the current is concentrated by a platinum or steel needle on the part to be affected. In all cases electrodes to be applied to the skin should be thoroughly soaked in a solution of salt in warm water in order to diminish the resistance of the circuit and the pain of the current.

(3) *Faradic.*—For the production of the faradic current a simple form of induction coil is employed. The primary coil of thick wire is wound round a tube in which slides a bundle of iron wire. The secondary coil of fine wire fits over this. In the best forms of instrument the strength of the current can be regulated, both by the sliding of the iron bundle in and out of the primary, and also by the sliding of the secondary over, or off and away from the primary. Some form of simple magnetic interrupter (Neef's hammer) is connected with the instrument, and it is desirable that some means should be provided for regulating the rate of interruption. It must be borne in mind that at each movement of the interrupter two currents are generated in the secondary, the one, at the moment of making of the primary, in the opposite direction, and the other, at the moment of breaking, in the same direction as the primary current. The

currents from a faradic machine are thus alternating. But further, these differ in strength; the breaking current being reinforced by the 'extra stream' of the primary, is considerably the stronger. The signs + and − sometimes marked on the terminals of the secondary, refer only to this stronger or breaking current.

Physiological Effects of the Galvanic Current: (a) *On Sensory Surfaces.*—When a current of from 10 to 15 milliampères is applied to the skin by electrodes of 1 or 2 inches in diameter, a prickling followed by a burning sensation is experienced. If the current is gradually diminished and the electrodes removed, the skin will be found to be bright red, showing increased vascularity. While the current is being diminished it will be noticed that the sensation first disappears under the positive pole, and while being increased first appears at the negative one, thus indicating the greater exciting effect of the latter. (b) *On Motor Apparatus.*—If a large sponge electrode be applied to the spine in the dorsal region, and a smaller conical one be applied to such a muscle as the biceps in the upper arm, it will be found that if a current of sufficient strength be employed, the muscle will be thrown into contraction at the moment of making and breaking the current. The strength of current required to produce this effect will depend (1) on the pole applied to the muscle; (2) on whether the current is made or broken. In a state of health it is found that muscular contraction occurs with those conditions in the following order: (1) Current closed—negative muscle; (2) current closed—positive on muscle; (3) current opened—positive on muscle; (4) current opened—negative on muscle. Thus the weakest current capable of producing contraction will act when the current is closed with the negative on the muscle (1); and stronger currents will be required to produce contraction under the conditions 2, 3, 4. Or conversely, if a muscle contracts with an opening current, the negative being on the muscle (4), more and more powerful contractions will be obtained by altering the conditions with the same current to 3, 2, and 1.

Electrolytic Effects.—If a broad surface-electrode be applied to any part of the body and connected to one pole, and the other pole connected to a platinum or steel needle inserted into, say, a fibroid tumour of the uterus, or applied to any mucous surface, and a current of 15 to 250 milliampères passed, tissue in contact with the electrodes will be decomposed. Owing to the extent of the external electrode and small density of the current, the result here will be inappreciable, but it is very obvious at the internal one. Thus, if the electrode is positive, the products of decomposition will be strongly acid in reaction (turning litmus red), and the tissue round the electrode will be condensed, and contract round it. If the internal electrode is now negative, the products of decomposition will be strongly alkaline in reaction, and the tissue will be rapidly broken up, a loose frothy material escaping from the electrode, which will move freely in a sinus formed by the electrolysis. The negative pole while liberating alkaline products has much more marked disintegrating influence than the positive.

Physiological Effect of Induced Currents: (a) *On Sensory Apparatus.*—When a weak current from the secondary is applied to the skin, the sensation is that of gentle prickling or tingling. As the strength of the current is increased the sensation becomes more and more painful, but has never the burning character of the galvanic current. (b) *On Motor Apparatus.*—If one or both poles are applied to a muscle, and a single shock of sufficient strength sent, a single muscular contraction will be produced. If the shocks are repeated with sufficient slowness, a series of single contractions will follow; but if the rate of transmission is increased, the muscle will be thrown into a state of tetanus or continued contraction, the effect of one shock not having passed before the next has reached the muscle.

Diagnostic Uses of Electricity.—Galvanic and faradic currents are employed in the diagnosis of various nervous and muscular disorders. In certain diseases of the spinal cord and the cerebro-spinal nerves it is found that the normal phenomena of muscular contraction are much altered. Thus it may be found that a muscle may fail to respond to faradic stimuli of any strength, and yet continue to respond to interrupted galvanic stimuli; and again it may respond to galvanic stimuli in an order different to that indicated in a previous paragraph as normal to health. These abnormal phenomena are termed the 'reactions of degeneration.'

Therapeutic Uses of Electricity.—Only the most general indications of these can be given. The *static* form is of value in the treatment of various nervous disorders—e.g. old-standing neuralgia, chorea, hemi-anæsthesia, hystero-epilepsy, and hysteria. *Galvanism* is used in acute neuralgias, such as tic-douloureux, sciatica, &c.; in atrophy of muscle following hemiplegia, diabetes, writers' cramp, &c.; in spinal irritation, chronic myelitis; in the enlarged and stiffened joints of chronic rheumatism and rheumatic arthritis, and in lumbago; in chronic pharyngitis, in glandular laryngitis (clergyman's sore throat), naso-pharyngeal catarrh, chronic tonsillitis; and in other diseases associated with chronic inflammation and defective nutrition. *Faradism* is employed in general nervous exhaustion associated with insomnia, in functional disorders of the generative organs, in the acute stage of articular rheumatism, giving great relief to the inflamed and painful joints, in incontinence of urine from atony of bladder and sphincter, in irritable and painful prostate, in hysterical aphonia, neurasthenia, &c.

Galvanism in Electrolysis.—Nævi and aneurisms are frequently cured by electrolysis of their contents. Needles insulated to within a quarter of an inch of their points are plunged into the tumour, and through these the current is passed. Coagulation takes place round the needles, and forms a nucleus round which further clotting occurs, resulting in obliteration of the nævus, or strengthening of the walls and filling of the sac in an aneurism. For uterine hemorrhage a current of 100 to 250 milliampères is employed, a thick platinum wire carrying the *positive* current to the mucous membrane of the uterus, a large surface-electrode lying on the abdomen. The positive current is a powerful hæmostatic, and properly applied this method checks most cases of hemorrhage. So also fibroid tumours of the uterus are treated by similar high currents applied in the same way. But the disintegrating effect of the negative pole is preferred either lying in the uterine cavity or introduced into the substance of the tumour. Various inflammatory conditions both outside and inside the uterus are similarly treated. All these effects depend (1) *on the strength of the current*, which is obtained by the use of a sufficiently large pressure (30 to 40 cells = 40 or 60 volts), and a large surface external electrode which diminishes the resistance of the skin; (2) *on the density of the current* at the part to be affected, which is obtained by the use of an electrode consisting of a small platinum or steel needle.

In conclusion, a word may be said regarding the much advertised 'galvanic' and 'magnetic' belts. There is no doubt that galvanic chains, such as Pulvermacher's, are capable of giving a more or

less continuous current of electricity, and it may be that in some cases their use has been followed by benefit. But the irregularity of their action, and the impossibility of directing or controlling the current, render their use entirely hap-hazard. Moreover, very troublesome ulcerations have been produced in the skin by prolonged contact of the negative pole. On the other hand, there is not the least evidence that the so-called 'magnetic belts' have any influence whatever on the tissues or functions of the body. They consist of pieces of watch-spring, or of crinoline steel, more or less magnetised, sewn between layers of flannel or other material, and adapted to different parts of the body. It has never been shown that even powerful magnets have any influence on the bodily functions, and it cannot be believed that these appliances are of any use whatever. Any relief from pain which may follow their application is most probably due to the heat-conserving property of the flannel or other material in which the bits of steel are sewn.

Electric Light. The electric light, like light from most other sources, is produced by raising a body to a temperature so high that some of the radiations it throws out have a wave-length short enough to affect the retina. A slightly heated body gives radiations of long wave-length only; they may be detected, as any radiations may, by their heating effect when they fall on an absorbent surface, but the eye is not sensitive to them. When the body is made hotter the whole energy of the radiations increases, but the short waves increase in greater proportion than the long waves, and when the temperature is sufficiently raised the body begins to give out light. So long as the source is just hot enough to be luminous the light is nearly all red; as the temperature rises there are added more and more of the other colours, of shorter wave-length, towards the violet end of the spectrum. In the flame of a candle or of a gas-jet particles of solid carbon form the luminous source: their temperature, which is determined by the condition that they radiate energy as fast as work is done upon them by the process of combustion, is so low as to make the red and yellow constituents of the light preponderate. A higher temperature has the double advantage of giving whiter light, and of giving it accompanied by a smaller proportion of non-luminous infra-red rays, and therefore with less expenditure of energy in proportion to the amount of light produced.

One way of heating a body to a high temperature is by forcing a strong current of electricity to pass through it. The energy expended depends on the strength of the current and on the electromotive force which is required to make it pass, and this energy takes the form of heat. By selecting a conductor which offers considerable resistance to the passage of the current, it is practicable to produce so much heat in a small space that the temperature reached is only limited by the melting or volatilising of the heated body. In all actual electric lamps carbon is used, first and mainly because of its great infusibility, and second, because of its emissive power. Carbon is in fact the luminous body in nearly all sources of artificial light.

Arc Lighting.—The earliest means of applying the electrical current to the production of light was discovered in 1810 by Sir Humphry Davy, who found that when the points of two carbon-rods, to which the terminals of a powerful battery were connected, were brought into contact and then drawn a little way apart, the current continued to pass across the gap, forming what is known as the electric arc. The electric arc (fig. 1) is brilliantly luminous. The points of the carbon-rods become highly incandescent, and in addition the space between them is filled by a sort of flame, or cloud of particles of white-hot carbon. As the temperature of the arc is much higher than that of any ordinary flame, its efficiency as a source of light is exceptionally great, and it is specially rich in highly refrangible (or short wave-length) rays. The carbon-points being exposed to the air gradually burn away, and in addition to this there is a transfer of carbon particles across the arc from the positive to the negative rod, which has the effect of making the positive rod waste about twice as fast as the negative rod. The end of the negative rod becomes somewhat pointed, and a crater-like hollow forms on the end of the positive rod. As the points waste away the arc lengthens, and would presently break and the current would cease to pass if the rods were not pushed nearer together. Should the arc break it can be re-established by bringing the rods again into contact, and again drawing them a little way apart. Arc lamps are devices for holding the carbon-rods, so that they are first brought into contact and drawn apart, to establish or 'strike' the arc, and are then 'fed' together, continuously or at short intervals, to prevent the distance between the points from growing too long.

Fig. 1.

It was not until the development of the Dynamo-electric Machine (q.v.) as a means of producing the electric current economically on a large scale, that the electric light came to be of commercial importance. Before that, however, various contrivances had been devised for automatically striking the arc and regulating its length. As early as 1847 a lamp was patented by W. E. Staite, in which the carbon-rods were set vertically one over the other, the upper one being held fixed, while the lower rod was fed upwards by the intermittent action of clockwork, which came into gear whenever the current across the arc became reduced below a certain limit of strength through the lengthening of the distance between the carbon-points. Similar devices were proposed by Foucault and others; but the first really successful arc lamp was Serrin's, patented in 1857, which has not only itself survived, but has had its main features reproduced in many later forms. In 1858 a lamp designed by Duboscq was used to show the electric light, for the first time at sea, from the South Foreland Lighthouse, where the current to feed the lamp was generated by the large magneto-electric machine of Holmes; and this experiment was followed a few years later by the permanent establishment of electric lighting there and at Dungeness and other lighthouses. The invention of the self-exciting dynamo in 1867 paved the way for the development of electric lighting on a commercial scale. The Jablochkoff candle (1876), in which the arc was formed between the ends of a pair of parallel carbon-rods separated by a layer of insulating material which was slowly consumed as the carbon burned down, did good service in accustoming the public to the new illu-

minant, and the invention of simple and effective arc lamps by Brush and others, brought about its wide adoption in 1878–79 for lighting large rooms, streets, and spaces out of doors. In the following year the future of domestic electric lighting was secured by the introduction of the incandescent lamp.

In modern arc lamps, of which there are so many forms that it would be impossible even to classify them in the space at our disposal, the arc is generally struck by the action of the current in an electro-magnet or solenoid, which is connected in series with the carbons, so that when the current passes the armature of this magnet is attracted, and its motion is caused to separate the carbons. This sets the lamp in action, and then, as the carbon-points are consumed, the resistance to the passage of the current gradually increases. If the source of electricity is such as to maintain a constant, or nearly constant, difference of potential between the terminals of the lamp, the effect will be that the current will gradually become reduced. On the other hand, if the source is such as to maintain a constant or nearly constant current through the lamp, the effect will be that the difference of potential will increase. Either of these effects may be made use of to regulate the length of the arc. Generally the carbons (which are round rods formed by making powdered coke into a paste and baking it) stand in a vertical line, and the upper one is fixed in a heavy holder, which tends to slide down until the points touch. But its motion downwards is checked by a clutch or brake of some kind, which allows it to descend little by little, and only when the length of the arc has become unduly great. Fig. 2 is a skeleton diagram showing the mechanism of Serrin's arc lamp, which was one of the earliest successful forms. Here the upper carbon-holder, A, has rack teeth on it, which gear into the first of a train of toothed wheels, BC, so that the train must revolve as the carbon descends. The last wheel in the train, C (which moves much for a very small movement of the holder), is a star-wheel, whose projecting limbs hit or miss a detent, E, the position of which is controlled by an electro-magnet, G, pulling against a spring, F. When the arc is struck the star-wheel is locked, so that the upper carbon-holder is fixed.

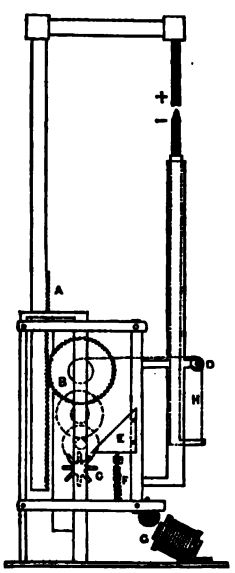


Fig. 2.

As the arc lengthens, the current in the controlling electro-magnet becomes weakened, and this goes on until the detent rises far enough to release the star-wheel. The holder, A, then descends until the current is again strong enough to make the electro-magnet draw the detent down and lock the wheel. Here the control depends on variations in the strength of the current passing across the arc, and the controlling electro-magnet is in series with the carbons (being in fact the magnet which also strikes the arc); if, however, the lamp were to be used with a constant current, the control could easily be effected by variations in the difference of potential between the carbons. The controlling magnet must then form a shunt to the arc itself, and be set so that when the shunt current in it is weak the star-wheel is locked, and when the shunt current exceeds a certain limit the detent is raised and the star-wheel is released. The lamp shown in fig. 2 has this peculiarity, that the descent of the upper carbon-holder makes the lower holder rise, through half the distance, by means of the pulley D, and chain H. The effect is to keep the arc burning always at one and the same place, the lower carbon being the negative one, which consumes half as fast as the other. Lamps with this feature are called 'focussing' lamps, and are useful in lanterns where the luminous centre must be maintained in the focus of a lens. For ordinary uses the focussing arrangement is not necessary, and is omitted.

In many modern lamps the controlling electro-magnet is double, consisting of a series and a shunt portion, combined in such a way that the holder is released, and the carbons are caused to approach by either a weakening of the current or an increase of the potential, or both. Such lamps may be used either with constant current or with constant potential.

In place of the train of wheels in Serrin's lamp, a single brake-wheel has been used, turned by a rack on the upper carbon-holder, and stopped or checked by a brake-lever which is pressed against or withdrawn from its circumference by the controlling electro-magnet. Some very successful modern lamps, such as those of Brush and Thomson-Houston, use a still simpler device. The upper carbon-holder slides through a loose collar or ring, which can be tilted by the controlling magnet, so that it clutches the holder. When the current falls or the potential rises this clutch collar is untilted, so that the holder slips through it and shortens the arc. A dash pot is employed to prevent the fall of the holder from being too rapid.

When a number of arc lamps are to be used together they are generally connected in series; a constant current is sent through the group, and the control of the carbons is effected by shunt electro-magnets, taking advantage of variations in the difference of potential between the carbons. To prevent the whole group from being extinguished should the feeding mechanism in any one lamp fail to act, a device is added by which any lamp that fails is short-circuited—i.e. the current passes through it by another path. They may, however, be grouped in parallel, if the control is arranged to depend on variations in the strength of the current. Parallel grouping is usual when the lamps are to be served with alternating electric currents.

The rate at which energy is expended in the electric arc is measured by the product of the current and the electromotive force required to maintain it passing across the gap. If the current be measured in ampères and the electromotive force in volts, their product gives the rate of expenditure of energy in watts, and may be reduced to horse-power by dividing by 746. It is found that the electromotive force between the points is nearly constant whether much or little current is passing, which shows that the opposition to the passage of the electric current across the gap is different in kind from the resistance of an ordinary conductor. However short the arc be it requires an electromotive force of from 30 to 40 volts to maintain it; when the arc is lengthened the electromotive force necessary to keep up the same current is increased, but not in proportion to the length. It is not found practicable to maintain the arc with less than a certain strength of current. Hence the power consumed in an arc

lamp is necessarily considerable, and the lamp can be employed to advantage only where a large amount of light will be serviceable. The arc lamps which are most extensively used take from three-quarters to one horse-power, and have an illuminating effect equivalent to something like 1000 candles. It is impossible to speak with any precision of the candle power of an arc lamp, because its light differs enormously in colour from that of a standard candle. A comparison of the blue rays of the arc with the blue rays of the candle will give a figure nearly three times more favourable to the arc than if the comparison be made between the red rays.

Incandescent Lighting.—In early attempts to produce light by the incandescence of a heated conductor, wire of platinum and of other refractory metals was employed; but these become melted or disintegrated at too low a temperature to let them serve as efficient sources of light. Carbon rods also had been used, but the matter was not brought to a practical issue till 1879, when Mr Edison (and, almost at the same time, Mr Swan) made lamps in which the incandescent conductor was a fine thread or filament of carbon, inclosed in a glass globe, from which the air was exhausted as completely as possible. The filament was originally formed by carbonising a thread of paper, cotton, bamboo, or other vegetable fibre: it is now more usually made by forcing a semi-fluid preparation of cellulose through a die, bending and drying the thread, and heating it to a very high temperature, surrounded with plumbago, in a crucible. The ends of the filament are attached to short conducting wires of platinum, which are sealed into the globe. By making the filament longer or shorter, thicker or thinner, the lamp is adapted to be used with more or less electromotive force, and to give more or less light. The lamp has a limited life, for the filament undergoes a slow process of disintegration, which finally breaks it. As in the case of an arc lamp the power consumed is measured by the product of the current and the electromotive force or difference of potential between the terminal. In ordinary use incandescent lamps consume from three to four watts per candle of light, and last for some 1500 hours. One may force them to a higher efficiency by increasing the electromotive force, so that the temperature of the filament is further raised, and the light is much increased with the expenditure of but little additional power. But this shortens the life of the lamp, and tends also to make a deposit of carbon particles form on the inside of the glass. The temperature of the filament is in no case so high as that of the electric arc; hence incandescent lighting is less efficient than arc lighting as regards the proportion of light to power, and the colour of the light is more yellow. But in point of steadiness and pleasantness, facility for distributing light, and convenience in placing and management, incandescent lamps have many claims to be preferred for indoor use.

An interesting part of the manufacture of lamps is the process of 'flashing' invented by Messrs Sawyer and Mann, which means the electric heating of the filament for a short time in a hydrocarbon atmosphere. The high temperature of the filament causes the dissociation of the gas in contact with it, and the carbon of the dissociated gas is deposited on the filament. This forms a convenient means of adjusting its thickness and resistance; it also tends to make the filament more uniform, for the process of dissociation and deposit goes on most actively at those places which are thinnest to begin with, and therefore hottest. Incandescent lamps work well with either continuous or alternating currents. They are now made of all sizes, from the miniature lamps of one candle power or less which are employed in surgery, up to two or three thousand candle power. When a number of them are used together they are almost always grouped in parallel. In the electric lighting of a house, for instance, positive and negative main conductors, consisting of insulated copper wire, are led from the dynamo, and to these the positive and negative branches are respectively connected, whose ramifications extend to every room. Wherever a lamp is to be placed a positive and a negative leading wire must come, and each lamp forms as it were a bridge between the positive and the negative side of the system. The difference of potential is nearly the same for all; it is a little less in the case of the more distant lamps, because a certain fall in the difference of potential is incurred through the resistance which the leading wires themselves offer to the passage of the current. This loss has to be kept within reasonable limits by making the sectional area of the leading wires great enough, and no serious difficulty is experienced in doing this when the lamps all lie within a few hundred feet of the source. But the difficulty becomes serious when distribution is attempted on a large scale. Not only is the loss of energy in the conductors then a large part of the whole energy supplied, but it may give rise to wider variations in the potential than can be tolerated. If the number of lamps in use in any district were nearly constant, so that a nearly constant current would flow through the mains leading to that district, it would be easy to allow for the fall of potential in those mains. But this fall is itself a variable quantity, depending on amount of the local demand; and to keep the potential sufficiently constant requires mains of large size, the cost of which becomes prohibitory when the area of distribution is much extended.

In such cases it is necessary to resort to other methods of distribution than by a simple system of parallel mains and branches. A sufficient number of sub-centres may be taken over the area to be lighted, and each of these made the starting-point of a system of parallel conductors, the sub-centres themselves being fed from the central source, through independent mains, with currents which are regulated to produce the necessary potential at each sub-centre. Even then, however, if the sub-centres are widely distant from the source the loss of energy in the mains will be serious. In distribution over a large area there is an obvious advantage in very high potential, for the same amount of electrical energy is then conveyed by a smaller volume of current, and consequently with less loss in the conductors. This advantage may be secured if we convey the electric energy to sub-centres in the form of small currents at a high potential, and convert it there into low-potential currents suitable for domestic use. Two plans of doing this have been put in practice—one, by means of storage batteries, is suitable for continuous currents; the other, by means of transformers, is suitable for alternating currents.

Storage Batteries are cells consisting of large sheets or grids of lead, superficially coated with oxide, which are immersed in dilute sulphuric acid, and are polarised by the passage of the current. Peroxide of lead is formed on the positive plates, and spongy metallic lead on the negative. After being charged by the passage of the current the cells will act for a time as electric generators, giving a current in the opposite direction until the plates again become inactive, when they may be again charged. The electric energy given out when the cells are discharging is somewhat less, but need not, if the cells are slowly charged, be very much less than the energy expended in charging

them. Each cell has an electromotive force of about two volts, and its internal resistance is made low by grouping a number of pairs of plates in parallel within a single cell (fig. 3). When such cells are used to convert an electrical supply from high to low potential, they are grouped in series while they are being charged, and the groups are then broken up into sections which may be discharged separately or connected in parallel for discharge. Apart from this use of storage batteries in electric lighting, they form a most valuable, but unfortunately very costly adjunct in domestic and other installations for steadying the electromotive force of the supply when used as a shunt across the terminals of the dynamo, and for storing electricity for use during intervals when the dynamo is not running. Small storage batteries have been successfully employed as a means of providing portable electric lamps for use in houses, carriages, and especially in mines. The miner's lamp is a small storage battery weighing a few pounds, and is inclosed in a watertight case no bigger than an ordinary lantern, in the front of which is fitted a small incandescent lamp protected by a stout glass cover. Primary batteries have also been used, in place of storage batteries, to supply electricity to portable lamps.

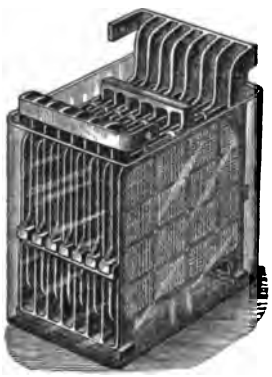


Fig. 3.

Transformers are induction coils, consisting of a core of soft iron on which two coils of insulated copper-wire are wound. When alternating currents are made to pass through one of these, called the primary coil, they produce corresponding periodic alternations of magnetism in the iron, and induce alternating currents of corresponding period in the other or secondary coil. The effect of the iron is to increase the coefficient of mutual induction between the two coils. When the number of windings in the secondary coil is small compared with the number of windings in the primary coil, the electromotive force induced in it is correspondingly smaller than the electromotive force impressed upon the primary; and this is taken advantage of in practice in the conversion of a high-potential into a low-potential supply for electric lighting. In order that the iron core should have as much magnetic susceptibility as possible, it is made in the shape of a ring or some other closed (poleless) magnetic circuit, and to prevent waste of energy by the induction of currents in the substance of the iron, the core is laminated by being built up of thin plates or of wire. Even then, however, there is some waste of energy in the core on account of what is called magnetic hysteresis in the periodic changes of magnetism it undergoes, and some further waste occurs through the heating of both the primary and secondary coils in consequence of the resistance they offer to the conduction of the currents. Notwithstanding these sources of loss the efficiency of a transformer working under favourable conditions is very high, as much as 90 and even 95 per cent. of the energy expended in the primary coil being given off in the converted currents from the secondary. In practice the direction of the current is reversed about 150 or 200 times per second.

Distribution of electricity for the purpose of lighting by means of transformers, high potential being used in the conveyance of the currents from the distant source, with conversion to low potential before use, has been effected on a fairly large scale in many places, especially in America, where the system has later taken practical shape in the hands of Mr Westinghouse. In London the same method has been successfully employed for some years over a pretty wide area by the Grosvenor Gallery Company, and in 1889 elaborate arrangements were completed for its being applied on a formerly unprecedented scale by the Electric Supply Corporation, from whose central station at Deptford alternating currents are conveyed to all parts of London at a potential of 10,000 volts, to be reduced to 100 volts or so by two successive conversions in transformers before they reach the lamps of the consumers.

Among the minor adjuncts in electric lighting, an important part in guarding against possible risk of fire is played by the 'cut-outs,' whose function is to interrupt the current in any main or branch conductor should it ever exceed a safe strength—as might happen in the event of an accidental cross-connection or short-circuit being formed between the wires. The usual form of cut-out is a safety fuse, consisting of a short piece of foil or wire made of lead or of some fusible alloy which any dangerous excess of current will melt, and so interrupt the current, in that portion of the system which is guarded by the cut-out, before any damage is done. Cut-outs are generally put at the junction of branch with main wires, as well as in the mains themselves. Where the amount of current to be passed is large, an electro-magnetic cut-out is often preferred to a fuse.

Numerous forms of *meter* have been devised for measuring and recording the quantity of electricity supplied to consumers, some suited for continuous currents only, and others for alternating as well as continuous currents. Space does not admit of any description of the ingenious meters invented by Ferranti, Aron, and others. In Edison's meter for continuous currents, which has done good service in central station lighting on the parallel system in New York, the amount of electricity which passes is measured by the deposit of metal in an electrolytic cell. In Forbes's meter, which acts equally well with continuous or alternating currents, the current heats a small coil of wire so that a stream of warm air rises from it; this is made to turn a little windmill, whose number of revolutions is registered, and is found to be a good index of the amount of current which has passed.

References.—The literature of electric lighting consists mainly of papers published in the scientific and technical journals, for the most part since 1878. In the article DYNAMO-ELECTRIC MACHINES (q.v.) reference has already been made to Professor S. P. Thompson's treatise on *Dynamo-electric Machinery*. A lecture by the same author (*Journal of the Society of Arts*, March 1889) gives a comprehensive account of various types of arc lamps. Much descriptive and historical matter regarding dynamos and arc lamps will be found in *Electric Illumination*, by J. Dredge. Reference should also be made to papers by J. Hopkinson, 'On some Points in Electric Lighting,' *Inst. Civ. Eng. Lectures* (1883); 'On Transformers,' *Proc. Royal Society* (1887); by G. Kapp, 'On Transformers,' *Proc. Soc. of Telegraph. Engineers* (1888), and 'On Alternate Current Machinery,' *Min. Proc. Inst. Civ. Engineers* (1889); by G. Forbes, 'On the Distribution of Electricity,' and 'On Electric Meters,' *Journal of the Society of Arts* (1885, 1886, and 1889).

Electric Railway. The proposal that electricity should furnish motive power on railways is nearly as old as the railway-system itself. In 1837, when it was still doubted whether steam locomotives would come into general use, an

experiment in electric traction was made by Robert Davidson, who propelled a car on the Edinburgh and Glasgow Railway by an electro-magnetic engine, with a galvanic battery to supply the current. But the cost of producing electricity on a large scale by means of a battery is so great as to make such a method of locomotion impracticable, however perfectly the electric energy may afterwards be converted into mechanical work. And the electro-magnetic motor of those days was an extremely inefficient machine, which did not succeed in utilising more than a small fraction of the electric power supplied to it. The matter consequently fell into complete abeyance, and was not revived until engineers had at their command a much cheaper mode of producing electric energy, and a much more efficient mode of turning it to mechanical account. This came about with the introduction of the Dynamo-electric Machine (q.v.), which gave a cheap means of converting work done by a steam-engine or any other prime mover into the electrical form, and with the recognition that the operation of the dynamo was reversible—that it would serve as a motor, to do mechanical work by the agency of the electric current. Hence it became practicable to work a railway electrically, by having at one station a dynamo to produce the current, driven by a steam-engine, turbine, or any other source of power, and by using this current to drive another dynamo, as a motor, upon the train, electrical connection between the train and the source of supply being maintained by means of conductors with which the train should be kept in contact throughout its course.

This was first demonstrated on a practical scale at the Berlin Exhibition of 1879, by Werner Siemens, who made and worked with complete success a line 219 yards long, on which three carriages, carrying twenty people, ran at a speed of about 7 miles an hour, by means of the current from a fixed dynamo, which was driven by a steam-engine. The current reached the car through a special conducting rail placed between the wheel-rails, and insulated from the ground by blocks of wood. The motor on the car took the current from this rail by the rubbing contact of copper brushes, and the circuit was completed through the car wheels and the ordinary rails. In 1881 a permanent electric tramway, 1½ mile long, was established at Lichterfelde (Berlin), where a still simpler plan of conducting the current was employed: the two ordinary rails, insulated from the ground and from one another by wooden sleepers, formed the two conductors. Soon after that a number of electric tramways or railways were constructed in various parts of Europe, and a still greater number in the United States, where, at the end of 1888, there were nearly 150 miles at work; and on January 1, 1895, of the 12,527 miles of tramway track, 9008 miles were electric.

The plan of using the rails themselves as the only conductors is obviously impracticable, except on very short lines and in special circumstances, on account of the difficulty of maintaining good insulation. In some of the most important existing lines a special stiff conducting rail is used, raised from the ground on insulating supports. The Portrush and Bushmills Railway in Ireland (opened in 1883) is an instance in point. There the line is 6 miles long, the dynamos that supply the current are placed at a station about a mile from it, and are driven by water-power. The same plan is followed at the Bessbrook and Newry Railway (1885), where passenger-cars, on which the motors are placed, serve as locomotives to drag a train of goods-wagons. The trains run at a speed of about 10 miles an hour, and the expenses of working are from 3d. to 4d. per train-mile. A stiff conductor, set alongside of the rails, is also used for electric traction on some portions of the New York elevated railroads. In a few cases the conducting rail is put in a trench underground—an arrangement which allows this system to be applied to city tram-lines. But in by far the greater number of electrical railways or tramways, especially in America, the conductor is a wire carried on posts overhead, either immediately above the cars or alongside of them. In many instances the current is taken from the overhead conductor by means of a little carriage running on it, and drawn along by the car. An extremely simple overhead system has been suggested by Dr Hopkinson, in which the conductor is a wire, or strand of wires, supported by means of posts, so that it hangs slack over the line, at such a height that a metal rod, fixed on the top of the car, rubs against it. There are two rods—one near the front of the car and the other near the back—and these keep up continuity of contact as the car passes under the supports, from one to another of the slack spans in which the conductor hangs.

When there are several motor cars running on an electric railway at the same time, they are commonly arranged in electrical 'parallel'—that is to say, the motor of every train forms a cross connection between a single pair of positive and negative conducting mains. If, however, the line be divided into a sufficient number of short sections, it is possible to run the trains in electrical 'series,' each train spanning a gap in an otherwise continuous conductor, and the same current passing through all in succession. This plan, which has the advantage of requiring a smaller volume of current (but at a correspondingly greater potential), was patented by Fleeming Jenkin in 1882. It is used on an electric tramway which was opened at Northfleet in 1889, where the insulated sections of the conductor are carried in a trough underground.

All the arrangements for electric traction that have been referred to above are *conductor* systems. Energy is continuously passing to the car through the conductor which maintains connection between the distant dynamo and the motor on the car, and any break of continuity in the conductor, or any failure on the part of the car to make contact with it, deprives the car instantly of locomotive power. The introduction of storage batteries (see ELECTRIC LIGHT) has made a very important alternative method of electric traction practicable—viz. the *storage* system, in which each car or train is self-contained as regards power. In this system there are no conductors along the line, but each locomotive is furnished with a set of storage cells, which are charged from time to time by means of a station dynamo, and carry enough energy to last during the trip. The storage system has been put in practice at Antwerp, Hamburg, Brussels, New York, London, and elsewhere, in some cases by placing the cells under the seats of the car, in others by using a separate locomotive car to carry them and the motor. For city tram-lines its advantages are obvious: it makes each car independent, it causes no obstruction of the street by troughs or posts to carry conductors, and it allows existing lines to be utilised for electric traction without change. Its chief drawbacks are the dead-weight of the batteries and the cost of renewing these when they are worn out or injured by the rather rough treatment they receive on the road. In conductor and storage systems alike there is a considerable loss of energy in the successive transformations, amounting generally to 40 or 50 per cent. On short lines this waste should be less when conductors are used; but on long lines the

loss which is caused by the resistance of the conductors may be greater than the loss which the charging and discharging of a battery entails.

An important feature in conductor methods of electric traction is the possibility they afford of applying an absolute automatic block system, so as to make it impossible for trains to overtake one another, without any control being exercised from the trains themselves. When the line is divided into sections, it is possible to arrange matters so that the presence of a train on one section has the effect of cutting off the supply of electric energy to the section behind, and thus a train entering the latter finds itself unable to proceed until the train in front has advanced to the section beyond. A number of plans by which this idea may be carried out have been invented by Fleeming Jenkin and by Ayrton and Perry. Fleeming Jenkin, too, it was who proposed the word *Telpherage*, as a distinctive name for electric traction developed on these lines. In one of his systems of telpherage, suitable for transporting minerals or goods in small parcels and at a low speed, the line consists of a series of short spans of steel cable, supported overhead upon stout posts, at a distance of some 70 feet apart. The train is a number of light cars, which hang from the line; they are free to swing, and are spaced and connected together by light coupling rods. A telpher line of this construction, about a mile long, was erected in 1885 at Glynde, in Sussex. The trains carry cement clay in small skeps or buckets, and travel at a walking pace without driver or guard.

Electric Telegraph. See TELEGRAPH.

Electric Welding. See WELDING.

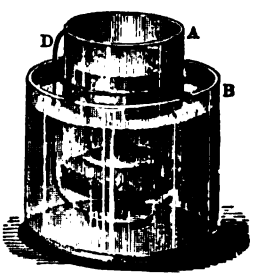
Electro-biology is a term used both of Animal Electricity, discussed at ELECTRIC FISHES, and of Mesmerism, or a phase of Animal Magnetism (q.v.).

Electrolysis. See ELECTRICITY.

Electro-magnetism. See MAGNETISM.

Electro-metallurgy is the art of depositing, electro-chemically, a coating of metal on a surface prepared to receive it. It may be divided into two great divisions—electrotype and electroplating, gilding, &c., the former including all cases where the coating of metal has to be removed from the surface on which it is deposited, and the latter all cases where the coating remains permanently fixed. Gold, platinum, silver, copper, zinc, tin, lead, cobalt, nickel, can be deposited electrolytically.

Electrotype is the art of copying printing type, woodcuts, seals, medals, engraved plates, ornaments, &c. by means of the galvanic current in metal, more especially copper. Suppose we wish to copy a seal in copper; an impression of it is first taken in gutta-percha, sealing-wax, fusible metal, or other substance which takes, when heated, a sharp impression. While the impression —say, in gutta-percha—is still soft, we insert a wire into the side of it. As gutta-percha is not a conductor of electricity, it is necessary to make the side on which the impression is taken conducting; this is done by brushing it over with plumbago by a camel-hair brush. The wire is next attached to the zinc pole of a weakly charged Daniell's cell, and a copper plate is attached by a wire to the copper pole of the cell; or, as is now usual, the current required is supplied by Dynamo-electric Machines (q.v.). When the impression and the copper plate are dipped into a strong solution of the sulphate of copper, they act as the – and + electrodes. The copper of the solution begins to deposit itself on the impression, first at the black-leaded surface in the vicinity of the connecting wire, then it gradually creeps over the whole conducting surface. After a day or two on the old method—after a few hours when the magneto-electric is used—the impression is taken out; and the copper deposited on it, which has now formed a tolerably strong plate, can be easily removed by inserting the point of a knife between the impression and the edge of the plate. On the side of this plate, next the matrix, we have a perfect copy of the original seal. If a medal or coin is to be taken, we may proceed in the same way, or we may take the medal itself, and lay the copper on it. In the latter case, the first cast, so to speak, that we take of each face is negative, showing depressions where the medal shows relief; but this is taken as the matrix for a second copy, which exactly resembles the original. The adhesion between the two is slight, and they can be easily separated. The cell of a battery is not needed to excite the current. A galvanic pair can be made out of the object to be coated and a piece of zinc. The figure shows how this may be done. B is a glass vessel containing sulphate of copper; A is another, supported on B by a wire frame, and containing a weak solution of sulphuric acid. The glass vessel A is without a bottom, but is closed below by a bladder. A piece of zinc, Z, is put in the sulphuric acid, and a wire, D, coated with insulating varnish, establishes a connection between it and the impression, C, which is laid below the bladder. Electrotype is of the greatest importance in the arts; by means of it duplicates in copper of pages of type are obtained, as is done with this Encyclopædia; engraved copper plates may be multiplied indefinitely, so that proof-impressions need be no rarity; woodcuts can be converted into copper; bronzes can be copied; and similar like applications are made of it too numerous to mention. By connecting a copper plate ready for corrosion with the + pole, and making it a + electrode, it can be etched with more certainty than with the simple acid, and without the acid fumes.



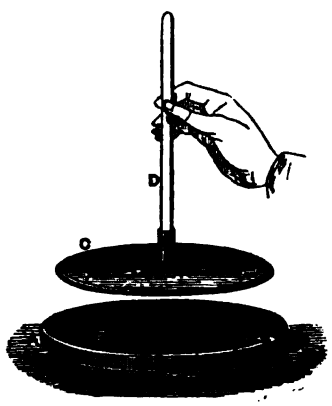
Electroplating.—This is the art of coating the baser metals with silver by the galvanic current. It is one theoretically of great simplicity, but requires in the successful application of it very considerable experience and skill. Articles that are electroplated are generally made of brass, bronze, copper, or nickel silver. The best electroplated goods are of nickel silver. When Britannia metal, iron, zinc, or lead are electroplated, they must be first electro-coppered, as silver does not adhere to the bare surface of these metals. Great care is taken in cleaning the articles previous to electroplating, for any surface impurity would spoil the success of the operation. They are first boiled in caustic potash to remove any adhering grease; they are then immersed in dilute nitric acid to dissolve any rust or oxide that may be formed on the surface; and they are lastly scoured with fine sand. Before being put into the silvering bath, they are washed with nitrate of mercury, which leaves a thin film of mercury on them, and this acts as a cement between the article and the silver. The bath where the electroplating takes place is a large trough of earthenware or other non-conducting substance. It contains a weak solution of cyanide of silver in cyanide of potassium (water, 100 parts; cyanide of potassium, 10 parts; cyanide of silver, 1 part). A plate of silver forms the + electrode; and the articles to be plated, hung by pieces of wire to a metal rod lying across the trough, constitute the – electrode.

When the plate is connected with the copper or + pole of a one or more celled galvanic battery, according to the strength required, or subjected to the magneto-electric current, and the rod is joined with the zinc or – pole, chemical decomposition immediately ensues in the bath, the silver of the cyanide begins to deposit itself on the suspended objects, and the cyanogen, liberated at the plate, dissolves it, re-forming the cyanide of silver. According, then, as the solution is weakened by the loss of the metal going to form the electro-coating, it is strengthened by the cyanide of silver formed at the plate. The thickness of the plate depends on the time of its immersion. The electric current thus acts as the carrier of the metal of the plate to the objects immersed. In this way, silver becomes perfectly plastic in our hands. We can by this means, without mechanical exertion or the craft of the workman, convert a piece of silver of any shape, however irregular, into a uniform plate, which covers, but in no way defaces, objects of the most complicated and delicate forms. When the plated objects are taken from the bath, they appear dull and white; the dullness is first removed by a small circular brush of brass wire driven by a lathe, and the final polish is given by burnishing. The process of electro-gilding is almost identical with that of electroplating. Success in either is attained by proper attention to the strength of the battery, the strength of the solution, the temperature, and the size of the + electrode. See George Gore's *Electro-metallurgy* (1877) for a sketch of the art —from Wollaston's application of the principle of the voltaic pile to the deposition of one metal upon another (1801), on to subsequent application of that principle by Bessemer (1834), Jacobi (1838), Spencer (1839), and the Elkingtons (from 1838 onwards).

Electrom'eter. See ELECTRICITY.

Electromotive Machines. See DYNAMO-ELECTRIC MACHINES.

Electroph'orus, an instrument for obtaining electricity by means of induction. It generally consists of a tin mould, A, which in practice is kept in connection with the ground, filled with shell-lac or resin, B, and a movable metal cover, C, with a glass handle, D, as shown in the fig. The shell-lac is poured in when melted, and is mixed with some other substance to make it less brittle. When the apparatus is used, the surface of the resin or the shell-lac is smartly beaten with cats' fur. This electrifies the resin negatively. When the cover is brought near the lower part of the apparatus, it is charged positively on its under surface, negatively on its upper. If then it is touched, the negative escapes, and the cover is charged with + electricity; and if removed and applied to any conductor, it will give a positive charge to it. The process may be repeated for a great number of times with only a small diminution of B's charge, except by connection or dampness. It is usual to have the earth connection made by a metallic pin passing through B to A, or by a piece of tinfoil, *e*, pasted extending slightly over B, and connected with A.



Electrophorus.

Electroplating, Electrotype. See ELECTRO-METALLURGY.

Electrum (amber; Gr. *élektron*) is a term also applied to native gold as it is associated with silver.

Electuary, a form of medicinal preparation in which the remedy is enveloped or suspended in honey or syrup, so as to make a thick, semi-fluid mixture.

Elegit. In England, a judgment creditor may elect to have a *Fieri Facias* (q.v.) to the sheriff to levy the debt, or that the sheriff should deliver to him the land (and formerly the goods) of the debtor. If he chooses to seize the land, he does so under a writ of elegit, and so long as he remains in possession he is tenant by elegit. The writ was formerly used chiefly for seizing chattels; but in most cases it was a less convenient remedy than a *Fi. fa.*

Elegy (Gr. *elegeia*), according to its derivation, signifies a song of lamentation, but the term was employed at an early period by the Greeks to designate any poem written in distichs. The alternation in elegiac verse of hexameter with pentameter helps to give to this species of poetry its character, which consists in the connection of subjective feelings and emotions with external incidents or objects. Many poems have been written in this form which are not elegies proper. Of the numerous elegies of the Greeks, few have come down to us. Among the Romans, Catullus was the first good elegiac writer; after him came Propertius, Tibullus, and Ovid. Tibullus, in particular, brought the erotic elegy to its highest perfection. In modern times, the term elegy is applied in England to any serious piece where a tone of melancholy pervades the sentiments, as in Gray's famous *Elegy, written in a Country Churchyard.* It includes also such splendid tributes to the dead as the *Lycidas* of Milton, the *Adonais* of Shelley, the *In Memoriam* of Tennyson, and the *Thyrsis* of Matthew Arnold. See *The Book of British Elegies,* by W. F. M. Phillipps (1879).

Elemental Spirits, beings who, according to the popular belief of the middle ages, presided over the four 'elements,' living in and ruling them. The elemental spirits of fire were called Salamanders; those of water, Undines; those of the air, Sylphs; and those of the earth, Gnomes. Paracelsus wrote a treatise upon them, and they play a part in Pope's masterpiece of mock-heroic poetry, *The Rape of the Lock.*

Elements, in Astronomy, are those numerical quantities, and those principles deduced from astronomical observations and calculations, which are employed in the construction of tables exhibiting the planetary motions. They include the greatest, least, and mean distances of the planets from the sun, the eccentricities of their orbits, their mean motions, daily and annual, with the motions of their aphelia, and the inclinations of their orbits to the ecliptic; their masses and densities, &c. See PLANETS, PLANETOIDS, &c.

Elements, CHEMICAL, the simplest known constituents of all compound substances. Chemists regard as elementary substances or elements only those substances which have not been proved to be compound. It is not inconceivable that some of the substances at present designated elements (for list of known elements, see ATOMIC THEORY) may hereafter be proved to consist of more than one simple kind of matter, but in the meantime they are correctly called elements, as that term is

applied above. The elements are somewhat arbitrarily divided into non-metals and metals, the latter forming by far the larger class. There is no sharp line of demarcation between the two classes, several elements occupying positions on the border line. The elements commonly classed as non-metals are thirteen in number, and are as follows: Hydrogen, chlorine, bromine, iodine, fluorine, oxygen, sulphur, selenium, boron, nitrogen, phosphorus, carbon, silicon. Hydrogen, however, in its chemical relations behaves like a metal. Speculation at present is on the whole rather favourable to the view that all the elements are composed of one fundamental elementary substance (see also CHEMISTRY, and METALS). The time-honoured 'Four Elements' of the Greeks—air, fire, water, earth—are discussed at EMPEDOCLES. The 'Shoo-king,' a Chinese work older than Solomon, has five elements—water, fire, wood, metal, earth. The Indian Institutes of Manu have also five—subtle ether, air, fire, water, and earth.

Elemi, a fragrant resinous substance, is obtained from the pitch-tree, Arbol de la Brea, a native of Manilla. Formerly, many varieties of elemi, such as Mexican, Brazilian, and Mauritius elemi, were in the market, but these have now been supplanted in Great Britain by the original substance, that obtained from Manilla. Manilla elemi, when pure and fresh, is colourless, and resembles in consistence old honey, but it is usually found mixed with impurities, hard, and of a yellow tint. It possesses an aromatic odour resembling that of a mixture of lemon, fennel, and turpentine, and when distilled, yields as much as 10 per cent. of essential oil. When treated with cold alcohol, it partly dissolves, leaving about 20 per cent. of a white resinous substance called Amyrine. Elemi is never used internally, and only seldom as a stimulating ointment to old wounds.

Elephant, a genus of mammals in the order Proboscidea, now represented only by two species. These two survivors of a once numerous and widely distributed order occupy a zoological position of peculiar isolation, but they are connected by the

Fig. 1.—African Elephant ('Jumbo').

extinct Mastodon and Dinotherium to Coryphodon and the Dinocerata, and further back still to a probable origin among primitive hoofed or ungulate animals. The modern elephants—African and Indian—are quite distinct from one another, and are sometimes referred to separate genera (fig. 2). Like other giant animals, they are becoming gradually restricted in distribution and numbers, a fact of course hastened by the demand for the ivory of their tusks.

Principal Characters.—In some of their structural features, especially in nose, skull, and teeth, the elephants are as highly differentiated as they are in general intelligence; while on the other hand the anatomy of their limbs and anterior venous system is simple and primitive. The huge size, thick skin, and scanty hairs; the enormous head with high rounded skull containing large air-spaces and with wide expanse for the insertion of muscles; the long, muscular nose or proboscis with the nostrils at the tip; the short stiff neck which makes the trunk such an advantage; the huge simple limbs and massive feet, are conspicuous features. The brain is not much larger than man's, but as one would expect from the elephant's cleverness, is richly convoluted; the hind portion or cerebellum is, however, uncovered like a rabbit's. The teeth consist (1) of a pair of enormous, ever-growing upper incisors or tusks, composed mainly of the precious dentine or ivory; and (2) of the large plaited molars, the final result of a long series of historical differentiations, six on each side above and below, but never represented by more than one in full use at a time. The upper parts of the stout limbs are very long, so that the knees especially are situated far down; the five toes are inclosed in a common hoof which is very massive, the circumference of the fore-foot measuring about half the height at the shoulder. More technical characters are the presence of two superior venæ cavæ, the simple stomach and large cæcum, the abdominal situation of the male organs, the two-horned uterus, deciduate zonary placenta, and the position of the two teats upon the breast. The diet is vegetarian, and the animals are gregarious. An elephant may weigh 3 to 4 tons, and live 120 years, though the average seems to be about eighty.

The Two Species.—The Indian Elephant (*Elephas indicus*) is now restricted to the forest-lands of India and south-east Asia, including Ceylon and Sumatra. The African Elephant (*E.* or *Loxodon africanus*) inhabits the greater part of the African continent south of the Sahara. The contrast between the two species may be indicated as follows:

INDIAN.	AFRICAN.
Ears of moderate size.	Ears 3½ feet long by 2½ feet broad.
Molar teeth with folds parallel.	Lozenge-shaped folds.
Trunk ends in finger-shaped upper lobe.	Lobes of trunk apex nearly equal.
Concave forehead.	Arched forehead.
Four or five nails on the hind-foot.	Three nails on the hind-foot.
Males about 10 feet at shoulder.	Males about a foot higher.

For extinct forms such as the Mammoth (*Elephas primigenius*), nearly allied to the Indian species, for the ancient British forms, for the Pigmy Elephant (*E. melitensis*), and for even more gigantic forms than the two species now alive, the reader is referred to the articles MAMMOTH and MASTODON.

Habits: Food.—The elephants use their trunks in gathering leaves, branches, and herbage, which they pass dexterously to the mouth. The Indian elephant eats the leaves of the palm, fig, and jak trees, &c.; the African form is fond of the succulent mimosa. Most kinds of palatable vegetable food, from sugar-canes to cocoa-nuts, are acceptable. Those brought to Britain are largely fed on hay and carrots. They prefer forest and mountainous regions; are ready to plunder rice and other crops, but seem to have a wholesome dread of fences.

Drinking.—Without bending head or limbs, the elephant dips the end of the trunk into the water, and fills it by a strong inspiration. The trunk is

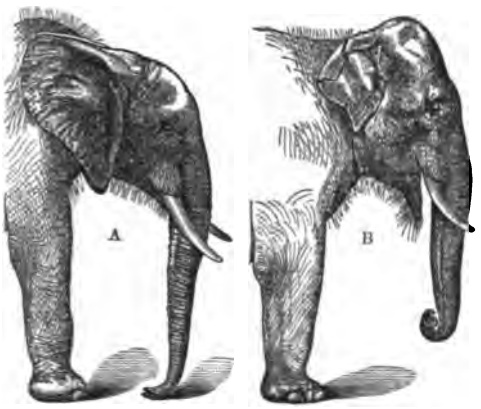


Fig. 2.—Heads of (A) African and (B) Indian Elephants.

then inserted into the mouth and forcibly emptied. In the same way water or even sand may be blown over the body for cleaning and cooling the skin.

Locomotion.—The general leisurely and heavy tread of the elephant can be changed into a very fast trot or peculiar shuffle, especially when the males furiously charge their rivals or enemies. Their slow but sure progress is found most serviceable in difficult mountain travelling. Though one would hardly expect it, they undoubtedly have considerable powers of swimming. 'A whole herd has been known to swim without touching bottom for six consecutive hours, rest a while, and then swim three more, with one rest.' When a herd with young ones is forced to take to the water, the mothers hold some up with their trunks, while others find a more comfortable position on their mothers' backs.

Fig. 3.—Tips of Trunks of (*a*) African and (*b*) Indian Elephants.

Herding.—Elephants are conspicuously social, a habit which has doubtless directly influenced their intellectual development. The herds are usually family parties; the mothers and young go in front, the males bring up the rear. The positions are reversed in alarm and danger. Both family likeness and family sympathies are often strongly marked. The leader is obeyed and also protected with much *esprit de corps.*

Breeding.—The males of both species are rather larger than the females, and excel in strength, endurance, and in the greater development of the tusks. A male is on this last account valued at one-fifth more than a female. In some localities—e.g. Ceylon, the female incisors remain very small, and the disproportion is always more marked in the Indian species. The male elephant is polygamous, and usually rules alone in the herd, expelling or killing his rivals. By means of such habitual contests the tusks have doubtless been perfected in strength. Except at the breeding season, the adult males live much by themselves, probably for selfish reasons rather than from love of solitude. At pairing-time a gland opening on the side of the head, between eye and ear, becomes especially active in the adult males, which are then said to be in 'must,' and are then well known to be probably the most dangerous of animals. The gland secretes a substance of strong musk-like odour, and is one of the numerous secondary sexual characters exhibited by animals. The fragrance is probably attractive to the female sex, though this must be a subsequent advantage, and not in any way a cause of the development of such an organ. 'The elephant,' Darwin observed, 'is reckoned the slowest breeder of all known animals, and I have taken some pains to estimate its probable minimum rate of natural increase: it will be under the mark to assume that it begins breeding when thirty years old, and goes on breeding till ninety years old, bringing forth three pair of young in this interval; if this be so, at the end of the fifth century there would be alive fifteen million elephants, descended from the first pair.' It is obvious enough that mortality and enemies, especially man nowadays, obviate any approximation to even such slow, natural increase of numbers. The elephant is one of the best examples of Spencer's law of the inverse ratio of individuation and rate of reproduction. Endless stories are told of the savageness of 'rogue' elephants, which seem chiefly to be males who have been expelled from the herd, and have in part the savageness of Ishmaelites, and in part the madness of enforced celibacy. The mothers manifest much maternal affection and care. One young elephant is born at a time, though occasionally twins may occur. There is a long (20½ months) period of gestation. The elephant sometimes breeds in captivity. Even after twenty years of menagerie life, birth is said to have occurred. In Siam and other parts of the East, breeding studs are kept up, but recruiting by fresh captives is always necessary. One of the baby Asiatic elephants born in America weighed 245 lb. at birth, and was about the size of a sheep. It took milk for six months, and afterwards began to eat tender grass. The sucking is done as usual with the mouth, not with the trunk.

While the tusks of the male are much used in the customary contests with rivals, they serve other purposes. Thus Darwin notes: 'The elephant uses his tusks in attacking the tiger; according to Bruce, he scores the trunks of trees until they can be thrown down easily, and he likewise thus extracts the farinaceous cores of palms; in Africa he often uses one tusk, always the same, to probe the ground, and thus ascertain whether it will bear his weight.' The tusks are also used in ploughing the ground in search of bulbs. According to the position and curvature of the tusks, he either 'flings the tiger to a great distance—it is said to even 30 feet, or endeavours suddenly to pin him to the ground'—an action dangerous to the rider, if there be one, who is apt to be jerked off the howdah.

The trunk can be used in endless ways, to pull down a tree or snip a bunch of grass, to lift an immense weight or a pin from the ground, to fight or to fondle. Through it they make a loud shrill sound described by Aristotle as resembling the hoarse noise of a trumpet.

Intelligence.—Though the eyes are very small, they are quick to discern, and the other senses are highly developed. The elephants are also social animals. These two conditions, always favourable to intellectual development, are certainly here associated with a high degree of intelligence. Their memory both for friends and foes is strong, and has been more than once remarkably illustrated by tamed elephants, which, having escaped and been recaptured, returned with all their old obedience to their keeper. In higher mental qualities elephants are only excelled, according to Romanes, by dog and monkey. By dexterous blowing, an elephant made a potato, which had fallen out of reach,

rebound against the opposite wall so as to return to an accessible place. Darwin observed similar experiments in the Zoo. Their dexterity in assisting human labour, their quiet submission to operations, the gusto with which decoys practise deceit, the manner in which they thatch their backs in summer to keep off sun and flies, their selection, shaping, and dexterous use of pieces of wood (implements) for leech-scrapers, fans, &c., their discriminating way of lifting and handling different materials according to their hardness, sharpness, (abstract ideas), &c., are all remarkable. To pile up materials round the base of a tree, so as to make a platform from which to reach an otherwise inaccessible enemy, shows decided power of rational device. An elephant has been known to feign death, and the working tamed forms are said to have an accurate sense of time. Of their capacity for learning tricks little need be said; to take tea at a table and ring for the waiter, to uncork bottles and drink the contents, or even to salute princes, puts more strain upon the elephant's patience than upon his intellect.

Emotions.—The elephant may be extremely gentle and affectionate, or when injured, both passionate and vindictive. They readily form friendships with their keepers, with children, or with fellow-animals, and sometimes manifest quite human tenderness. The partnership between the wild elephants and the birds which pick insects from their skin and rise screaming when alarm threatens, is obviously not disinterested. The better emotions, such as sympathy, appear undoubtedly to predominate, but there is no doubt as to their proverbial vindictiveness. The classic story of the tailor and the elephant has been repeatedly verified, in some cases with tragic results. As peculiarities of emotional temperament, Romanes notes the following: 'If a wild elephant be separated from its young for two or three days, though giving suck, it never after recognises or acknowledges it. The members of a herd are exclusive, a strayed stranger is driven off, and may thus become a "rogue" or "goondah." Such an Ishmaelite undergoes a transformation of disposition, becoming savage, cruel, and morose. He is possessed not by sudden bursts of fury, but by a deliberate brooding resolve to wage war on everything, and lies patiently in wait for travellers.' Elephants are also subject to sudden death from what the natives call a 'broken heart,' and which seems in some cases at least referable to psychical or cerebral conditions.

White Elephants.—Albinos occur among elephants as in other animals. In these the colouring matter of the skin is deficient; but the adjective white can hardly be used to describe the result. Their rarity has made them valuable, and they are revered as incarnations of Buddha. Holder notes that in the 16th century Pegu and Siam fought over one for many years, till five successive kings and thousands of men were killed, while Barnum in 1883 bought one in Siam which cost him $200,000 by the time it reached America. Elephants vary slightly in the amount of hair on their characteristically naked hides. Those on high cool regions in India are said to have rather more hair, thus approaching the woolly extinct species of long past Arctic climates.

Apropos of Barnum, an elephant-craze of modern times was illustrated in regard to an elephant named Jumbo, which had at least an eventful history of travel. Born in Central Africa, sold to the Jardin des Plantes in Paris, thence to the Zoo in London, and thence in 1882 to Barnum for $10,000 in spite of outcry and petitions, shipped with some difficulty to New York, and killed by a railroad car in Canada—such is in brief the life-history of an animal which secured an unusually large share of popular attention. Its remains—skin and skeleton—were presented to two American museums.

Hunting.—The elephant is hunted either for captivity, work, and pageantry, or for the sake of its ivory. The Indian forms are often captured alive in numbers by organised parties of four hundred or so natives, and the process is both tedious and costly. The herd is surrounded, and the circle narrowed by fires and watching. A strong fence and moat are made to form the so-called 'kheddah' into which the elephants are driven. There they are separated and hobbled by riders on tame elephants, whom the captives, curiously enough, do not touch. Single elephants are also noosed or decoyed by tame females; the pitfall method is too frequently fatal to be profitably employed if the elephants are wished alive. They are of course also hunted and killed both for sport and ivory. Sometimes, too, their ravages on cultivated ground have necessitated check. The shots are said to kill only on the forehead, temple, and behind the ear. The African elephant is not now trained, as it used to be, for war or show, but is rapidly being hunted to death to supply European markets with ivory. It is followed either on horseback or foot, and some of the Arabs are said to be daring enough to face it with only sword and shield.

Uses.—The Indian elephant has been, and still is, much used as a beast of burden. In its half-domesticated state it becomes a patient and effective worker. They are of great service in lifting and carrying heavy burdens, which they edge on to their tusks with the trunk. An ordinary elephant can carry half a ton continuously on a level road. In their natural state they often march for 20 miles to their feeding-ground or water-supply. In captivity they require a great deal of care and as much food. 'A large tusker needs 800 lb. of green fodder in 18 hours.' Their expensiveness, delicacy, and infertility are obstacles to domestication. The African elephant, once trained for war and pageantry, is no longer tamed, apparently from lack of enterprise. The natives of Africa eat the flesh, and are said to be especially fond of the trunk, feet, and fat of the elephant. The skin is used for water-bags.

From very ancient times elephants have been used in war. Alexander encountered them in his campaigns; Semiramis took clever advantage of their prestige by making sham ones. In the Carthaginian wars, the Romans were at first disastrously affrighted by them, but with familiarity learned to terrify them with torches. They captured several from Pyrrhus in 276 B.C., and took them to Rome, calling them 'Lucanian oxen.' The Carthaginians are said to have used 140 elephants at the siege of Palermo; Hannibal took 37 over the Alps, where, according to Philemon Holland's quaint translation of Livy, they had 'much ado not to topple on their noses in the slabby snow-broth;' and the Romans themselves learned to use them. Even in modern times, in the East, they have continued to be so used, and in the Burmese war, though not actively engaged, elephants were found of great use both for transport and for clearing passages in the jungles.

Elephants have been almost equally used in pageantry and games. Cæsar held elephant tournaments and employed them to draw chariots, while Nero characteristically matched an elephant against a single fencer. So too they have for many centuries held their place in the Juggernaut processions, and were remarkably displayed in honour of the visit of the Prince of Wales to India.

Ivory.—The tusks of an elephant may weigh

150–300 lb., and 'a famous tusk exhibited by Grote & Co., New York, measures 8 feet 11 inches on outside curve, has a diameter at the base of 6½ inches, and weighs 184 lb.' They have small 'milk' predecessors, but these fall out when the animal is very young. The true tusks are what are called rootless teeth, growing from persistent pulp, and owe their value to the large mass, elastic nature, and somewhat peculiar texture of the dentine portion (see TEETH). The enamel is very slightly developed, and only at the apex. It is estimated that about 75,000 animals, especially in Africa, have recently been killed annually for the sake of their tusks, while 500 tons per annum were imported into Great Britain alone between 1880–84. In more recent years the importation has decreased, there is no doubt that the ivory king is becoming rarer, and an abstinence from the purchase of ivory is the bounden duty of every admirer of the elephant. The fit use of this beautiful animal product is for works of high art, like those of the ancients, and not for handles of pocket-knives. For technical details, see IVORY.

Proboscidean Fictions.—Under this title, Holder, in his interesting account of the 'Ivory King,' collects a number of the oddities erroneously recorded in regard to elephants. Thus it was long believed that they shed their tusks every ten years, but buyers of ivory can no longer have such comfortable assurance. Writers of the 14th century allude to the belief that they have two hearts, such extremes of temperament do they exhibit! From the low position of the knee-joint, the idea arose that the elephant's legs bend in opposite directions to those of other animals; while a different view is expressed by Ulysses in *Troilus and Cressida:* 'The elephant hath joints, but none for courtesy, his legs are for necessity, not for flexure.' Choicest by far, however, is the expression to a common belief given by Sir Thomas Browne in *Pseudodoxia Epidemica*—the elephant 'hath no joynts, and being unable to lye down, it lieth against a tree, which the hunters observing do saw almost asunder, whereon the beast relying by the fall of the tree falls also downe itselfe, and is able to rise no more.'

See DINOTHERIUM, IVORY, MAMMOTH, MASTODON; C. F. Holder, *The Irory King* (London, 1886), an admirable account of the general natural history of the elephant, from which many of the above facts are derived; G. J. Romanes, *Animal Intelligence* (Inter. Sc. Series), and other works. For anatomical characters, see Huxley's *Anatomy of Vertebrates*, and Flower's *Osteology of the Mammalia*.

Elephanta (native *Ghárápuri*), an island over 4 miles in circuit, in the harbour of Bombay, 6 miles E. of the city, and 4 miles from the mainland. It owed its European name to a large figure of an elephant which stood near its former landing-place, but which, after 1814, gradually sank into a shapeless mass. Of the island's far-famed Brahmanic rock-caves, four are complete, or nearly so; the most important is the Great Temple, still used by the Hindus on Sivaite festivals. It is entirely hewn out of a hard trap-rock, and measures 130 feet from north to south, and the same distance from east to west; the body of the cave forms a square of about 91 feet, originally supported by twenty-six columns, and sixteen half-columns, of from 15 to 17 feet, many of which have been injured or destroyed. The most striking of its many sculptures is a three-headed bust of Siva, nearly 18 feet high and 23 feet round the eyes. This unique bust, like most of the other figures here, has been much defaced, and policemen are now employed to protect the cave. The caves

Caves of Elephanta—Entrance.

most probably date from the 9th century. See Burgess, *The Rock Temples of Elephanta* (Bombay, 1871), and Fergusson and Burgess, *The Cave Temples of India* (1880).

Elephanti'asis Arabum (also called *Cochin* or *Barbadoes Leg*, or *Pachydermia*) is a disease chiefly of tropical climates, and especially frequent in India. It consists in an overgrowth of the skin and connective tissue of the parts affected, with occasional attacks of inflammation resembling erysipelas. It is associated with, and probably caused by, obstruction of the lymphatic vessels of the affected part. In many cases occurring in the tropics, a parasitic worm (*Filaria sanguinis hominis;* see PARASITIC ANIMALS) is found in the blood, and is believed to be the cause of the obstruction; but the disease may occur from other causes. The lower limbs and genital organs are the parts usually affected, and may attain an enormous size; the scrotum has been known to weigh over 100 lb. In the early stages it can sometimes be reduced or kept in check by firm bandaging, with careful avoidance of all causes of irritation—e.g. over-fatigue, great changes of temperature. But in severe cases, amputation of the part affected is often necessary to allow the patient to move about at all. For the wholly distinct disease, *Elephantiasis Græcorum*, see LEPROSY.

Elephantiné (Arab. *Gezírat Aswân*, or *Gezírat-ez-Zahr*, 'isle of flowers'), a small island of the Nile, 'a mosaic of vivid green, golden sand, and black syenite,' lying opposite to Assouan (q.v.), the ancient Syene, on the confines of Egypt and Nubia, in 24° 5′ N. lat., and 32° 34′ E. long. The ruins of the ancient city are traced in a large mound near the modern villages. From this island the Greek mercenaries were sent into Ethiopia by Psammetichus I. to recall the Egyptian deserters, and it was garrisoned in the times of the Pharaohs, Persians, and Romans. The island was anciently called *Ab*, or the 'ivory island,' from its having been the entrepôt of the trade in that precious material. The most important ruins, preserved till 1822, when they were mainly demolished to build a vandal governor's palace, were a late granite gateway of the time of Alexander III.; and a small temple dedicated to Khnum, the god of the country, and Sati, the goddess of the inundation, which was

built by Thothmes III. and his successors down to Amenhotep III. Another remarkable edifice (also destroyed in 1822) was the Roman Nilometer, mentioned by Strabo, which appears to have been built in the time of the Cæsars; several inscriptions still preserved record the heights of inundation from the time of Augustus to Severus. The island had the honour of giving a dynasty (the 5th) to Egypt, and was the capital of the first nome of the Southern Kingdom; the inscriptions on the rocks attest the adoration paid by Seti I., Psammetichus II., and other monarchs, to the local deities. Other interesting monuments have been found on this island; amongst which may be cited part of a calendar recording an important chronological datum—the date of the rising of the star Sothis, marking the beginning of the Egyptian year, in the reign of Thothmes III. (1445 B.C.); a Roman quay; and numerous inscribed potsherds—principally receipts in the Greek language—given by the farmers of the taxes in the reign of the Antonines. The population of the island is at present exclusively Nubian.

See Wilkinson; Champollion; Mariette, *Mon. of Upper Egypt;* Brugsch, *Hist. of Egypt under the Pharaohs;* Birch, *Hist. of Anc. Pottery, Guide to First and Second Egyptian Rooms in the British Museum;* A. B. Edwards, *A Thousand Miles up the Nile.*

Elephant-seal, or SEA-ELEPHANT (*Macrorhinus proboscideus* or *leoninus*), the largest of the seals, the male measuring about 20 feet in length. It occurs in the southern oceans off Patagonia, Juan Fernandez, Kerguelen, &c. The colour is grayish, the teeth relatively very small, the hind-feet without nails. The males are much larger than the

Elephant-seal (*Macrorhinus proboscideus*).

females, and have a tubular prolongation of the snout, dilatable in excitement. They live in families and societies, and feed on fish and molluscs, especially cuttle-fishes. The skin furnishes leather; the oil is valuable for burning; the tongue alone is palatable. Some distinguish a second, almost exterminated, species (*M. angustirostris*), found off the coasts of California and Western Mexico. See SEAL.

Elephant's Foot, or HOTTENTOT'S BREAD (*Tamus* or *Testudinaria elephantipes*), a plant of the yam order (Dioscoreaceæ), of which the root-stock forms a large fleshy mass, curiously truncate, or somewhat resembling an elephant's foot, and covered with a soft, corky, rough, and cracked bark, recalling the shell of a tortoise, whence its other name. From this springs annually a climbing stem, which bears the leaves and flowers. The starchy root-stock is used as food by the Hottentots. The plant is not unfrequent in hothouses. A few species are North American.

Elephant-shrew, a name applied to a number of long-nosed, long-legged Insectivora, forming the family Macroscelidæ. They are natives of Africa, and are notable for their agile jumping over loose sand. They use their hind-legs somewhat in kangaroo fashion. There are two genera, Macroscelides and Rhynchocyon, with fourteen species.

Elettaria. See CARDAMOMS.

Eletz. See JELETZ.

Eleusiné, a genus of Grasses, of which several species are of importance as cultivated cereals, notably *E. corocana* and *E. indica* in India, and *E. Tocusso* in Abyssinia. *E. indica* is now common in the United States.

Eleusis, next to Athens the most important town of ancient Attica, on the Bay of Eleusis, opposite Salamis, was connected with the capital by the Sacred Road. It was famous as the chief seat of the worship of Ceres, whose mystic rites were here performed with great pomp and solemnity from the earliest authentic times till the era of Alaric, by whom the second and famous temple of the goddess, designed by Ictinus, the architect of the Parthenon, was destroyed. For the Eleusinian mysteries, see MYSTERIES. The site of the old Eleusis is now occupied by the little village of Lefsina, 16½ miles WNW. of Athens by rail.

Eleu'thera, one of the Bahamas (q.v.), has an area of 238 sq. m., and a pop. of 7010.

Eleuthera Bark, an old name of Cascarilla Bark, borrowed from its native island. See CASCARILLA BARK, CROTON.

Elevation, in Architectural Drawing, is a representation of the flat side of a building, drawn with mathematical accuracy, but without any attention to effect. For elevation in geology, see UPHEAVAL; for elevation crater, see VOLCANOES.

Elevation, in Astronomy and Geography, means generally the height above the horizon of an object on the sphere, measured by the arc of a vertical circle through it and the zenith. Thus, the elevation of the equator is the arc of a meridian intercepted between the equator and the horizon of the place. The elevation of the pole is the complement of that of the equator, and is always equal to the latitude of the place. The elevation of a star, or any other point, is similarly its height above the horizon, and is a maximum when the star is on the meridian.

Elevation of the Host. See HOST.

Elevators (GRAIN) is the name given, especially in the United States, to erections for the transhipment of grain, and in which it is often stored for months, being weighed both when received and when sent out. There are elevators capable of storing 1,000,000 to 1,500,000 bushels of corn within their walls of wood. The largest are erected at Chicago and Buffalo. The grain on being received at the elevator is examined and graded, all of the same quality being kept together. The farmer or merchant who brings it receives an acknowledgment for so much grain of such a quality; and the grain which is delivered from the elevator on his account is grain of that quality, and not the same as he brought. In New York, floating elevators are frequently employed to transfer the grain from barges to sea-going vessels direct. Fixed elevators are generally built so as to be approachable by vessels on one or two sides, and have tramways running in on the level of the street; the chain of buckets which raises the grain moves, as the case may be, in an inclined plane passing through the wall to a vessel outside, or in a vertical plane into pits into which the grain has been shot from railway-trucks. The chain receives its motion from an endless band passing over one or two horizontal shafts in the upper part of the structure, the engine and boiler being

located in a building outside the elevator itself.—Elevators in hotels, &c. are in Britain generally called Lifts (q.v.).

Elf. See FAIRIES.

Elf-bolts, also called *Elfin-arrows*, *Elf-darts*, *Elf-shot*, and *Elf-stones*, names popularly given in the British Islands to the arrow-heads of flint which were in use among the early inhabitants of Britain and of Europe generally (see FLINT IMPLEMENTS). It was believed that elves or invisible beings shot these barbs of flint at cattle, and occasionally even at men. Thus, Robert Gordon of Straloch, an accomplished country gentleman of the north of Scotland, writing in 1654, tells how one of his friends, travelling on horseback, found an elf-bolt in the top of his boot, and how a gentlewoman of his acquaintance, when out riding, discovered one in the breast of her habit. Cattle dying suddenly in the fields were believed to have been struck by elf-arrows—a belief which yet lingers in Ireland. The elf-bolt was occasionally set in silver, so as to be worn on the person as a talisman, or had a hole drilled through it, so that it might be dipped in water, which, being thus endowed with healing virtue, was used sometimes as a wash, more commonly as a draught. As a talisman, the elf-bolt was believed to be most efficacious as a preservative from poison and witchcraft.

Elgin, the county town of Elginshire, 5 miles by rail SSW. of its seaport, Lossiemouth, 37 ENE. of Inverness, and 178 N. of Edinburgh. It lies on the Lossie in the 'garden of Scotland;' and while it retains a few quaint old houses, a cross (restored in 1888), and its ruined cathedral, it has brightened up much during the 19th century. The Elgin Institution was erected in 1832 as an almshouse and school, out of £70,000 bequeathed by Andrew Anderson (1746–1822), who from private had risen to be major-general in the service of the East India Company. Other edifices are Gray's Hospital (1819) and the adjoining asylum (1834–65), the county buildings (1866), the court-house (1841), the market buildings (1850), the academy (1800), and the parish church (1828), with a tower 112 feet high. The once glorious Gothic cathedral (1224–1538) was a cruciform structure, 289 feet long by 120 across the transept, with two western towers, and a loftier central spire (198 feet). It was partially burned in 1270, and again in 1390 by the 'Wolf of Badenoch;' was dismantled in 1568; and in 1711 was finally reduced to ruins by the fall of the great tower. The chapter-house, with its 'prentice pillar,' is noteworthy. The town itself has suffered much from fire, its partial destruction in 1452 at the hands of the Earl of Huntly giving rise to the proverb 'Half done, as Elgin was burnt.' Little remains of the royal castle, which in 1296 lodged Edward I. of England; its ruins are surmounted by a monument (1839–55) to the last Duke of Gordon. A royal burgh since the reign of David I. (1124–53), Elgin unites with Banff, Macduff, Peterhead, Inverurie, Cullen, and Kintore to return one member to parliament. Pop. (1881) 7533; (1891) 7799. See Young's *Annals of Elgin* (1879).

Elgin, a city of Illinois, on the Fox River, 36 miles WNW. of Chicago by rail, with large watchworks employing 500 hands, and manufactures of carriages and agricultural machinery. Pop. (1880) 8787; (1890) 17,823.

Elgin and Kincardine, EARL OF, Governor-general of India. James Bruce, eighth Earl of Elgin, and first Baron Elgin in the peerage of the United Kingdom (1849), was born in London, 20th July 1811. He was son of the seventh Earl of Elgin (1766–1841) who brought from Athens the collection of sculptures known as the 'Elgin Marbles.' As governor of Jamaica (1842–46), and as governor-general of Canada (1847–54), he displayed administrative abilities of the highest order. While on his way to China in 1857, as plenipotentiary extraordinary, he learned at Singapore the outbreak of the Indian mutiny, and promptly diverted the Chinese expedition to the aid of Lord Canning. The mission to China was delayed, but ultimately, after some military operations and diplomacy, issued in the treaty of Tientsin (1858). He also negotiated a treaty with Japan, by which certain ports were opened to British trade. On his return home he was appointed Postmaster-general. In 1860 he was again in China for the purpose of enforcing the ratification of the treaty. A combined English and French force penetrated to the capital, and enabled Lord Elgin and Baron Gros to dictate a peace under the walls of Pekin. On the expiration of Viscount Canning's term of service, the governor-generalship of India was offered by Lord Palmerston to Lord Elgin (1861), and accepted by him. He died at Dharmsala in the Punjab, 20th November 1863. See Walrond, *Letters and Journals of Lord Elgin* (1872); and Laurence Oliphant, *Mission of Earl of Elgin to China* (1859).

Elgin Marbles, a celebrated collection of ancient sculptures, brought from Greece by the seventh Earl of Elgin, then ambassador to the Porte, and acquired from him by the nation for the British Museum in 1816, at the sum of £35,000. Early in the century he obtained a firman to examine, measure, and remove certain stones with inscriptions from the Acropolis of Athens, then a Turkish fortress. His agents, on the strength of this firman, removed the so-called Elgin Marbles, packed before Elgin's recall in 1803, but not finally conveyed to England till 1812. They are said to have cost the ambassador upwards of £74,000; and

Part of the Frieze of the Parthenon—Elgin Marbles.

both before the purchase by the government and afterwards, there was fierce controversy as to the artistic value of the statues, and Elgin's right to remove them from Athens. Lord Byron's view as to the unjustifiableness of the removal was shared by

many, who nevertheless believed not merely that the marbles were thus saved from great risks, but that they were now made vastly more accessible to students than they could have been in Athens during the troublous times that followed.

These sculptures adorned certain buildings on the Acropolis of Athens. The chief portions, which are from the Parthenon or Temple of Minerva, were designed by Phidias, and executed by him, or under his superintendence. They consist mainly of statues from the pediments, metopes, and a large part of the frieze of the cella (see ATHENS, Vol. I., p. 538); a figure from the Erechtheum, and a statue of Dionysus, and part of the frieze of the Temple of Winged Victory. See Newton in the *Contents of the British Museum, Elgin Room* (1881–82).

Elginshire, or MORAY, a Scottish county extending 30 miles along the low shore of the Moray Firth. It is 34 miles long, and 488 sq. m. in area, a former detached portion having in 1870 been annexed to Inverness-shire, whilst a corresponding portion was transferred from that county to Elginshire. The surface has a general southward ascent, and attains a maximum altitude of 2328 feet. Rivers are the Spey, Lossie, and Findhorn; and of several small lakes much the largest is Lochindorb (2 miles by 5 furlongs). West of the Findhorn's mouth are the sand-dunes of Culbin, due to drifting chiefly in 1694, and some of them rising 118 feet (see DRIFT). The predominant rocks are crystalline in the south; next Old Red Sandstone, with fish remains; and then reptiliferous sandstone of (probably) Triassic age (see DICYNODON). Agriculture is highly advanced over all the flat fertile lower tract; still, only thirty-one per cent. of the entire area is in cultivation. Burghead and Lossiemouth are fishing-villages; and whisky is distilled in the higher districts. Elgin and Nairn shires return one member to parliament. Pop. (1801) 27,760; (1881) 43,788; (1891) 43,448. The ancient province of Moray included the counties of Elgin and Nairn, with parts of Banff and Inverness shires. Scandinavians early gained a footing; and it did not become an integral part of the Scottish kingdom till the later half of the 12th century. Antiquities, other than the pseudo-Roman remains of Burghead (Ptolemy's *Alata Castra*), are Kinloss Abbey (1150), Pluscarden Priory (1230), a Romanesque church at Birnie, and the castles of Duffus, Lochindorb, and Spynie, the last with memories of Bothwell. See Shaw's *History of Moray* (1775; 3d. ed. 1882).

Eli, high-priest at Shiloh, before whom the child Samuel ministered unto the Lord (1 Sam. i.–iv.). He also judged Israel for forty years (according to the Hebrew text; the Septuagint has twenty years); and in his old age had to bear the curse that followed his culpable negligence in not restraining the evil dispositions of his sons Hophni and Phinehas. He fell from his seat and died on hearing that the ark of Jehovah had been taken by the Philistines.

Elias Levita. See LEVITA.

Elie, a pretty little watering-place of Fife, 23 miles NE. of Edinburgh (by rail 34). Pop. 917.

Élie de Beaumont. See BEAUMONT.

Elijah (in the New Testament, Elias), the greatest of the prophets of Israel, flourished about 900 B.C., during the reigns of Ahab and Ahaziah. For the story of his life a reference to the Old Testament is sufficient (1 Kings, xvii.–xix., xxi.; 2 Kings, i., ii.; 2 Chron. xxi. 12–15). The anticipation of his return as the precursor of the Messiah harmonises with the account of his removal from the earth, and finds support in the words of the last prophet (Mal. iv. 5). In the New Testament this prophecy is declared to have its fulfilment in John the Baptist, who is said to have come 'in the spirit and power of Elias' (Matt. xi. 14; xvii. 11–13; Mark, ix. 13; Luke, i. 17). Elijah appears with Moses on the Mount of Transfiguration. In Russian folklore, the ideas that once were associated with Perun, the thunder-god, have become attached to the Prophet Ilya or Elijah, on whose festival (20th July) a beast is sacrificed in many districts. See *Elijah, his Life and Times*, by Dr Milligan (1887); and *The Hallowing of Criticism: Nine Sermons on Elijah*, by T. K. Cheyne (1888).

Elimination, in Algebra, is the operation which consists in getting rid of a quantity or letter which is common, say, to two equations, by forming out of the two a new equation, in such a way as to make the quantity in question disappear. In complicated equations, elimination becomes difficult, and often impossible. Elimination is an important process in other sorts of reasoning besides the mathematical; in this larger acceptation, it means the setting aside of all extraneous considerations —of everything not essential to the result. In astronomical observations, the elimination of errors of observation is often effected by repeating the observations several times in such a way as to cause the errors to be of opposite kinds, then adding the observed values, and taking their average.—The word to 'eliminate' is often erroneously used in the sense of to 'elicit,' or bring to light.

Eliot, CHARLES WILLIAM, president of Harvard University, was born in Boston in 1834, and was educated at Harvard, where he filled some minor posts, and became president in 1869. Under his rule the university has been doubled in strength, and the old prescribed curriculum has been finally abandoned for an optional system of studies. President Eliot is LL.D. of Williams, Princeton, and Yale, and has published, with Professor Storer, two manuals of chemistry.

Eliot, GEORGE. This is the *nom de plume* of the great English novelist, who is perhaps best known as the author of *Adam Bede*. She was born on 22d November (St Cecilia's Day) 1819, and died on 22d December 1880. Her baptismal name was Mary Ann Evans, but she usually signed herself Marian Evans. She was the youngest daughter of the second family of Mr Robert Evans, a land-agent in Warwickshire, on the property of Mr Francis Newdigate. Mr Evans was at the time of the child's birth living at Arbury Farm, on the Newdigate property. Four months later he removed to Griff on the same property, 'a charming red-brick, ivy-covered house,' and here the afterwards celebrated authoress lived during the first twenty-one years of her life. Robert Evans was a man of strongly-marked and strenuous character, many of the leading traits of which were transferred by his daughter to the characters of Adam Bede in the novel of the same name, and of Caleb Garth in *Middlemarch*. But as Mr Evans died in 1849, and George Eliot's first work of fiction was produced in January 1857, the father was never made aware of the character of the daughter's genius. Of the life at Griff, many of the features are given in the sketch of Maggie Tulliver's and Tom's childhood in the *Mill on the Floss*; and especially her relation to her own brother Isaac, who was her senior by three years, is there powerfully painted. Her first school was at Miss Lathom's of Attleboro, where she remained between the ages of five and nine. Then she went to Miss Wallington's at Nuneaton, where the principal governess was Miss Lewis, with whom she formed a close friendship, and with whom she corresponded during those earlier years of expanding mind and receding faith, which intervened between her father's removal to Coventry in 1841 and his death in 1849. Between the ages of thirteen and

sixteen, she went to school at Miss Franklin's at Coventry, where she became for a time a fervent evangelical. She lost her mother, whom she loved devotedly, in 1836, when she was only sixteen; and early in 1837 her elder sister Christiana, who was five years her senior, and whose character and relation to herself are said to have been in some degree reflected in the Celia of *Middlemarch*, and in the relation between Celia and Dorothea in that tale, married Mr Edward Clarke, a surgeon, practising at Meriden in Warwickshire. From this time Mary Ann Evans took entire charge of her father's house. A master came over from Coventry to give her lessons in German and Italian, and another came to teach her music, of which she was passionately fond throughout life. But besides her studies in language and music, she was an immense reader on all sorts of subjects which interested her.

In the spring of 1841, when Mary Ann Evans, or Marian Evans, as she now called herself, was just of age, her brother Isaac married and took the house at Griff, her father removing to Foleshill Road, in the outskirts of Coventry. Here she became acquainted with Mr Charles Bray, the author of several works setting forth the philosophy of necessity from the phrenological point of view, and formed a close friendship with his wife (*née* Caroline Hennell), as well as with her sister Sarah, and with her brother Charles Hennell, who had published in 1838 *An Inquiry concerning the Origin of Christianity*, from the rationalistic point of view. On 2d November 1841, Marian Evans announces to Miss Lewis, her evangelical friend, that she is about, as she hopes, 'to effect a breach in the thick wall of indifference, behind which the denizens of Coventry seem inclined to intrench themselves,' and her biographer, Mr John Cross (to whom she was married in 1880), says that 'this probably refers to the first visit paid by Miss Evans to Mr and Mrs Bray at their house in Coventry.' We understand it as anticipating some success in bringing her new friends to a more religious state of mind. If so, the result was just the opposite of her expectations. Before a fortnight had passed—i.e. on the 11th November, she writes to the same friend anticipating that Miss Lewis may feel estranged from her as a consequence of some revolution which was taking place in her own mind, and that the visit which Miss Lewis was to have paid to Miss Evans at Christmas may no longer be one which she would wish to pay; and before the end of the year she had so greatly offended her father by refusing to go to church that he actually formed some intention, though he did not carry it out, of breaking up his household and going to live with his married daughter. Subsequently Marian Evans withdrew her objection to going to church, though she did not modify her views, and the breach between father and daughter was avoided.

At the opening of 1844, the work of translating Strauss's *Leben Jesu*, which had been at first undertaken by Mrs Charles Hennell, was transferred to Marian Evans, and at this she worked most laboriously till its publication in 1846. It was done in very scholarlike fashion. Indeed, the accuracy of George Eliot's work, whenever scholarship was needed, was all the more remarkable for her great imaginative power. There was nothing loose or slipshod about her. She may occasionally be fairly accused of pedantry, never of slovenliness, never of carelessness concerning facts, or of trusting to her imagination for what she had the means of verifying. She was painstaking by temperament as well as by self-discipline, though it would be difficult to find a case in which that very bad definition of genius, as 'an infinite capacity for taking pains,' would be more wholly inapplicable. George Eliot had a vast capacity for taking pains, and she had also a great genius; but her capacity for taking pains was as distinct from her genius, and showed itself in intellectual achievements as different as *Silas Marner* from her translation of Strauss's *Leben Jesu*. She translated later Spinoza's *Tractatus Theologico-Politicus*, and in after-years his *Ethics*, though we are not aware whether either translation was ever published, certainly not with her name. On the last day of May in 1849 her father died, and on the 11th June Marian Evans went abroad with Mr and Mrs Bray, ultimately to Geneva, where she remained for some months, the Brays returning home without her. Towards the close of March 1850 she returned to England, crossing the Jura on a sledge, and reaching London on 23d March. She now began to write for the *Westminster Review*, and in September 1851, in the year of the Great Exhibition, she became its assistant editor, lodging at its headquarters in the Strand, and becoming the centre of the literary circle of which Mr Herbert Spencer and Mr G. H. Lewes were two of the most influential members. It was at this time that she translated Feuerbach's *Essence of Christianity*, the only book to which she appended her real name. The drift of this book was to show that God is only a 'virtual image of man, the magnified form of his hopes and desires.

Gradually her intimacy with Mr Lewes grew, and in 1854 she formed a connection with him which lasted till his death in 1878, a connection which was the great false step of her life. In July 1854 she went abroad with him, staying three months at Weimar, where he was preparing for his *Life of Goethe*. After a somewhat longer stay at Berlin, George Eliot and Mr Lewes returned to England, and took up their abode first at Dover, then at East Sheen, and then at Richmond. In November 1856, when she was just thirty-seven, she attempted her first story, *The Sad Fortunes of the Rev. Amos Barton*, the commencement of the *Scenes of Clerical Life*. The first part of it was published in *Blackwood's Magazine* in January 1857, and almost all who read it recognised at once that a new English author of great power had arisen. This story was quickly followed by *Mr Gilfil's Love Story* and *Janet's Repentance*. In 1858 she wrote *Adam Bede*, partly at home, partly abroad at Munich and Dresden, completing it at Richmond in November. After the publication of this brilliant story, which had the most marvellous success, George Eliot found, to her amazement and annoyance that a Mr Liggins, who had lived in the same country as herself in the Midlands, claimed to be himself the author. There was a sharp controversy in the *Times* on the subject, and it was not till the publisher, Mr Blackwood, had intervened, that Mr Liggins's authorship was generally discredited. After the publication of *Adam Bede*, *The Mill on the Floss*, *Silas Marner*, *Romola*, and *Felix Holt* appeared in succession, but not rapid succession, for George Eliot always took her time, the last story coming out in 1866. Her first poem, *The Spanish Gypsy*, was published in 1868, followed in the next year by *Agatha*, *The Legend of Jubal*, and *Armgart*; and in 1871 appeared the first part of what proved to be, we think, in every sense her greatest work, *Middlemarch*. After that *Daniel Deronda*, published in 1876, showed a marked falling off in power, though many of the scenes are sufficiently rich in pathos, humour, and insight. Of the *Impressions of Theophrastus Such*, a volume of somewhat miscellaneous essays not unlike Thackeray's *Roundabout Papers* in their rather

vague structure, no good critic, we think, formed any very high estimate.

After the death of Mr Lewes, on 28th November 1878, George Eliot, who was always exceedingly dependent on some one person for affection and support, fell into a very melancholy state, from which she was roused by the solicitous kindness and attention of Mr John Cross, an old friend of her own and of Mr Lewes's, and to him she was married on 6th May 1880. Their married life lasted but a few months. George Eliot died in Cheyne Walk, Chelsea, on 22d December of the same year, and is buried in Highgate Cemetery, in the grave next to that of Mr Lewes.

As a novelist, George Eliot will probably always stand among the greatest of the English school; above Richardson, whom she greatly admired, and with whose painstaking and elaborate style of portraiture she had something in common, though in her preference for studies taken from simple rural life, from commonplace subjects so delineated as to bring out the humorous side of human shortcomings and the overmastering power of pitiable passions, she approached nearer to the still greater genius of Fielding. But her mind had not the movement and vivacity of Fielding's. If it had had that movement, that elasticity, that freedom of life in it, her genius would probably have shown itself much earlier than it did, and not waited till she was close upon forty before it betrayed even its existence. In early life she seems to have given her whole mind to the higher problems of life, and to have declared them virtually insoluble before she took refuge in portraying, with the wonderful power she actually displayed, the disappointments, the breakdowns, the narrow discontents, as well as the generous hopes and unsatisfied ideals of other human beings. She did not give the first-fruits of her intellectual energy to fiction. She exhausted, to her own thinking, the province of theology first, and having accepted with her usual too great docility the negative view of those who held that we have no trustworthy evidence that Christ's life was a revelation of divine power at all, and who held that Christianity is a mere dream dreamt in the idealising mood of eager human aspiration, she passed on sadly to a pitying study of man in the frame of mind of one who is determined to make the best of a bad business. And she extracted, perhaps, from our human lot all the good that it is possible for any one to extract from it who has once come deliberately to the conclusion that, though something may be done to elevate, and a good deal to alleviate it, and though not a little amusement may be extracted from it, yet that no power can really transfigure it, and that the more modest the aim, the less serious will be the inevitable disappointment. This subdued tone of regret that the highest human endeavour is destined to be baffled runs through all her tales, and it can hardly be doubted that their pervading melancholy is at least in some degree due to the false step which she herself, under the influence of a negative school of religious thought, had deliberately taken, when she sacrificed her own life to the ends of a connection out of which most of the joy, and almost all the sacredness, were taken by the unnatural and morally humiliating circumstances under which she entered upon it. It was greatly to her credit that, in spite of these circumstances, she steadily refused to lower the moral ideal at which she aimed, though she pursued it with scanty hope, and without the assistance of the faintest trust in the help of any higher power. She told her friend Miss Hennell in 1857, when the success of her *Scenes of Clerical Life* was already assured: 'If I live five years longer, the positive result of my existence on the side of truth and goodness will outweigh the small negative good that would have consisted in my not doing anything to shock others, and I can conceive no consequences that will make me repent the past' (*Life and Letters*, vol. i. p. 461). She lived twenty-three years more; but the good of living up to one's own ideal is neither small nor negative, and the Life appears to show that the shock of having herself contributed to the world an example of a mode of life of which in her literary work she was constantly struggling to 'outweigh' the influence, was far greater and more enduring than she had at this time realised.

George Eliot's mind was one of extraordinary reflective power, but deficient in vivid personal instincts. She notices in *Silas Marner* how slowly impressions grow up within us, and how little we are sometimes aware of the origin of even those impressions which are destined to produce the greatest effects upon our character and external life. 'Our consciousness,' she says, 'rarely registers the beginning of a growth within us any more than without us. There have been many circulations of the sap before we detect the smallest sign of the bud.' In most men and women, such obliviousness of the first appearance of a germ of evil would hardly apply to a violation of wholesome instincts of that peculiar and marked kind by which she set her actual life at variance with her moral ideal. But perhaps it was so in her case. Her *Life and Letters* appear to show that the suave and long-drawn melancholy and somewhat artificial condition of self-repression in which she lived grew upon her more and more as 'the sap circulated' and fed her ideal of the true relation of husband and wife. In story after story she attempted to impress upon others the absolute sacredness of the relations to which her own action had apparently shown her to be indifferent. Her most impressive stories, *Adam Bede*, *Silas Marner*, *Romola*, *Felix Holt*, *Middlemarch*, and *Daniel Deronda*, were all penetrated with the desire to show how selfish and desecrating what is called love may be without marriage, and how equally selfish and desecrating marriage may be without love; yet at every return to that subject there seems to be less of hopefulness, less of awe, less of testimony to the sharp remorse which follows wrong-doing, less of vivid instinct, more of the tone of tragic warning, more of a tendency to acquiescence in inevitable misery, in her treatment of the theme.

Her pictures of the English farmers and tradesmen and the lower middle class generally of the Midland counties are hardly surpassed in English literature, and may be put on a level with Sir Walter Scott's similar pictures of the Scotch peasantry. Jeanie and Effie Deans in the *Heart of Midlothian* are hardly more impressive than Dinah and Hetty in *Adam Bede*, and many might plausibly contend that they are less so. George Eliot's drawing had finer touches, and was more from within; Sir Walter Scott's was more rapid and vigorous, and excited a deeper interest in the outward careers of his *dramatis personæ*. Then again, George Eliot's farmers and millers, and farriers and auctioneers, and parish-clerks, are painted not with more humour perhaps, but with humour of a rarer and finer kind, though it is less popular and effective than Sir Walter Scott's bailies and drovers, and dominies and gypsies. What George Eliot is too frequently deficient in is action; what Sir Walter lacks is depth of insight. But on the whole George Eliot's stories give us at least as good a picture of the life of the Midland counties, as masterly and full-length portraits of the slow-moving, beef-consuming, habit-ridden population of those counties in the earlier part of this

century, as Sir Walter Scott has given us of the Border counties during the whole of the 18th century, with their wilder and more adventurous people. Of course there is a great difference in method between the two novelists, corresponding pretty closely to the difference between their favourite subjects. Sir Walter loved to show his favourites embarked in perilous adventures, Rob Roy gaining access to the Glasgow Tolbooth, and endangering his own neck to help a friend, or again, persuading the soldier to whom he was buckled to let him loose himself and dive for his life as they crossed the Forth. George Eliot on the other hand is seldom so successful as when she patiently develops her characters in rather slow but humorous dialogue—such dialogue as Shakespeare loved to interpolate in his plays when he chose to show us how the 'Goodman Dull' of the Midlands talked away in his stupid but comfortable self-satisfaction. Perhaps now and then George Eliot a little overdoes this microscopic view of inarticulate natures. In that curious short story of hers, *The Lifted Veil*, she gives a picture of a man with a quite preternatural insight into the vagrant and frivolous background of the minds of those amongst whom he lives, who is made to complain of 'the obtrusion on my mind of the mental process going forward in first one person and then another, with whom I happened to be in contact; the vagrant, frivolous ideas and emotions of some uninteresting acquaintance . . . would force themselves on my consciousness like an importunate, ill-played musical instrument, or the loud activity of an imprisoned insect.' Had not George Eliot herself some curious gift of the same kind?—as for instance in the very long analysis she gives of the way in which the gossips of Raveloe constructed, out of their own consciousness, the dress and personal appearance of the pedlar who is supposed by them to have stolen Silas Marner's gold? She seems sometimes to have had the buzz of dull but excited gossip almost revealed to her by a kind of disagreeable intuition, and to have written it down at too great length in order to rid herself of its leaden predominance over her imagination.

But if in delineating character George Eliot is often more than the equal of Sir Walter Scott, because she goes deeper and has a more penetrating insight, she is greatly his inferior in play and richness of pictorial imagination, in rapidity of movement, and in warmth of colour. *Romola*, her one historical romance, though it is full of subtlety of conception, contains some very striking figures, and is painted with a surprising minuteness of realistic detail, is a doubtful success. Sir Walter Scott never failed in making the chief historical figure of his historical romances the most interesting figure in his group. His studies of Mary Stuart in the *Abbot*, of Elizabeth in *Kenilworth*, of James I. in the *Fortunes of Nigel*, and of Louis XI. in *Quentin Durward* are studies which will live in the imaginations of men as long as the most vivid of historical portraits. George Eliot did not thus succeed in painting Savonarola. It was in Tito and Tessa that she achieved her great successes. As regards the historical background of *Romola*, one can hardly say that it holds its place at all as compared with even the least successful historical romance of Sir Walter Scott, say, *Anne of Geierstein* or the *Fair Maid of Perth*. George Eliot's imagination was not buoyant enough to travel back into these far regions of history, and create them anew for us. Nor does her story move rapidly enough to make up for the difficulty of transporting our sympathies to so distant a region. We miss the vividness and we miss the action which are needful for the art of historical romance.

And again in her poetry George Eliot falls far short of Sir Walter Scott; she is sombre, stately, even Miltonic after a fashion of her own, but Miltonic without Milton's felicity and charm. She is as grandiose as Milton without being as grand. Sometimes she attains true grandeur, as in her delineation of the selfishness that remained at the heart even of the inspired musician Jubal:

> This little pulse of self that living glowed
> Through thrice three centuries, and divinely strowed
> The light of music through the vague of sound,
> Ached smallness, still in good that had no bound.

The last line is grand, but not with Milton's sweet and winning grandeur. And usually George Eliot falls quite short of true grandeur in her poetry, and seems to be impressive without actually impressing the reader. The rhythm is laboured, the thought is laboured, the feeling is laboured, and the effect is more artificial than artistic.

Perhaps the most curious feature of George Eliot's genius is that she wrote so very much better and with so much more ease when she was writing dramatically than she did when she was writing her own thoughts in her own name. There is hardly a good letter—considered as a letter—in the whole three volumes, made up chiefly out of her letters, which Mr Cross has given to the world. There is on the contrary hardly an ineffective speech put into the mouth of any of the characters whom she delineated in her novels. Sir Walter Scott has given us a far larger *proportion* of ineffectively painted characters, though also a greater number of effectively painted characters, than George Eliot. There is hardly a country squire, or dairymaid, or poacher, or innkeeper, or country lad or lass to whom George Eliot does not give a thoroughly individual voice; but when she comes to speak for herself, her voice is measured, artificial, monotonous, and a little over-sweet. Her letters read as if they were turned out by machinery, though machinery invented by some gently intellectual and laborious mind. Scott's letters are delightful reading; Miss Brontë's are full of interest; even Miss Austen's, though they disappointed everybody, give the impression of a lively and observant mind. But George Eliot's have no freedom or personal stamp upon them, unless the absence of personal feeling be itself a personal stamp. It almost seems as if her mind had been intended more as an instrument for interpreting the minds of others, more as a phonograph through the agency of which the natures of all the various interlocutors with whom she met could be delicately registered and made to report themselves to the world, than as a distinct organ of her own taste and purpose. George Eliot is in the highest degree original in her power of interpreting others, but she gives an effect of faded second-hand suavity when she comes to interpret herself. Nevertheless she will be named in the same category with Sir Walter Scott, Thackeray, and Dickens, perhaps even above Miss Austen, if only for the richness and quantity of her admirable work. When the novelists of the nineteenth century come to be discussed in the twentieth, she will certainly rank above Trollope, or Mrs Oliphant, or Miss Brontë, or Mrs Gaskell, or Bulwer Lytton, or any of the other clever novelists who have filled so large a part of this century with their lively and skilful work.

See the *Life of George Eliot, as unfolded in her Letters and Journals*, edited by J. W. Cross (3 vols. 1885–86); *George Eliot*, by Mathilde Blind (1883); F. W. H. Myers, *Essays: Modern* (1883); *Essays, Theological and Literary*, by R. H. Hutton (1871), and his *Modern Guides of English Thought* (1887).

Eliot, JOHN, 'the Indian Apostle,' was born probably at Widford in Hertfordshire in 1604, the son of a yeoman, graduated at Cambridge in 1622, and, after taking orders in the Church of England,

quitted his native country for conscience' sake, and landed at Boston in New England in 1631. For some months he 'exercised' in the church there, but being fore-engaged to friends who had settled at Roxbury, he repaired thither in the summer of 1632. In 1646, after two years' study of the language, he delivered a long sermon in the native dialect at Nonantum, about five miles from Roxbury; and other meetings soon followed. He shortly after began to establish his converts in regular settlements, his work meeting with approval both in the colony and at home; in England a corporation was founded in 1649 'for the promoting and propagating the Gospel among the Indians of New England,' which defrayed the expenses of the preachers and the cost of printing translations. At one time there were over a dozen townships of 'praying Indians' within the bounds of Massachusetts, and many more outside these limits, with numbers estimated in 1674 at 3600; but, although the organisation survived until the death of the last native pastor in 1716, the decay of the 'praying towns' was rapid after the war with a native king, Philip (1675), in which the converts suffered equal cruelties at the hands of their countrymen and of the English, whom they are nevertheless believed to have saved from extinction. Eliot died at Roxbury, 21st May 1690; there are monuments to his memory in the Indian burying-ground at South Natick, and at Newton, near the scene of his first Indian sermon. A man of earnest piety and devotion to evangelisation, warm-hearted, and of a singularly attractive manner, he has left a memory that is honoured among the first in the history of New England. Along with his colleague Thomas Weld, and Richard Mather, Eliot prepared an English metrical version of the Psalms, the 'Bay Psalm-book' (Camb. 1640), which was the first book printed in New England. He was also the author, among other works, of *The Christian Commonwealth* (Lond. 1659; suppressed by the general court, and now extremely rare), of *The Communion of Churches* (Camb. 1665; the first book privately printed in America), of several tracts, and of translations into the Indian tongue of Baxter's *Call*, Bayly's *Practice of Piety* (abridged), and Shepard's *Sincere Convert*. But the great work and the noblest monument of his devoted life was the translation of the Bible into the tongue of the Indians of Massachusetts (Algonquin), of which the New Testament appeared in 1661, and the whole work, with a version of the Psalms in metre, and a page of 'catechisin,' in 1663. His *Indian Grammar Begun* was printed in 1666, his *Indian Primer* in 1669; a reprint of the only known copy of the latter, now in the library of the Edinburgh University, was issued in 1880, along with a reprint of one of the only two extant copies (not alike) of *A Christian Covenanting Confession*. The finest collection of unique and scarce copies of Eliot's works is in the Lenox Library, New York; many of them have been reprinted.

The best Life of Eliot is that by C. Francis in vol. v. of the first series of *Sparks's American Biography* (1836), the earliest that by Cotton Mather (1691); see also two careful articles in the *Cyclopædia of Amer. Biog.* (vol. ii. 1887) and the *Dict. of Nat. Biog.* (vol. xvii. 1889).

Eliot, SIR JOHN, English statesman, the earnest champion of the supremacy of parliament in the government of the nation, was the son of a country gentleman of Cornwall, in which county, at Port Eliot on the Tamar, he was born, 20th April 1592. His education was that usual for young men of his position. During the course of his continental travels he became acquainted with Villiers, afterwards Duke of Buckingham, an acquaintanceship which had a most important influence upon his subsequent parliamentary career. In fact his relations with Buckingham, first in support of the duke, and afterwards in antagonism to him, and his position as an ardent champion of the independence of the House of Commons are the two chief determining factors of his public life. He entered the parliament of 1624 as an adherent of Buckingham, whom he heartily supported in his warlike policy against Spain. But during the course of the next parliament (1625) his eyes seem to have become opened to the true character and designs of the favourite, and he finally broke with him that same year, owing to an arrogant refusal on Buckingham's part to acknowledge the House of Commons as the real ruling power in the nation. And in Eliot's case, as in that of most enthusiastic impetuous natures, it was almost a matter of course that, having become convinced of the unworthiness of his former leader, he should swing over to the extreme of fierce, implacable hostility to him. Accordingly, in the next parliament, in which, from the force of circumstances, Eliot was the leading spirit, his policy was in the main one of antagonism to the king, and finally culminated in the impeachment of Buckingham. For this he was sent to the Tower on 11th May, and not released until the 19th. In the parliament of 1628 Eliot raised his voice against arbitrary taxation, and was instrumental in forcing from Charles the celebrated Petition of Right. For having again protested formally against the king's proceedings in matters of taxation and religion, Eliot was, on 4th March 1629, sent, along with eight other members, to the Tower; and steadfastly refusing to acknowledge himself to have been in error, was kept in confinement until his death, on 27th November 1632. During his incarceration, Eliot composed an account of Charles's first parliament, *Negotium Posterorum* (first printed in 1881); a philosophico-political treatise, *The Monarchy of Man* (1879); and *An Apology for Socrates* (1881), a vindication of his own public conduct. Besides these he also left *De Jure Majestatis, a Political Treatise of Government*, and the *Letter-book of Sir John Eliot*, both published in 1882. See the Biography by John Forster (2d ed. 1871).

Eliot, SIR THOMAS. See ELYOT.

Eliot, SAMUEL, an American author, born in Boston in 1821, graduated at Harvard, and was professor of History and Political Science in Trinity College, Hartford, in 1856–64, being also its president in 1860–64. Between 1864 and 1874 he lectured there and at Harvard, and he afterwards filled important posts in the Boston schools. He received the degree of LL.D. from Columbia in 1863, and from Harvard in 1880. The first two parts of a *History of Liberty* appeared in 1847–49–53. He also published a *Manual of United States History* (1856; revised ed. 1873).

Eliott, GENERAL. See HEATHFIELD (LORD).

Elis, one of the ancient divisions of the Peloponnesus, bounded N. by Achaia, E. by Arcadia, and W. by the Ionian Sea. The northern and more fertile region, watered by the Penēus and numerous smaller streams, was famed for the excellence of its horses; the southern and more rugged district is drained by the Alphēus, which rises in the mountains of Arcadia. On its banks were the grove and temple of Olympic Zeus, and the plain in which the great Olympic games were celebrated. For long the sacred character of Elis, as the seat of the greatest of the national festivals, protected the country from invasion, but during the Peloponnesian war, the Athenians, and afterwards the Spartans, disregarded the privileges of the Eleans. See OLYMPIA, for excavations.

Elisha (in the authorised version of the New Testament, Elisæus), a prophet of Israel, the successor of Elijah. He exercised his functions for a period of fifty-five years, during the reigns of Jehoram, Jehu, Jehoahaz, and Jehoash (1 Kings, xix. 19; 2 Kings, ii.–ix., xiii. 14–21). Though a double portion of Elijah's spirit was promised to him, he displays little of his master's impetuous and uncompromising temper. The contrasts between the two prophets have been frequently discussed. Elisha is canonised in the Greek Church; his day is the 14th of June.

Elixir (Arab. *el iksír*, 'the philosopher's stone;' see ALCHEMY), a term in pharmacy which has come down from the days of Alchemy (q.v.). By the alchemists the term was applied to various solutions employed in the attempt to transmute metals. But the most notable elixir, sought after by many, was the *elixir vitæ*, 'the elixir of life,' that sublime, potent, perfect, invaluable preparation which, if discovered, would confer immortality or at least extreme length of life on him who drank it. The name has recently been appropriated to a class of American pharmaceutical preparations. These are very different from the old-fashioned elixirs, which corresponded in the main to our modern tinctures; for in the American elixirs the first object sought is to present the medicine under an agreeable form, even if frequently with a loss of potency. These newer elixirs are often highly alcoholic, and are sweetened and flavoured with great skill. In British pharmacy, *Elixir of Vitriol* is almost the only representative of the old class, and is prepared by mixing together sulphuric acid, alcohol, tincture of ginger, and spirit of cinnamon. This preparation, also known as aromatic sulphuric acid, is useful for quenching thirst, sharpening the appetite, checking profuse perspiration, and often reducing the action of the pulse. The dose may range from ten to forty drops, administered in syrup or water.

Elizabetgrad, a fortified town of South Russia, in the government of Kherson, 283 miles by rail NE. of Odessa, is an important military depôt, with a strong citadel. Soap-boiling, tallow-refining, and candle-making are the principal industries. Elizabetgrad was founded in 1754, and named after the Empress Elizabeth. In 1881 there were murderous assaults on the Jews, who are very numerous here. Pop. (1894) 58,418.

Elizabeth, capital of Union county, New Jersey, and formerly capital of the state, lies 5 miles SSW. of Newark by rail, with one quarter (generally called Elizabethport) on Staten Island Sound. It contains a court-house, city hall, and several good schools, and is the seat of a large Singer sewing-machine factory, and of a number of manufactories of oil-cloth, pottery, ironwares, hats, combs, &c. Elizabethport has steamboat communication with New York city, 12 miles to the north-west, and ships large quantities of anthracite coal; it also has several foundries. A great drawbridge over Staten Island Sound, 800 feet in length, with a draw-span 500 feet long, connects New Jersey here with the Staten Island shore. Pop. (1880) 28,229; (1885) 32,119; (1890) 37,764.

Elizabeth, Queen of England and Ireland, was the daughter of Henry VIII. by his second wife, Anne Boleyn, and was born in Greenwich Palace, 7th September 1533. From her father she inherited physical strength, resolution, energy, hauteur, a fiery temper, an inclination both to cruelty and to coarseness, and a passion for splendour; to her mother may be attributed such physical attractions as can be claimed for her, whatever of feminine piquancy flashed fitfully across her essentially masculine life, and probably also her insincerity, her jealousy, and her love of artifice. The marriage of her parents was a secret one, and when, in 1536, her mother was beheaded, and her father married Jane Seymour, she, as well as her half-sister Mary, the daughter of Catharine of Aragon, was declared illegitimate. Her early years were in consequence passed under a cloud, though profitably so far as intellectual discipline was concerned. The governesses and teachers, in whose society she spent most of her time till the death of her sister Mary, and of whom the chief were Lady Bryan, Lady Tyrwhitt, Sir John Cheke, William Grindal, and Roger Ascham, were almost all devotees to the New Learning, while some were adherents of those Reformation principles which her father partially accepted and established in England. Her accomplishments, like her charms, the ardour of her Protestantism, and even her patriotism and political foresight, were exaggerated by the historians-in-waiting of her reign. But it is beyond question that she learned to read Cicero, Sophocles, and even one or two of the Fathers in the original, to speak German and French with fluency, and to acquire a mastery over the then limited *technique* of music.

During the life of Elizabeth's father, two of her stepmothers, Anne of Cleves and Catharine Parr, looked upon her with a friendly eye, and the latter, but for her father's temper or dislike, would have had her much at court during the closing years of his reign. But till, on the death of Mary, she ascended the throne, she did not play an important part in English politics. During the reign of Edward VI. she, then a girl of sixteen, was subjected to the dubious attentions of Lord Seymour, High Admiral of England, and responded so far to them that her conduct was made the subject of a public inquiry. On her brother's death she took the side of her sister against Lady Jane Grey and the Duke of Northumberland, but her identification with Protestantism aroused the suspicion of Mary and her counsellors, and led to her being implicated in Wyatt's rebellion in 1554, and thrown into the Tower. Subsequently she was strictly guarded in Woodstock, and her adroit and seemingly not altogether insincere conformity to the Catholic ritual was probably the sole cause of her not sharing the fate of the leading Protestants of the time, and being sent to the block.

On the death of Mary, 17th November 1558, Elizabeth, then twenty-five years of age, was summoned to the throne amid the acclamation alike of Protestants, who saw in her advent a cessation to the persecutions of the preceding five years, and of Catholics, who had more than a suspicion of her indifferentism in ecclesiastical and theological matters. Although to the end of her life she retained a liking for the splendour of Catholic ceremonial, and had no sympathy with the doctrines of Geneva, her political sagacity enabled her at once to perceive that her part in Europe must be that of a Protestant sovereign, while her courage led her to act promptly. Having presumably taken the advice of Sir William Cecil (afterwards Lord Burghley), whom three days after her accession to the throne she appointed Chief Secretary, she issued a proclamation to the effect that the church service be read in English, and the elevation of the host be discontinued. She also ordered the English ambassador at Rome to notify to the reigning pontiff, Paul IV., her acceptance of the throne. Paul IV. replied that Elizabeth, being illegitimate, must resign all pretensions to the crown of England, which he claimed a right to dispose of, that country being a fief of the holy see. The only result of this assumption was to make Protestantism and patriotism in England synonymous. The Anglican Church, with its Thirty-nine Articles, its Book of Common Prayer, and its acknowledgment of the

headship of the sovereign, was there and then virtually established in its present form. The change that was effected was in no sense a revolution. Of the prelates who were in office when Elizabeth began her reign, only one, Walson, Bishop of Lincoln, agreed to the innovations contained in her proclamation, but of 9000 clergy, fewer than 200 resigned their livings.

To an exceptional extent, even for a sovereign with such strong absolutist instincts as Elizabeth, her life was bound up with the history of England (q.v.). Here, therefore, it will be necessary only to point out how her personal prejudices and opinions, and still more, her likes and dislikes, affected the policy of her country. The great blots upon her reign were the persecution of the Catholics, and the execution of Mary, Queen of Scots. It is impossible to say now how much feminine jealousy on Elizabeth's part of a woman with greater personal attractions than herself had to do with the precipitation of this tragedy, but it is unquestionable that such jealousy existed. The discovery of designs against her life, such as the Ridolfi plot, had probably also not a little to do with her final determination, and certainly led to the execution of the Duke of Norfolk. The great glory of Elizabeth's reign, on the other hand, was the destruction of the Spanish Armada in 1588; but for this great national deliverance but slight credit is due to Elizabeth. It is true that, when an army assembled at Tilbury to resist invasion, she showed the courage of her race, and addressed her troops in language which has the genuine ring of patriotism. But it is also true that she at first declined to admit the national danger, although it was apparent to all her advisers, that she hesitated lamentably as to the steps to be taken to meet it, and that her parsimony in such matters as the naval commissariat led to the risk of disaster, and prevented the victory which was actually won from being so complete as otherwise it would have been. The triumph of England over Spain is to be attributed to the wisdom and energy of Elizabeth's advisers, to the skill and courage of the great English captains of the time, and to the generous patriotism of English, and especially of London, merchants.

It would be difficult to say whether the romantic side of Elizabeth's life is more notable for its prominence or for its farcicality, if not unreality. From her sixteenth year to her fifty-sixth, one matrimonial scheme or violent passion, not always remarkable for delicacy, succeeded another. Before she ascended the throne, her name was mentioned in connection either with marriage or with love, not only with Admiral Lord Seymour, as already mentioned, but with Edward Courtenay, son of the Earl of Devonshire; the Earl of Arran; Philip of Spain, who married Mary; and Philibert of Savoy. After she became Queen of England, Philip renewed his courtship, while her hand was also solicited by or for Eric, king of Sweden, Henry III. of France, his successor Henry of Navarre, the Archduke Charles of Austria, and the Duke of Alençon. Letters preserved in Hatfield show that she cherished an attachment for the last until he died, worn out with debauchery, in 1584; although at the time they first met she was thirty-eight and he nineteen, and a dwarf with a face horribly disfigured by smallpox. But her heart was most profoundly touched by Robert Dudley, Earl of Leicester (q.v.), master of the horse, an accomplished courtier, and a handsome and clever, though dissolute and essentially shallow man. She indicated her partiality for him even before the death of his wife, the ill-fated Amy Robsart. The despatches of the Bishop of Aquila, ambassador of Philip II. in London, represent her indeed as accessory to the 'murder' of Amy, and as being willing to become a Roman Catholic, provided Philip consented to her marriage with Leicester. But the bishop violently disliked Elizabeth, and there is every reason to believe that he was befooled by her, while it is by no means certain that the death of Leicester's wife was the result of foul play. But it is unquestionable that Elizabeth would have married Dudley but for the remonstrances of her chief adviser, the elder Cecil. After Leicester's death, Robert Devereux, second Earl of Essex (q.v.), succeeded to his position as favourite. But Elizabeth's relations towards Essex, as indicated by outbursts of temper as well as of affection, were essentially those of a mother towards a spoiled child. When Essex was beheaded for rebellion in 1601 she does not seem to have exhibited much grief. The eccentricity of Elizabeth was shown even more in her passion for adulation and extravagance in dress than in her coquetries. Raleigh felt constrained to compare her in a breath to Alexander, Diana, Venus, Orpheus, an angel, and a nymph. She is Shakespeare's 'fair vestal throned by the west,' and Spenser's Gloriana. Paul Hentzner, a German, who saw her going to chapel when she was in her sixty-fifth year, says that at that time she 'had pearls with rich drops in her ears, wore false red hair, had a small crown on her head, her bosom uncovered, her dress white silk, bordered with pearls of the size of beans, a collar of gold and jewels.' So long as she retained any activity she attended theatrical and other pageants; and the more splendid these were, the more they were to her taste. The vigorous style of her dancing was commented on sarcastically by her enemies. The variety and number of her dresses have passed into a proverb. When every allowance has been made for the manner in which Elizabeth's charms were enhanced by her own artifices, and by the flattery of her courtiers, she must still be believed to have had some personal attractions. When young she was noted for her abundance of auburn hair and mobile though regular features, while Hentzner found her 'stately and majestic,' and remarked 'a special beauty in her delicate white hands.'

Patriotic as Elizabeth was after her own peculiar fashion, she was outside of and had no sympathy with either the intellectual or the religious movements of her time. Protestantism in the form of Puritanism she abhorred; she was indifferent to the genius of Shakespeare, though his plays were performed before her. She never advanced beyond the essentially classical studies of her girlhood; yet, in virtue mainly of translations from Greek, Latin, and French, she has been included by Horace Walpole in his *Catalogue of Royal and Noble Authors*.

A personal interest attaches to the last years of Elizabeth's reign, owing to her great loneliness. This was due in large measure to the fact that her leading advisers and friends, including Burghley, Walsingham, Hatton, Bacon, and Warwick, predeceased her. Their places were taken by other men of ability, Sir Robert Cecil, Burghley's second son, being in particular both a skilful diplomatist and an accommodating courtier. But she never was on exactly the same terms with them as she had been with their predecessors. She also felt lonely in a political sense. She had inherited Tudor views as to the absolute supremacy of the crown over parliament. During the last thirteen years of her reign parliament assembled three times, in 1592, 1597, and 1601, and although, partly owing to her tact and partly to its timidity, no actual collision occurred between them, it protested against monopolies, and sought to curtail Elizabeth's expenditure. With such manifestations of public spirit Elizabeth could have no sympathy, and indeed she felt somewhat of a stranger in her own country, and among a

people whose intellectual, religious, and even political ideas were widely different from, and in some cases diametrically opposed to her own. Nevertheless, her indomitable spirit enabled her to retain her zest for the pleasures of life; to the last, too, she retained her indifference to the sufferings of others. As late as the year 1601 she was able to give receptions, to visit at the country-houses of wealthy subjects, and even to comport herself after the fashion of a hoydenish school-girl. Within a few weeks of her death a seminary priest of the name of Richardson was hanged and disembowelled at Tyburn. In the beginning of 1602 those immediately about her noticed a decline in her health. She revived temporarily, however, and was able to ride, hunt, and even dance once more. In the second week of 1603 she caught cold, and never recovered. In February she was seized with sickness, which was aggravated by melancholy. She would take no medicine and little food, refused to go to bed, and rested in silence day and night on cushions. She continued in this condition till March 24, when she died in the presence of her council. She had previously made a sign with her hands in answer to a question by Cecil, which was interpreted as indicating her wish to be succeeded by James VI. of Scotland.

'The golden days of good Queen Bess' are more than ever regarded as one of those periods of British history of which we have as a nation much reason to be proud. It is emphatically the period in which Great Britain took up her position as a 'world power,' and it is impossible to believe that Elizabeth had no personal part in making it what it was. The 'Virgin Queen' nearly stands revealed by history as cruel, capricious, insincere, at once unpleasantly masculine and weakly feminine, but she was highly popular with her subjects, and this popularity cannot be quite explained away by circumstances outside of herself. She had unquestionably the invaluable faculty—in her case it amounted almost to genius—of selecting as her advisers on political affairs the most capable of the men around her.

Of the many biographies of Elizabeth, Miss Strickland's Life is, on the personal side, the best; M. Wiesener's *La Jeunesse d'Elisabeth d'Angleterre* (Paris, 1878; Eng. trans. 1879) may also be consulted. The most reliable authorities on the public events of her reign are the calendars of the state papers, especially the calendar of the MSS. at Hatfield, and the calendar (1509–1603) of the state papers relating to Scotland. Among historical works dealing with this period, Mr Froude's, in spite of the doubts which have been thrown on his accuracy by able critics, is still the best and most exhaustive. Hallam, Lingard, Birch's *Reign of Queen Elizabeth* (1754), Wright's *Queen Elizabeth and her Times* (1838), Dean Church's *Elizabeth* (1889), and Motley's *Rise of the Dutch Republic* and *History of the United Netherlands* should also be consulted. Essays on Elizabeth are innumerable; that of Dr Jessopp (1889), contributed to *The Dictionary of National Biography*, will be found exceptionally bright and comprehensive. See also the articles MARY, QUEEN OF SCOTS; BURGHLEY, ARMADA, LEICESTER, ESSEX, DRAKE, RALEIGH; and for the Elizabethan Literature, see ENGLAND (LITERATURE OF), and DRAMA.

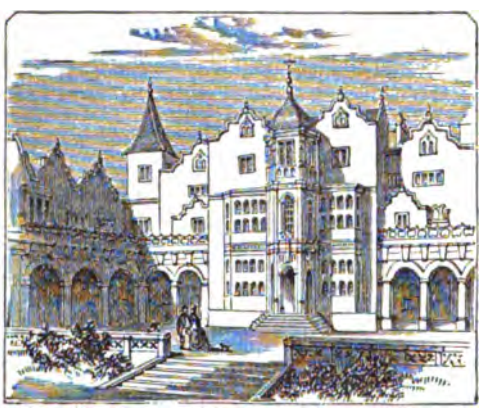
Elizabeth, Queen of Bohemia, forms the connecting link between the ancient royal families of England and Scotland and the present reigning dynasty. Daughter of James VI. of Scotland and I. of England, she was born in the palace of Falkland, 19th August 1596, educated in England, and in 1613 married to Frederick V. (q.v.), Elector Palatine, who in 1619 was chosen by the Bohemian estates to fill the throne of Bohemia. The following year the army of the 'Winter King' was routed by the forces of the Catholic League, and the royal family took refuge in Holland, where they had to endure sore poverty. Of the thirteen children of Elizabeth, mention may be made of Charles Louis, who was restored to the hereditary electorate at the close of the Thirty Years' War in 1648; Rupert, the 'mad cavalier;' Maurice, who also fought in England during the Civil War; and Sophia, who was married to Ernest Augustus of the House of Brunswick, afterwards Elector of Hanover. After the Restoration Elizabeth went to England, where she died February 13, 1662. When in 1701 the question of succession to the crown of Great Britain was debated, it was found that all the descendants of James I. were either dead or were Roman Catholics, except Sophia, Electress of Hanover, and her family. By act of parliament the crown was accordingly secured to her and her descendants, 'being Protestants;' and in virtue of this Act of Settlement, on the death of Queen Anne Sophia would have ascended the throne, but she predeceased the queen three months, and her son became king of Great Britain as George I., August 12, 1714. In this extraordinary and unforeseen manner did the unfortunate queen of Bohemia originate the dynasty of the reigning monarch. In her prosperity fond of luxury and magnificence, in adversity a devoted wife and mother, she was always resolute and vivacious, and exercised a singular charm over her contemporaries. See her Life in Mrs Everett Green's *Lives of the Princesses of England* (1851); Gardiner's *History of England;* and the *Memoirs of Sophia, Electress of Hanover* (trans. 1888).

Elizabeth, MADAME (1764–94), a French princess, sister of Louis XVI. (q.v.).

Elizabeth, ST, daughter of Andreas II., king of Hungary, was born at Presburg in 1207. At the age of four she was affianced to the Landgraf of Thuringia, Louis IV., and brought to his court in the Wartburg near Eisenach to be educated under the eyes of the parents of her future husband. She early displayed a passion for the severities of the Christian life. She despised pomp, and ambition, cultivated humility, and exhibited the most self-denying benevolence; her conduct even as a girl astonished the Thuringian court. The marriage took place when Elizabeth was only fourteen. Louis himself, far from blaming the devout girl whom he had made his wife for her long prayers and ceaseless almsgiving, was himself partially attracted to a similar mode of life. A boy and two girls were the fruit of their union. Louis died as a crusader at Otranto in 1227. Great misfortunes soon befell the saintly landgravine. She was deprived of her regency by the brother of her deceased husband, and driven out of her dominions on the plea that she wasted the treasures of the state by her charities. At last she found refuge in a church, where her first care was to thank God that he had judged her worthy to suffer. Subsequently, after other severe privations, such as being forced to take up her abode in the stable of a hostelry, she was received into the monastery of Kitzingen by the abbess, who was her aunt. When the warriors who had attended her husband in the crusade returned from the East, she gathered them round her, and recounted her sufferings. Steps were taken to restore to the unfortunate princess her sovereign rights. She declined the regency, however, and would only accept the revenues which accrued to her as landgravine. The representations of other potentates soon induced her brother-in-law to allow her to return to Marburg, and to draw a yearly revenue of 500 marks. She now devoted herself wholly to a life of asceticism, put on nun's raiment, and took up her residence in a cottage at the foot of the hill on which stood her castle of Marburg. The remainder of her days were

devoted to incessant devotions, almsgivings, and mortifications. All her revenues were given to the poor, and what she required she earned with her own hands. She died 19th November 1231, and was canonised four years after by Pope Gregory I. Miracles surrounded her even during her lifetime; thus a basket conveying provisions to the poor, when opened by a suspicious person, was found to contain nothing but roses. Above her grave at Marburg the beautiful Elisabeth-kirche was founded in 1236. See Montalembert's *Histoire de Sainte Elisabeth de Hongrie* (1836; 17th ed. 1880). Kingsley's *Saint's Tragedy* (1848) is based on the story of Elizabeth's life.

Elizabethan Architecture, a term applied to the mixed style which sprang up on the decline of Gothic architecture. It is chiefly exemplified by mansions erected for the nobility in the reigns of Elizabeth and James I., and originated in the first attempt to revive classic architecture. This tendency came from abroad, and was influenced, no doubt, by Holbein, who was patronised by



Holland House.

Henry VIII., and furnished several designs in this manner. John of Padua succeeded him, and built in the mixed style a palace for the Protector Somerset (for which purpose the cloisters of St Paul's were taken down), and the mansion of Longleat for his secretary, Sir John Thynne. At first the classic forms were applied to the details only, and the old English design was preserved, both as regards the plan and general aspect of the exterior; but by degrees the classic taste pervaded the whole design. Thus the bow-windows and turrets of the Tudor style are preserved, but their decoration is treated with classic cornices and pilasters instead of Gothic enrichments. The vast dimensions of the apartments, the extreme length of the galleries, and enormous square windows are leading characteristics of this manner of building. The ornaments both within and without were cumbrous but picturesque, while the plaster ceilings wrought into compartments are amongst the most original and striking features. In short, the architecture was in keeping with the dress of the period, rich and gorgeous, rather than elegant and graceful; but the domestic arrangements and general planning of the houses were carried to a degree of completeness and comfort which has scarcely been exceeded since. The following examples of mansions of the 17th century may be still seen near London: Holland House, Campden House, Sir T. Willow's at Charlton, the Marquis of Salisbury's at Hatfield, and Knowle, the property of the Duke of Dorset. The most eminent architects of those times were John Thorpe, Gerard Christmas, Rodolph Symonds, and Thomas Holt.

Elizabeth Petrovna, Empress of Russia, daughter of Peter the Great and Catharine I., was born in the year 1709. Of doubtful legitimacy, and apparently indifferent to everything but the gratification of her passions, she did not oppose the accession of the boy Peter II. in 1727, of Anna, Duchess of Courland, in 1730, and of the infant Ivan VI. in 1740. In 1741 the infant emperor was deposed, and Elizabeth raised to the throne, chiefly by the agency of Lecocq, a surgeon, and the Marquis de Chetardie, the French ambassador. In the following year Elizabeth proclaimed as her successor Peter, the son of her sister the Duchess of Holstein-Gottorp. During this reign a war with Sweden was brought to a successful conclusion by the peace of Abo. The anti-Prussian policy of her advisers and her personal animosity towards Frederick II. led her to take part in the war of the Austrian Succession and in the Seven Years' War, before the close of which she died in January 1762. Though profligate in conduct, she was strict in the observance of the public ordinances of religion. Averse to business, she was guided by favourites, while corruption prevailed in every department of the state. She founded the university of Moscow and the Academy of Art at St Petersburg.

Elizabethpol, a town of Russian Transcaucasia, is situated on a tributary of the Kur, at an altitude of 1450 feet. Its streets are narrow and its houses mean, but it has several mosques and churches, the mosque of Shah Abbas being particularly fine. Elizabethpol is not a healthy town; its inhabitants, about 19,000 in number, are compelled to retire to the hills in summer. The town and its vicinity are famous for their fruit-trees; and horticulture, the breeding of silkworms, and agriculture are the chief industries of the place. Elizabethpol was formerly known as Gansha or Kanga, and belonged to the Turks. The modern town was founded by Shah Abbas of Persia, but fell into the hands of the Russians in 1804. On 25th September 1826 the Persians were defeated here by the Russians under Paskevitch.

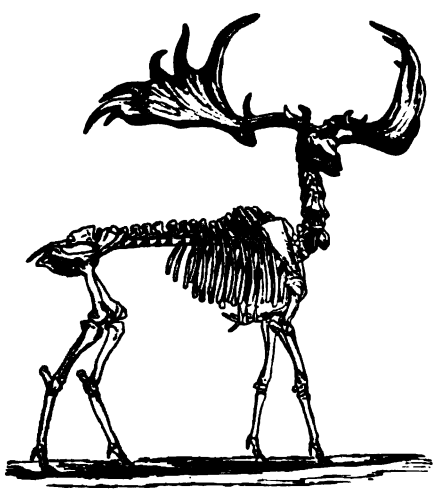
Elk, or MOOSE (*Alces machlis*, or *palmatus*), the largest living deer, a magnificent animal of circumpolar distribution, in Europe, Asia, and especially in America. It is the only species of its genus or sub-genus, but is nearly allied to Cervus (see DEER). It must be distinguished from the Wapiti (*Cervus canadensis*), with which it is often, verbally at least, confused. The adult elk usually stands about six feet high at the shoulders, and may exceed even this noble stature. The male bears very broad (palmate) divergent antlers, with which it has been known to kill a wolf at a single blow. The general colour is dark reddish-brown, but becomes slightly lighter and grayer in winter. The limbs, especially the fore-legs, are very long, and as the neck is short, the elk browses more upon bushes and the like than upon the ground herbage, which it is but little adapted to reach. The tail is very small. More detailed characters are the broad hairy nostrils, the overhanging upper lip, the small

Head of Elk (*Alces machlis*).

eyes and tear-pits, the long and broad ears, the low stiff mane on the back of the neck, the loose mane on the lower side of the neck and on the breast, the long brittle hair, &c. The antlers form between them a sort of basin, for each broadens out in a great shovel-shaped expansion, with marginal prongs or snags, increasing as usual with the years of life. The entire 'head'—i.e. the pair of antlers, sometimes weighs 40 lb., while adult animals are said to weigh in all about 10 cwt. The young male elks do not begin to acquire antlers till they are nine months old, and growth seems to go on for fourteen years. The younger elks are also marked by a large goitre-like swelling under the throat.

Elks are for the most part solitary in their habits, except at the breeding season. They delight in marshy places and in forests. The widely separating halves of the hoof enable them to find firmer foothold in soft ground or among snow. In the forest, their magnificent antlers, as Mr Darwin notes, must sometimes be rather in the way than otherwise. When walking leisurely, they carry themselves so well that entanglement is avoided, but it is easy to see how the case is altered when, with head thrown back, they flee before the wolves. The usual gait is a shambling trot, but the elk can also gallop rapidly. Only when the deep snow impedes it are the hunters, aided with snow-shoes, able to run it down. The usual method of hunting is to steal upon the elk as it rests, but as its senses are extremely acute and the trails often confused, successful capture is regarded as a feat. Naturally timid and inoffensive, the disposition changes in the breeding season. The male elks fight with one another, and are at that season sometimes decoyed to the hunter, who imitates the sounds of a rival. As the elk is then furious, this device demands strong nerve and sure aim.

The European and Asiatic distribution of the elk is now much restricted. In Germany, for instance, they were abundant in the time of Cæsar, but are now all but extinct. In the Baltic provinces, in



Skeleton of Irish Elk (*Megaceros hibernicus*): Height to summit of antlers, 10 feet 4 inches.

Northern Russia, in Norway and Sweden, they still occur, but not in the abundance which is still exhibited in North America. Domestication has been tried with success, and the animal trained to the sledge. The flesh is esteemed a good kind of venison; the fat is remarkably soft; the nose and tongue are reckoned delicacies. The skin is used for a variety of purposes. As the elk feeds largely on leaves, buds, and bark, it does considerable damage to forest trees.

Elk, Irish (*Megaceros giganteus* or *hibernicus*), a giant deer now extinct, known from the remains found in the Pleistocene diluvium of Middle Europe, Britain, and especially Ireland. It must have been a magnificent animal, standing about 6 feet high at the shoulders, and probably very like a fallow-deer. The antlers formed the most striking feature. They have their own peculiarities, but recall in part those of the quite distinct modern elk, and also those of the fallow-deer. Antlers have been found 5 feet in length, while a straight line drawn between the extreme tips in one specimen measured 10 feet 10 inches. In a specimen where the skull alone weighed 5¼ lb. the antlers weighed 81 lb. Associated with such an enormous head-growth we naturally find large and strong neck vertebræ and fore-limbs. The skeletons are to be seen in most museums. See Deer.

Elkesaites. See Ebionites.

El-khargeh. See Oases.

Elkhart, a town of Indiana, at the junction of the St Joseph and Elkhart rivers, 101 miles E. by S. of Chicago by rail, with a rolling-mill, several planing-mills, machine-shops, and railway workshops, and manufactures of paper, flour, and starch. Pop. (1880) 6953; (1890) 11,360.

Ell (allied to *el*bow, Ger. *ellen*bogen, Lat. *ulna*, 'the forearm'), a measure originally taken in some vague way from the arm, and which has been used to denote very different lengths. The English ell, as a measure of cloth, is equal to 1¼ yard (q.v.), the Flemish to ⅝ yard, and the French to 1⅛ yard.

Elland, a town in the West Riding of Yorkshire, on the river Calder, 3 miles SE. of Halifax by rail. It has some cloth-mills, and there are valuable stone-quarries in the vicinity. Pop. 9991.

Ellenborough, Earl of. Edward Law, first Earl of Ellenborough, was eldest son of the first Baron Ellenborough (1750–1818), Chief-justice from 1802 of the King's Bench. Born 8th September 1790, he entered parliament in 1813, held office under several administrations, and in 1841 was appointed Governor-general of India. He received the thanks of parliament in 1843 for his 'ability and judgment' in supporting the military operations in Afghanistan, but his treatment of the civil servants of the Company, and his policy of conciliating the natives by oriental display and proclamations which appeared to sanction idolatry, led to his recall in 1844. Supported by the ministry, he was created Viscount Southam and Earl of Ellenborough, and in 1846 was First Lord of the Admiralty under Peel. In the Derby administration of 1858 he was Minister for India, but the publication of a despatch in which he severely rebuked Viscount Canning forced him to resign in order to avert the overthrow of the government. He afterwards took a frequent and influential part in the debates of the Upper House. In 1863 he expressed strongly his sympathies on behalf of Poland, and in 1864 advocated British intervention in favour of Denmark. Ellenborough died without issue, December 2, 1871, when the barony devolved on a nephew, but the earldom and viscounty became extinct. See *History of the Indian Administration of Lord Ellenborough*, by Lord Colchester (1874), who also edited his *Political Diary, 1828–30* (1881).

Ellery, William (1727–1820), born in Newport, Rhode Island, sat in the congress of 1776, and was one of the signers of the Declaration of Independence. From 1790 till his death he retained the office of collector in his native place.

Ellesmere, a town of Shropshire, near a beautiful lake or mere of 120 acres, 19 miles NNW.

of Shrewsbury. Pop. 1875. The Ellesmere Canal, connecting the Severn and the Mersey, passes here. It is carried across the Dee and the Vale of Llangollen by Telford's Ellesmere Aqueduct (1805), 1007 feet long and 127 high. Ellesmere Port, at its mouth, on the Mersey, is a station on the line of the Manchester Ship Canal.

Ellesmere, FRANCIS EGERTON, first EARL OF, was second son of the first Duke of Sutherland, and was born in London, 1st January 1800. Educated at Eton and Christ Church, Oxford, he sat for Bletchingley, Sutherland, and South Lancashire, and successively (1828–30) held the offices of Irish Secretary and Secretary for War. In 1833, on succeeding to his father's Bridgewater estates, he assumed the name of Egerton, in lieu of his patronymic Leveson-Gower, and in 1846 became Earl of Ellesmere and Viscount Brackley. He translated *Faust* fairly, published an interesting record of his travels, and was a generous patron of the arts. He died 18th February 1857.

Ellice Islands are in the South Pacific, due N. of Fiji, and SW. of Samoa; extending for some 360 miles from NW. to SE. between 5½° and 11° S. lat., and 176° and 180° E. long. They consist of nine groups of atolls or coral islands, one of which groups, known specially as Ellice Islands (the main island in it being Funafuti), was discovered in March 1819 by the American Captain Peyster, in the *Rebecca*. Another of the atolls had previously been discovered in 1781. The population of the whole archipelago, exclusive of Samoan missionaries and a few white traders, has been given at about 2500 Polynesians, mostly Christianised. Like the people of Samoa and Tonga, they have a fine physique, and are peaceable in disposition. The islands grow little but cocoa-nut trees, copra being the main export. They have not been annexed by any European power, and British subjects within their limits are subject to the jurisdiction of the High Commissioner for the Western Pacific.

Ellichpur, chief town of a district (area, 2623 sq. m.; pop. 313,805) of the same name, in the north of Berar, was at one time capital of the Deccan, and is said to have contained 40,000 houses. Its buildings include an extensive palace (fast falling to ruin), a detached fort, the burial shrine of Dalla Ráhman, and several handsome tombs of the nawábs. The military cantonment of Paratwada is 2 miles distant. Pop. (1881) 26,728, with a force of 9445 troops; (1891) 36,240.

Ellicott, CHARLES JOHN, Bishop of Gloucester and Bristol, was born 25th April 1819, at Whitwell, near Stamford, of which parish his father was rector. He was educated at Oakham and Stamford schools, and at the university of Cambridge, where he graduated in 1841, and was elected fellow of St John's College. He became rector of Pilton, Rutlandshire, in 1848, professor of Divinity at King's College, London, in 1858, Hulsean lecturer at Cambridge in 1859, and Hulsean professor of Divinity the year after. He was nominated Dean of Exeter in 1861, and raised to the episcopal bench in 1863. His episcopate has been honourably distinguished by the most vigorous and catholic-spirited activity in educational, missionary, and church extension work. Dr Ellicott was chairman for eleven years of the New Testament Revision Committee. He is best known as a commentator on the Epistles of the New Testament, and is distinguished for thoroughness of grammatical criticism. He has published critical and grammatical commentaries on Galatians (1854), Ephesians (1855), Philippians, Colossians, Thessalonians, Philemon, and the Pastoral Epistles (1861); works on the Sabbath, on Scripture and its Interpretation, and on Modern Scepticism. A useful work which he has edited is *A New Testament Commentary for English Readers* (3 vols.), and a corresponding work on the *Old Testament* (5 vols.).

Elliot, JEAN, the author of 'The Flowers of the Forest,' a touching lyric on the disaster of Flodden, was the daughter of Sir Gilbert Elliot of Minto House, Teviotdale, where she was born in 1727. The greater part of her life was spent in Edinburgh (1756–1804). She died at the family seat or at Monteviot, on 29th March 1805. Her eldest brother, Sir Gilbert Elliot (1722–77), was himself a song-writer; whilst John, the third brother, who died in 1808, was a distinguished admiral. See MINTO.

Elliotson, JOHN, an English physician, was born in London in 1791. After leaving Jesus College, Cambridge, he studied medicine at Edinburgh and London, and was for five years assistant physician at Guy's Hospital. In 1831 he became professor of the practice of medicine in the university of London, and took an active share in the establishment of University College Hospital. He was at this time one of the foremost physicians of London, and a successful lecturer. In 1837 he became a convert to mesmerism, which cost him his professorship in 1838, but did not apparently much diminish his private practice. He died in London on 29th July 1868. Besides being one of the first to use the stethoscope, Elliotson conducted numerous useful experiments as to the action of drugs, and did much to encourage the practice of clinical study. He was the founder of the Phrenological Society. His name will live securely from its connection with Thackeray's *Pendennis*.

Elliott, EBENEZER, the Corn-law Rhymer, was born of mixed moss-trooper and yeoman ancestry at the New Foundry, Masbro', in Rotherham parish, Yorkshire, on 17th March 1781. A shy and morbid boy, who proved a dull pupil at four different schools, he worked in his father's foundry from his sixteenth to his twenty-third year, and threatened to become a 'sad drunken dog,' till the picture of a primrose in Sowerby's *Botany* 'led him into the fields, and poetry followed.' His *Vernal Walk*, written at sixteen, was published in 1801; to it succeeded *Night* (1818), *The Village Patriarch* (1829), *Corn-law Rhymes and the Ranter* (3d ed. 1831), and other volumes—collected in 1840 (new ed. 2 vols. 1876). He had married early, and sunk all his wife's fortune in his father's business; but in 1821, with a borrowed capital of £100, he started on his own account as a bar-iron merchant at Sheffield, and throve exceedingly, 'making £20 a day sometimes without stirring from his counting-house, or ever seeing the goods he disposed of.' Though in 1837 he lost fully one-third of his savings, still in 1841 he was able to retire with good £300 a year to a house of his own building at Great Houghton, near Barnsley. Here he died 1st December 1849.

Elliott the poet is well-nigh forgotten. His poems are nowadays little more read than in his lifetime was his tragedy *Tauruscides*. It had three readers, Elliott one of them. But Elliott the Corn-law Rhymer is still remembered as the Tyrtæus of that mighty conflict whose triumph he lived to witness, as the typical maker of ballads, not needing to care who should make the laws of the nation. This Corn-law Rhymer had been bred a 'Berean' and Jacobin; yet he hated Communists, Socialists, and physical-force Chartists; he lies buried in Darfield churchyard; he left two sons Established clergymen. His whole life long he looked on the Corn-laws as the 'cause of all the crime that is committed;' agriculturists, he maintained, 'ought not to live by robbing and murdering the manufacturers.' On the other hand, 'Capital has a

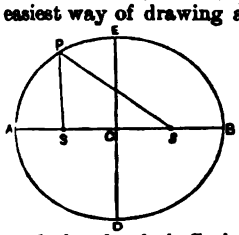
right to rule the world,' and 'competition is the great social law of God.'

There are two poor memoirs of Elliott, by his son-in-law, John Watkins (1850), and by 'January Searle'—i.e. George S. Phillips (1850). See also Carlyle's essay from the *Edinburgh*, July 1832, and Prof. Dowden in Ward's *English Poets* (2d ed. 1883).

Elliott [Eliott], GENERAL. See HEATHFIELD (LORD).

Ellipse, a geometrical curve and figure, intermediate to the circle and parabola (see CONIC SECTIONS). It is of great importance in Astronomy, being the shape of the orbit described by a planet under the action of gravitation. Mathematically, the ellipse is a closed curve, every point of which has the sum of its distances from two fixed points always the same. These two fixed points are called the foci; and the diameter drawn through them is the major axis; the minor axis bisects the major at right angles. The distance of either focus from the middle of the major axis is the *eccentricity*. The less the eccentricity, as compared with the axis, the nearer the figure approaches to a circle. When the foci coincide the ellipse becomes a circle, and when they are infinitely apart it becomes a parabola. The tangent at any point of the curve is always equally inclined to the two focal distances; and any diameter bisects all the chords which are parallel to the tangents at its extremities.

The Trammel or Elliptic Compass affords the easiest way of drawing an ellipse. It depends on the principle that when a line of fixed length moves so that its extremities are always on two fixed perpendicular lines, any point in it must describe an ellipse. A simple practical method is by passing a loop of thread over two pins stuck in the foci, S*s* in the diagram, the length of the loop being equal to SB. If the point of a pencil be put into the loop P, and moved round so as to keep it stretched, the pencil will trace an ellipse AEBD. There are also various ways of approximating to the figure by the use of circular arcs.



The equation to an ellipse (see GEOMETRY, ANALYTICAL), referred to its centre as origin, and to its major and minor axes as rectangular axes, is $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, where a and b are the semi-major and semi-minor axes respectively. From this equation it may be shown, by the integral calculus, that the area of an ellipse is equal to πab; or is got by multiplying the product of the semi-major and semi-minor axes by 3·1416. It may also be shown that the length of the circumference of an ellipse is got by multiplying the major axis by the quantity $\pi\left\{1-\left(\frac{1}{2}\right)^2\frac{e^2}{1}-\left(\frac{1.3}{2.4}\right)^2\frac{e^4}{3}-\left(\frac{1.3.5}{2.4.6}\right)^2\frac{e^6}{5}-\text{\&c.},\right\}$ to which there is an excellent practical approximation, viz., $\frac{\pi}{2}\left(a+b\sqrt{2(a^2+b^2)}\right)$. The eccentricity, e, is $=\sqrt{1-\frac{b^2}{a^2}}$ and the *ellipticity* is the ratio $a-b$ to a.

Ellipsis (Gr., 'omission') is a term used in Grammar and Rhetoric, to signify the omission of a word necessary to complete the expression or sentence in its usual form. The object of ellipsis is shortness and impressiveness; accordingly, it prevails in proverbs. Ellipses are used in all languages, but the same forms of ellipses are not common to all.

Ellipsoids are of two kinds, the simpler being those of revolution, produced by an ellipse turning round the major or the minor axis. The surfaces so generated are known as probate and oblate spheroids respectively, and our globe is a well-known instance of the latter. The ellipsoid proper has three rectangular axes of different lengths, and its section in any direction is an *ellipse*, whereas the spheroids must give a circular section if cut at right angles to the axis of revolution.

Ellis, ALEXANDER JOHN (formerly Sharpe, the name having been changed by royal license in 1825), a learned philologist, was born on the 14th June 1814, and educated at Shrewsbury, Eton, and Trinity College, Cambridge, where he graduated sixth wrangler in 1837. He was elected a Fellow of the Royal Society in 1864, and of the Society of Antiquaries in 1870, was president of the Philological Society during 1872–74, and also 1880–82, and was a member of the Mathematical Society of London. He wrote numberless papers of great learning on mathematical, musical, and philological questions, and did more than any other scholar to advance the scientific study of phonetics, of early English pronunciation, and of existing English dialects. Of his many and valuable books the most important are *Essentials of Phonetics* (1848); *Universal Writing and Printing* (1856); *Early English Pronunciation, with especial reference to Chaucer and Shakespeare* (6 parts, 1869–89); *Practical Hints on the Quantitative Pronunciation of Latin* (1874); and a translation of Helmholtz's *Sensations of Tone as a Physiological Basis for the Theory of Music* (1875; 2d ed. 1885). Died October 28, 1890.

Ellis, SIR HENRY, antiquary, born in London in 1777, was educated at Merchant Taylors' School, and at St John's College, Oxford, of which he became a Fellow. Having been for some time assistant-librarian to the Bodleian at Oxford, in 1800 he received an appointment at the British Museum, of which he became principal librarian in 1827. He received the honour of knighthood from William IV. in 1833. Ellis retired from the museum in 1856. He was for many years director, and one of the secretaries, of the Society of Antiquaries. His *Introduction to Domesday Book* was published in 1833; his *Original Letters illustrative of English History*, issued in three series, in the years 1824–46; and his invaluable edition of Brand's *Antiquities*, in 1813. He was likewise the author of a *History of the Parish of St Leonard, Shoreditch*, and of works on the Townley and Elgin Marbles, and was the chief editor and writer of the English portion of the edition of Dugdale's *Monasticon* (1817–30). His works exhibit much learning and research. He died in London, 15th January 1869.

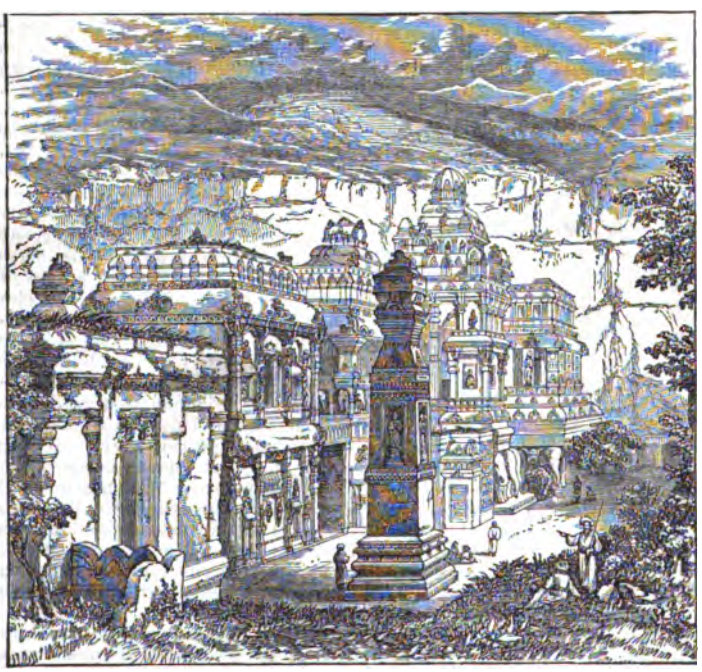
Ellis, WILLIAM, an eminent English missionary, was born in London, 29th August 1794. He was brought up as a gardener, but having offered himself to the London Missionary Society, was trained and despatched in 1816 to the South Sea Islands, where he laboured for nearly ten years, first at Eimeo, next at Oahu, one of the Sandwich Islands. The illness of his wife obliged him to return to England in 1825, after which he became foreign secretary to the London Missionary Society. Meantime his *Tour through Hawaii* (1826) and his *Polynesian Researches* (1839) extended his fame as a missionary of rare earnestness and enthusiasm, and still rarer intelligence and breadth of sympathy. His wife died in 1835, and two years later he married Sarah Stickney, who for many years conducted a school for girls at Hoddesdon in Hertfordshire, and wrote many excellent and popular books, as *The Women of England* (1838), *The Daughters of England* (1842), *The Wives of Eng-*

land (1843), *Hearts and Homes* (1848–49), and *The Mothers of Great Men* (1859). Ellis published in 1838 a history of Madagascar, and in 1853 he was sent to that island with a view to improve the condition of the Christians there. He made four different visits to the island, the last extending over four years (1861–65), and by his tact and sagacity did much to settle the external relations of the Christians on a safe basis. His *Three Visits to Madagascar* (1858), *Madagascar Revisited* (1867), and *The Martyr Church of Madagascar* (1870), besides their personal and religious interest, are still the best books we possess on the history, the scenery, the productions, and the people of Madagascar. Ellis died 9th June 1872; his wife, but a week later. See the Life by his son (1873).

Elliston, ROBERT WILLIAM, actor, was born in London, the son of a watchmaker, in 1774, and was educated at the expense of his uncle, who was master of Sidney College, Cambridge. In 1791 he ran away from home, and made his first appearance on the stage at Bath, where his Romeo in 1793 lifted him into public favour. In 1796 he appeared at the Haymarket and Covent Garden; and after 1803 he made London his headquarters, though still making occasional essays as a provincial manager. He was a member of the Drury Lane company in 1804–9 and 1812–15; in 1819 he became lessee and manager of the theatre, from which, in 1826, he retired a bankrupt. He afterwards played in the Surrey Theatre; but years of dissipation had shattered his health, and an apoplectic seizure brought on his death, 8th July 1831. Elliston was an actor of wonderful versatility, the first comedian and one of the first tragedians of his day, and in Leigh Hunt's estimation the 'best lover on the stage both in tragedy and comedy;' Lamb's eulogy is well known. See the Life by Raymond (2 vols. 1845), and the article by Joseph Knight in *Dict. Nat. Biog.* (vol. xvii. 1889).

Ellora, a village in the Nizam's dominions, 13 miles NW. of Aurungabad. It is celebrated for its wonderful rock-cut temples. Of these there are 34 of a large size, Buddhist, Brahmanical, and Jain. Some are cave-temples proper—i.e. chambers cut out in the interior of the rock—but others are vast buildings hewn out of the solid granite of the hills, having an exterior as well as an interior architecture, and being, in fact, magnificent monoliths. In executing the latter, the process was first to sink a great quadrangular trench or pit, leaving the central mass standing, and then to hew and excavate this mass into a temple. The most beautiful of these objects is the Hindu temple, called the Kailás, dedicated to Siva. At its entrance the traveller passes into a large antechamber adorned by numerous rows of pillars. Thence he ascends a few steps into a great rectangular court, averaging 276 feet in length and 154 in width, in the centre of which stands the temple itself, a vast mass of rock richly hewn and carved. It is supported by four rows of pilasters, with colossal elephants and other animals beneath, and seems suspended in the air. The interior is about 103 feet long, 56 broad, and 17 high, but the entire exterior forms a pyramid 164 feet long, 109 wide, and 100 high, and is overlaid with sculpture. In the great court are numerous ponds, obelisks, colonnades, sphinxes, and on the walls thousands of mythological figures of all kinds, from 10 to 12 feet in height. The interior, and certainly some parts of the exterior, have been plastered over and painted. It is now generally believed that the caves date from the 7th century.

Ellore (*Elúr*), a town in the Godavari district, Madras, on the Jammaler River, 255 miles N. of Madras, with manufactures of woollen carpets and saltpetre. The heat is very oppressive, reaching 110° F. in the shade. Pop. 25,092.



The Kailás Temple at Ellora. (From Fergusson.)

Ellsworth, a port of entry in Maine, on the river Union, 28 miles SE. of Bangor, with a very large lumber trade. Pop. (1880) 5052; (1890) 4804.

Ellwangen, an industrial town of Würtemberg, on the Jagst River, 55 miles N. of Ulm by rail. Pop. 4793. The old castle of Hohen-Ellwangen, close to the town, has been used as an agricultural school since 1843.

Ellwood, THOMAS, whose name will never be forgotten from its connection with Milton's, was born at Crowell in Oxfordshire in 1639. At twenty the influence of his friends the Penningtons converted him to Quakerism, from which neither his father's blows, nor confinement within his house, nor frequent imprisonments could cure him. In 1662 he made Milton's acquaintance, and soon visited him 'every day in the afternoon, excepting on the first day of the week, and sitting by [the poet] in his dining-room, read to him in such books in the Latin tongue as he pleased to hear me read.' Milton taught him to read Latin in the foreign manner. The readings were interrupted six weeks later by Ellwood's illness; but again, in 1665, we find him hiring a cottage at Chalfont St Giles, where Milton might escape the plague then raging in London. One day Milton

gave him the manuscript of *Paradise Lost* to read, and when returning it Ellwood said, 'Thou hast said much of "Paradise Lost," but what hast thou to say of "Paradise Found?"' When Milton handed him *Paradise Regained* in London, he added, 'This is owing to you, for you put it into my head by the question you put to me at Chalfont, which before I had not thought of.' Ellwood married in 1669, was busy in controversy, and seems to have had more than his share of the persecutions that fell upon the Quakers almost till his death in 1713. Of his many tracts, treatises, epistles, and even poems, only his Autobiography is now interesting, and that not for his own sake, but because he crossed the orbit of almost our greatest poet. An excellent and accessible edition is that in Professor Henry Morley's 'Universal Library' (1885).

Elm, a village of Switzerland, at the head of a mountain-girt valley in the canton of Glarus, with 1000 inhabitants when, in 1881, the whole of the northern side of Tshingel Peak (10,230 feet) crashed down upon it, destroying a large part of it, and filling the narrow valley with the debris of the landslip.

Elm (*Ulmus*), a genus of trees of the natural order Ulmaceæ, natives of temperate climates, with serrated leaves unequal at the base, and small flowers growing in clusters appearing before the leaves, and containing 4–12 stamens and one germen. The fruit is a samara, or compressed one-seeded little nut, winged all around. Elm is a remarkably variable genus, so much so that botanists are greatly divided in opinion as to which are species and which varieties among the numerous forms comprised in it. There are two well-marked types common to Britain, and having a wide distribution in Europe and Western Asia and Northern Africa. These are the English Elm (*U. campestris*), which is the most common in English woods and pleasure-grounds; and the Scotch or Wych Elm (*U. montana*), which, though more common in Scotland and in Ireland, is more sparingly distributed also in England and on the Continent.

Common English Elm (*Ulmus campestris*): *a*, flower; *b*, fruit.

The English elm often attains a height of from 70 to 90 feet, with a diameter of from 5 to 6 feet, before it is one hundred years old—an age that the elm-tree rarely much outlasts; it may even exceed 100 feet in height. Both species have been productive of many varieties, some of which are so distinct as to be by some considered species and by others as merely well-marked sub-species or varieties. The fact that no reliance can be placed on the progeny of any of these forms, when reared from seed, having the features and attributes of the parent appears to corroborate the latter view. In consequence of this peculiarity in elm it is necessary, if we wish to perpetuate any specially desirable or meritorious kind, to propagate it by budding, grafting, or layering. Varieties of the English elm are numerous. All are not alike valuable as timber-trees. For forest planting, seedlings of the type and other well-marked kinds are selected. Besides the typical form, varieties known to nurserymen as the Broad-leaved English Elm (*U. c. latifolia*), the Red English Elm (*U. c. stricta*), and the White English Elm (*U. c. alba*) are preferred to any others as the seed parents, their progeny proving almost invariably valuable timber producers. Of this species there are some interesting and beautiful varieties, much esteemed for their effect in ornamental grounds and garden scenery. The most distinct are the typical form with silver variegated leaves, and also with yellow variegated leaves, and *U. c. viminalis*, of which there is also a silver-leaved form, both of them being remarkable for the small, twiggy character of their shoots, and their light, elegant appearance. The Twisted Elm (*U. c. tortuosa*) is a very singular variety of French origin. Its trunk marked with alternate protuberances and hollows gives it a very remarkable appearance in old trees. Its timber is preferred in France above all others by wheelwrights, particularly for spokes, its fibre being exceedingly tough, twisted, and interlaced together. The Dutch Cork-barked Elm (*U. c. major*) is a well-marked variety or sub-species of the English elm, which was introduced by William III. when the Dutch style of gardening was fashionable. Its rapid growth and adaptability to being clipped into the stiff, formal shapes essential to that style of gardening led to its being much used while the fashion prevailed; but when Dutch gardening disappeared, the cultivation of this variety of elm almost ceased, as its timber is comparatively worthless. The bark of the younger branches is rough and cork-like. The Cork-barked English Elm (*U. c. suberosa*) is a very handsome and well-marked sub-species, growing with greater vigour and to a larger size than the type, having also larger leaves and the bark of the branches distinctly lined with corky wings.

Common English Elm (*Ulmus campestris*).

The wood of the English elm is highly valued for its great strength, toughness, and closeness of texture. It is less liable to split than almost any other timber, and powerfully resists the decomposing action of water; it is therefore much in request for keels of ships and boats, naves and spokes of wheels, foundation piles, and wet-planking. The large bosses or knots with which the trunk is frequently covered are much prized in cabinet work and in turnery for their beautiful appearance when cut up

and polished. The bark is used in dyeing and in sugar-refining, and in times of scarcity has been used in Norway for grinding into meal and mixing in bread. The inner bark is used medicinally in cutaneous diseases; it is mucilaginous, and has a bitter astringent taste. In Persia, Italy, and the south of France galls are frequently produced on the leaves, often of large size, containing a clear fluid called *eau d'orme*, which is sweet and viscid, and is used to wash wounds. Towards autumn these galls dry up, leaving a residue of a yellow or blackish balsam called *beaume d'orme*, which was formerly in great repute for diseases of the chest. The seeds of the elm are eagerly eaten by pigeons and common poultry. A peculiar vegetable principle called *ulmin*, or *ulmic acid*, was first discovered in the substance which often spontaneously exudes from the bark of the English elm. It is a dark-brown substance, without smell or taste, insoluble in cold, sparingly soluble in boiling water, which it colours yellowish-brown, and soluble in alcohol and in alkaline solutions.

The typical form of Scotch elm is easily distinguished from the English by its less upright trunk, more spreading branches, and larger, broader leaves. The tree is generally considered more picturesque in style than the English elm. Its timber, though more liable to crack, is quite as much esteemed for its durability and toughness, and is used for nearly every purpose for which that of the English elm is in demand. The enormous bosses which frequently occur on the trunk are highly valued in cabinet-making. The varieties of this species are numerous, and some of them are important both as timber and as ornamental trees. The Smooth-leaved Wych Elm (*U. m. glabra*) is so distinct in its upright growth, smaller and smooth leaves, and other even more important characters, from the typical Wych Elm, that some are disposed to regard it as a species. It is certainly well marked, and from it have sprung the Huntingdon Elm, the Chichester Elm, and the Scampston Elm, all of which have a strong resemblance to each other, and are remarkable for their great rapidity of growth and their value as timber-trees. Of ornamental and curious varieties, the Wych Elm is the parent of several, the more remarkable of which are the Weeping Wych Elm (*U. m. pendula*), the Exeter Wych Elm (*U. m. fastigiata*), and the Variegated Wych Elm (*U. m. variegata*), the leaves of which are silvery striped. *U. effusa* is a continental species with a large spreading head and smooth bark, distinguished also by the long stalks of its flowers and its ciliated fruit.

The American or White Elm (*U. americana*), which abounds in the Mississippi basin, and attains its loftiest stature between 42° and 46° N. lat., is a magnificent tree, sometimes 100 feet in height, the trunk reaching 60 or 70 feet before it separates into branches, and the widely diffused pendulous branches floating gracefully in the air; but the timber is not much esteemed. Slippery Elm (*U. fulva*) is also common in the basin of the Mississippi as far south as 31° N. lat., and in the western parts of Canada. It attains a height of 50 or 60 feet. The wood is more valuable than that of the last species, but much inferior to the English elm. The leaves and bark yield an abundant mucilage, which is bland and demulcent, and esteemed a valuable remedy in catarrh, dysentery, and other complaints. The Wahoo or Winged Elm (*U. alata*) is a small tree, found from 37° N. lat. to Florida, Louisiana, and Arkansas, remarkable for the branches being furnished on two opposite sides with wings of cork. The wood is fine-grained, compact, and heavy. Both the English elm and the Wych elm have been introduced into the United States. *U. chinensis* is a Chinese species of elm, the leaves of which bear galls used in tanning and dyeing.

The name Spanish Elm is given in the West Indies to a valuable timber-tree also called Bois de Chypre, *Cordia Gerascanthus*, of the natural order Cordiaceæ; also to *Hamelia ventricosa*, of the natural order Rubiaceæ, the timber of which is known to cabinetmakers as Prince-wood.

Elmalu, a town of Asia Minor, in the province of Konieh, on the Lycian tableland, 45 miles W. of Adalia. It has manufactures of red leather, dyeworks, and a general trade. Pop. 25,000, mainly Greeks and Armenians.

Elmina, a British settlement and fortified seaport on the Gold Coast, a few miles W. of Cape Coast Castle. It was first settled by merchants of Dieppe, came into the hands of the Portuguese in 1471, and of the Dutch in 1637, and in 1872 was ceded to the British, who destroyed the native town during the Ashanti war. Pop. 6000.

Elmira, capital of Chemung county, New York, on the Chemung River, 149 miles ESE. of Buffalo by rail. It contains a court-house, a state reformatory, and a number of good schools, including the Elmira Female College, and has extensive manufactures of iron rails, railway and other carriages, flour, leather, woollens, boots and shoes, &c. Pop. (1870) 15,863; (1880) 20,541; (1890) 29,708.

Elmo's Fire, St, is the popular name of an electric appearance sometimes seen, especially in southern climates during thunder-storms, of a brush or star of light at the tops of masts, spires, or other pointed objects. It is also observed at the tops of trees, on the manes of horses, and occasionally about human heads. It is similar in kind to the luminous glow seen at the point when a lightning-rod is working imperfectly, or when there is any very rapid production of electricity (see ELECTRICITY). In the four years 1884–87 eleven cases of St Elmo's fire were recorded at the Ben Nevis observatory. The phenomenon, as seen at sea, was woven by the Greeks into the myth of Castor and Pollux, and was regarded as of friendly omen. The name of *Elmo* is by many thought to be a corruption of that of Helena, the sister of Castor and Pollux. Others take it to be a corruption of St Erasmus, a Syrian bishop and martyr of the 3d century (Italianised, *Ermo*, *Elmo*). The phenomenon has also been called the fire of St Elias, of St Clara, of St Nicolas, and of Helena, as well as *composite*, *composant* or *corposant* (i.e. *corpus sanctum*).

Elmshorn, a town in the Prussian province of Sleswick-Holstein, is situated on a navigable feeder of the Elbe, 20 miles NW. of Hamburg. It has considerable manufactures, especially of boots and shoes, an active trade in grain, a boat-building yard, and some breweries and tanneries. Pop. 8712.

Elmsley, PETER, classical scholar, was born in 1773, and educated at Westminster and Christ Church, Oxford, where he graduated B.A. in 1794. He next took orders, and was presented in 1798 to the living of Little Horkesley in Essex, which he held till his death. He lived at various periods of his life at Edinburgh, at St Mary Cray in Kent, and at Oxford, where he was in 1823 appointed principal of St Alban Hall, and Camden professor of Ancient History. Here he died, 8th March 1825. Elmsley contributed to the *Edinburgh* and *Quarterly* reviews, but is now remembered only by his valuable critical work on Sophocles and Euripides. See *Elmsleiana Critica* (1833).

El Obeid. See OBEID (EL).

Elocution (Lat., 'speaking out'), the art of effective speaking, more especially of public speaking. It regards solely the utterance or delivery; while the wider art of oratory, of which elocution

is a branch, takes account also of the matter spoken. The art of elocution held a prominent place in ancient education, and in the United States is more carefully cultivated than in Britain.

Éloge. When a member of the French Academy dies, it is customary for his successor to deliver an oration, setting forth his merits and services. This is called an *éloge* (Lat. *elogium*, Gr. *eulogia*, 'praise'), and a considerable branch of French literature goes by the name. Interesting and valuable collections are the éloges of Fontenelle (2 vols. 1731), and of Cuvier (1819).

Elohim, Heb., plural of *Eloah* (only used in poetry; cf. Arab. *Ilâh*, Chald. *Elâh*, Syr. *Alôh*), might, power; in plur., great beings, kings, angels, gods, *Deity*. As a *pluralis excellentiæ* or *majestatis*, and joined to the singular verb, it denotes, with very rare exceptions, *the One*, true God. Joined to the plural verb, however, it usually means gods in general, whether including the One or not. It is mostly used (in the singular sense) for or together with Jehovah; but some portions of the Scriptures employ exclusively either the one term or the other. This circumstance has given rise to endless discussions, and suggested the opinion that Genesis is by different authors (see BIBLE, JEHOVAH). It was very probably Peter Lombard who first tried to prove the Trinity out of this plural form—an attempt which, although unanimously and scornfully rejected by almost all scholars, from Calvin, Calixtus, the younger Buxtorf, &c., to our times, was revived by Rudolf Stier.

Eloi, or ELIGIUS, ST, Bishop of Noyon and apostle of Flanders (588–658), was originally a goldsmith, and as such became patron of goldsmiths and hammermen.

Elopement. See MARRIAGE, ABDUCTION, GRETNA GREEN.

Elopura. See BORNEO.

El Paso del Norte (*The Pass of the North*), commonly called EL PASO, a town of Mexico, including a line of settlements extending along a narrow valley of 9 or 10 miles in length, on the right bank of the Rio Grande (which forms the boundary between Mexico and the United States), in the Mexican state of Chihuahua. The valley is very fertile, yielding considerable quantities of wine and brandy. The town, 1232 miles NNW. of the city of Mexico by the Mexican National Railway, of which it is the terminus, is wretchedly built, and inhabited chiefly by Indian half-breeds; a large custom-house trade is carried on, however, besides almost equally active smuggling operations. Pop. 6000.—On the opposite bank of the Rio Grande, which is here crossed by a railway bridge, is El Paso, capital of El Paso county, Texas, through whose custom-house general imports to the value of $3,531,664, besides precious metals returned at $10,598,215, passed in 1886–87, as against only $40,909 of exports. Pop. (1880) 736; (1890) 10,338.

Elphin, a bishop's see in Roscommon, Ireland, united to Kilmore in 1833.

Elphinstone, ADMIRAL. See KEITH (VISCOUNT).

Elphinstone, MOUNTSTUART, fourth son of the eleventh Lord Elphinstone, was born in 1779, entered the Bengal civil service in 1795, and was posted to Benares, where he laid the foundation of that love of literature which distinguished him through life. During the operations of 1803 he was attached to Wellesley's staff, and his conspicuous services earned from his general the compliment that he had 'mistaken his profession, and ought to have been a soldier,' from his superiors the appointment to the post of resident at Nagpur. In 1808 he was selected as envoy to Shah Shuja (see AFGHANISTAN), of which the only fruit that remains is his *Account of Caubul* (2d ed. 1841); and in 1810 he became resident at Poona, where, in the Mahratta war of 1817, his military qualifications gained for him the honour of bringing the campaign to an end, and organising the newly-acquired territory. During his governorship of Bombay (1819–27) he founded the present system of administration, and greatly advanced public education. He returned to England in 1829, and declining the governor-generalship of India, lived in comparative retirement until his death, 20th November 1859. Elphinstone ranks next to Wellesley among those most instrumental in raising the fabric of British rule in India after the downfall of the Mahratta power. His well-known *History of India* appeared in 1841 (6th ed. 1874). See his Life (1884) by Sir E. Colebrooke, who also edited his *Rise of British Power in the East* (1887); and his *Official Writings*, with Memoir by Forrest (1884).

Elphinstone, WILLIAM, a celebrated Scottish prelate, and founder of King's College, Aberdeen, was born in 1431. He was the son of William Elphinstone, a canon of Glasgow, and archdeacon of Teviotdale—a natural son, for the marriage of ecclesiastics was then prohibited. Elphinstone studied at the university of Glasgow, where he took his degree of M.A. in 1452, some time later receiving priest's orders. He spent nine years on the Continent, and so highly distinguished himself in the study of law that he was appointed professor in the university of Paris, and afterwards at Orleans. He returned to Scotland, and was made successively official-general of the diocese of Glasgow (1471–72), rector of the university (1474), and official of Lothian in 1478, 'then probably,' says Mr Cosmo Innes (*Sketches of Early Scottish History*, Edin. 1861), 'the second judicial office in the kingdom.' He was made Bishop of Ross in 1481, and of Aberdeen in 1483; was several times engaged in embassies, and for a few months before the death of James III. held the office of chancellor of the kingdom. Under James IV. he was employed on a mission to the Continent, and seems to have been keeper of the Privy Seal from 1492 till his death. He applied himself to the faithful discharge of his episcopal functions, endeavouring to reform the clergy, the service, and the ritual of the church. It appears to have been chiefly through his influence that the first printing-press—that of Chepman and Millar—was established in Scotland. The college of Aberdeen was founded in 1500, and dedicated to St Mary, a name afterwards changed to King's College. Additions to the cathedral and a stone bridge over the Dee were also due to his energy and liberality. The fatal battle of Flodden, 9th September 1513, broke the spirit of Elphinstone, who was never seen to smile after. He died in Edinburgh, 25th October 1514, and was buried before the high altar of the chapel of King's College which he had founded. His *Breviarium Aberdonense*, printed in 1509–10, was reprinted in two volumes quarto at London in 1853.

Elsass-Lothringen. See ALSACE-LORRAINE.

Elsinore (Dan. *Helsingör*), a town and seaport of Denmark, on the island of Zealand, is situated on the western shore of the Sound, and at its narrowest part, 2¼ miles nearly due west of Helsingborg in Sweden, and 37 by rail N. of Copenhagen. The town, which has been in recent times considerably improved, consists of one principal street, with several lateral branches. The harbour (enlarged in 1883–84) has 18 to 20 feet of water, and the roadstead outside affords excellent anchorage. Elsinore has considerable trade, and some shipbuilding. The Sound dues were collected here until their abolition in 1857. Pop. (1890) 11,076.

Saxo Grammaticus, a famous writer of the 12th century, was born at Elsinore, and here too Shakespeare lays the scene of *Hamlet*. Elsinore was raised to the rank of a town in 1416; it was several times destroyed by the Hanseatic League, and in 1658 was taken by the Swedes, but restored to Denmark two years later. A short distance east of the town is the fortified castle of Kronborg, built in the Dutch Renaissance style by Frederick II. in 1580, while to the north-west of Elsinore stands the royal castle of Marienlyst, now much visited as a seaside resort; it commands an extensive view of the Sound and its islands, its shores, and the towns on them.

Elssler, the name of two celebrated dancers, sisters, and natives of Vienna—Therese (1808–78) and Fanny (1810–84). Their first great triumph was at Berlin in 1830; in 1841, after a tour through the capitals of Europe, the two sisters went to America, where they excited unwonted enthusiasm. They retired from the stage in 1851, in which year Therese became the wife of Prince Adalbert of Prussia, and was ennobled by the king of Prussia as Frau von Barnim.

Elster, the name of two rivers of Germany, the White and the Black Elster. The White Elster rises at the foot of the Elster Mountains, on the north-western boundary of Bohemia, flows in a northerly direction, and falls into the Saale, above the town of Halle, in Prussian Saxony. Total length, 122 miles. The Black Elster rises in Saxony, south of Elstra, flows north-west, and joins the Elbe 9 miles SE. of Wittenberg, after a course of 112 miles.

Elstracke, RENOLD, long classed as one of the earliest native English engravers, was born probably in Belgium towards the end of the 16th century, and flourished in England in the early part of the following century. He worked chiefly for the booksellers, and his engravings, including portraits of the kings of England, of Mary, Queen of Scots, and Darnley, of Whittington, and numerous other notabilities, are much sought after, chiefly from their rarity.

Elswick, a township on the western outskirts of Newcastle. Here are located the works of the firm of Sir W. G. Armstrong, Mitchell, & Co. (see ARMSTRONG, LORD), which are among the largest of the kind in Europe. The engineering section of these works dates from 1847; the ordnance-works were founded in 1857. The frontage towards the river is about one mile, the entire area occupied is about 125 acres, and in busy times about 14,000 work-people are employed. Elswick Park, including Elswick Hall, was opened as a recreation ground in 1878. Pop. about 40,000.

Elton, a shallow, oval-shaped salt lake of Russia, with a superficial area of 62 sq. m., is situated in the government of Astrakhan, the lat. of its centre being 48° 56′ N., and the long. 46° 40′ E. In spring the lake has a layer of almost pure salt-crystals, from 2 to 4½ inches thick. The annual yield ranges between 88,000 and 96,000 tons, being about one-seventh of the total salt production of Russia.

Elton, CHARLES ISAAC, of Whitestaunton, Somerset, an eminent jurist and ethnologist, was born in 1839, maternal grandson of Sir Charles Abraham Elton (1778–1853), of Clevedon Court, Somerset, poet and translator of Hesiod. He had his education at Cheltenham and Balliol College, Oxford, became Fellow of Queen's College in 1862, was called to the bar at Lincoln's Inn in 1865, and afterwards became Q.C. He was returned to parliament in the Conservative interest for West Somerset at the bye-election in 1884, was defeated for the West or Wellington division of Somersetshire at the general election of 1885, but again returned at the election the year after. He had already made a reputation as a jurist by his books, *The Tenures of Kent* (1867), *A Treatise on Commons and Waste Lands* (1868), *A Treatise on Copyholds and Customary Tenures of Land* (1874), and *Custom and Tenant Right* (1882), when he placed himself in the front rank of English ethnologists by his *Origins of English History* (1882). Not the least merit of this learned and ably reasoned work is its vindication of the Celtic element in the English race, which had been unduly minimised by the predominant Teutonic school of English history. The dissertation on *Borough English* (q.v.) is a masterpiece of learning and lucidity.

Elutriation is the term applied to the process of separating, by means of water, the finer particles of earths and pigments from the heavier portions. The apparatus generally used is a large vat, in which grinding wheels revolve; and the substance to be reduced to powder being placed in the vat along with water, the wheels in revolving not only pulverise the material, but from their motion being communicated to the water the latter is enabled to retain in mechanical suspension the finer particles of the clay, &c. By allowing a stream of water to flow in and out of the vat, the finer particles can be constantly floated away, and the liquid being run into settling vats, the fine powder settles to the bottom, when the water can be run off from the surface. This process is much employed in the manufacture of the materials used in pottery, and in the preparation of pigments.

Elvan, or ELVANITE, is the miner's name in the south-west of England for a granular crystalline rock, composed of quartz and orthoclase, which forms veins associated with granite. It occurs as veins not only proceeding from the granite and traversing other rocks, but in the body of the granite itself. It is included by geologists under Quartz-felsite.

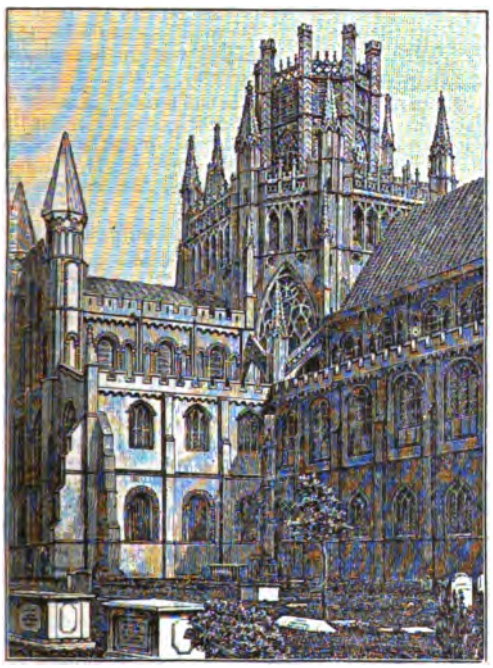
Elvas, the strongest fortified city of Portugal, in the province of Alemtejo, near the Spanish frontier, and 10 miles W. of Badajoz by rail. Standing upon a hill, it is defended by seven large bastions and two isolated forts, and has an arsenal and cannon-foundry. It is a gloomy town and a dirty, yet is supplied with water by a fine aqueduct, carried on three rows of superimposed arches. Its inhabitants (10,471) carry on an active contraband trade with Spain, principally in British manufactured wares, also in wool and wine. The district, which is very fertile, yields oil, wine, fruits, and vegetables. Elvas was made a bishop's see in 1570. In 1580 it was taken by the Spaniards, but they suffered a severe reverse before the town in 1659, and laid siege to it in vain in 1711. It was captured again in 1808 by the French.

Elves. See FAIRIES.

Elwes, JOHN, M.P., a famous miser, born in 1714, was the son of a successful brewer in Southwark named Meggot. With some good qualities of mind, he was so overcome by the passion of avarice that he would walk miles in the rain to save the hire of a conveyance, would sit for hours in wet clothes to save the expense of a fire, or risk his life to save paying a penny at a turnpike. His only indulgence seems to have been hunting. He died at Marcham, Berkshire, 26th November 1789, leaving property worth half a million.

Ely, a city of Cambridgeshire, crowns a low eminence on the left bank of the Ouse, amid the fen-land, 16 miles NNE. of Cambridge, and 30 SE. of Peterborough. Here, in 673, St Etheldreda (q.v.) founded a mixed monastery, which, burned in 870 by the Danes, was refounded in 970 as a Bene-

dictine abbey by Ethelwold, Bishop of Winchester. That abbey a century later became Hereward's 'camp of refuge,' until, in 1071, after a long and obstinate defence, Abbot Thurstan had to surrender to the Conqueror. In 1083 the first Norman abbot laid the foundation of the present church, which was made a cathedral in 1109, and which, as we see it to-day, is one of the most glorious shrines in Christendom. A cruciform structure, 537 feet long by 179 feet across the great transepts, it offers examples of all styles of Gothic, from early Norman to late Perpendicular, and is a growth of more than four centuries. There is the Early English 'galilee' or western porch (*circa* 1200); the western tower, 225 feet high, Transition Norman and Decorated (1174–1382); the south-west transept, now the baptistery; the late Norman nave (1150–89), 208 by 78 feet, with modern painted ceiling; the great transepts (1083–1170), Norman, with Perpendicular insertions; the richly sculptured choir (1234–1533), Early English, Decorated, and Perpendicular; the Decorated north-eastern Lady Chapel (1321–49); and at the crossing, the exquisite Decorated 'octagon' and lantern (1322–42), built by Alan de Walsingham on the fall of the great central tower. This, 'the only Gothic dome in existence,' rises to a height of 170 feet. Since 1845 the whole pile has been ably restored, mainly under the supervision of the late Sir G. G. Scott.



Ely Cathedral—Octagon.

It wants the north-west transept, the cloisters, and the chapter-house; but the 13th century Guesten Hall is now the deanery, and the 'Ely Porta,' or great gateway (1380), houses a grammar-school founded by Henry VIII. in 1541. The Bishop's Palace is a fine brick Tudor building. Among the bishops, nearly sixty in number, have been Langham, Bourchier, and Morton (archbishops of Canterbury), Arundel (archbishop of York), and Andrewes, Wren, Patrick, and Harold Browne. Of great laymen also, Ely has its memories, from Canute to Cromwell, who lived here 1636–40. There is a weekly market; and oil, earthenware, and clay-pipes are manufactured. Pop. (1851) 6176; (1881) 8171; (1891) 8017.—The 'Isle' of Ely, for which see the articles CAMBRIDGESHIRE and BEDFORD LEVEL, contains also March and Wisbeach, and is 355 sq. m. in area, with 63,328 inhabitants. Till 1837 it was a county palatine.

See Bentham's *History of Ely Cathedral* (2d ed. 1812); J. H. Clement's *History of Ely* (1868); Canon D. J. Stewart's *Architectural History of Ely Cathedral* (1868); Dean Merivale's *Bissexcentenary Festival of St Etheldreda* (1874); and Murray's *Eastern Cathedrals* (new ed. 1881).

Elyot, SIR THOMAS, author of *The Governour*, seems to have been born not later than 1490, in Wiltshire (not Suffolk), and not to have studied at either Oxford or Cambridge. In 1511 he became clerk of assize on the western circuit, in 1523 clerk of the king's council. In a letter addressed to Cromwell he complains that he performed the duties of this clerkship by the space of six years and a half 'withoute fee, withoute reward more than the ordinare, and that which more grevith me, withoute thank of the king.' Later letters reveal him to us much impoverished by lawsuits, and begging for a share in the confiscated property of the monasteries. In 1531–32, as ambassador to Charles V., he visited the Low Countries and Germany, having orders to procure, if possible, the arrest of Tyndale. In 1535 he went on a second embassy to the emperor, whom he seems to have followed from Barcelona to Tunis and Naples. Member for Cambridge in 1542, he died at Carlton, Cambridgeshire, 20th March 1546. His chief work, *The Boke named the Gouernour, deuised by Sir Thomas Elyot, Knight*, was published in 1531. It may be described as the earliest treatise on moral philosophy in the English language, the author's principal object being 'to instruct men in such vertues as shall be expedient for them which shall have authoritie in a weale publike.' An elaborate tenth edition appeared in two vols. in 1880, with an excellent life, notes, and glossary by Mr H. H. S. Croft. Elyot's twelve other works include *Of the Knowledge which maketh a Wise Man* (1533); *Pasquil the Playne* (1533); Isocrates' *Doctrinal of Princes* (1534); Picus de Mirandola's *Rules of a Christian Lyfe* (1534); *The Castel of Helth* (1534); *The Bankette of Sapience* (1534); *Bibliotheca* (1538), the first Latin-English dictionary; *The Image of Governance* (1540); *Defence of Good Women* (1545); and *Preservative against Deth* (1545). These books went through edition after edition in their author's lifetime, and they have now become among the rarest treasures of the bibliomaniac.

Elysium (Gr. *elysion*), a place in the infernal regions of the ancient classical mythology, where the souls of the good dwell after death. In the *Odyssey*, Homer describes it as a place where the souls of the departed lived in ease and abundance among innocent pleasures, enjoying a mild and wholesome air. In the *Iliad*, however, he gives a sombre view of the state of the departed souls. Achilles, though in Elysium, is made to envy the life of the meanest hind on earth. By succeeding poets the bliss of Elysium is drawn in much brighter colours. Besides the amenity and various delights of the place, diverse employments are found for the inhabitants, according to the ruling passion of each while on earth. The Elysian plains were supposed by some writers to be in mid-air, by others in the sun, by others in the centre of the earth, next to Tartarus, and by others in the Islands of the Blest. See HADES.

Elytra, or WING-COVERS, a term applied to the fore-wings of beetles (Coleoptera), which are modified to form more or less tough and hard coverings for the hind pair. The term Hemielytra is applied to the short, firm fore-wings of Earwigs (q.v.) (Dermaptera). See INSECTS, BEETLE.

Elze, FRIEDRICH KARL, Shakespearian scholar, was born at Dessau, May 22, 1821, studied at Leipzig and Berlin, devoting especial attention to English literature, and afterwards continued his studies in England and Scotland. In 1875 he was appointed to the newly-established chair of English Language and Literature at Halle, and here he died January 21, 1889. His early publications include a collection of English songs, and *Atlantis* (1853–54), a journal dealing with England and America. In editions of *Hamlet*, Chapman's *Alphonsus*, and Rowley's *When you see me, you know me*—the last two edited for the first time—he endeavoured to apply the strict method of classical philology to a modern language. An English translation of his biography of Byron appeared in 1872, and of his *Essays on Shakespeare* in 1874; these last are selected from the *Shakespeare-Jahrbuch*, which he edited for the German Shakespeare Society from 1868 to 1879. Other works are his *William Shakespeare* (Halle, 1876; Eng. trans. 1888) and his *Notes on Elizabethan Dramatists* (Halle, 2 vols. 1880–84). Elze was a laborious student and sagacious critic rather than a mere antiquary or collector, and, moreover, was sane beyond the measure of great Shakespearians.

El'zevir, the name of a celebrated family of printers at Amsterdam, Leyden, and other places in Holland, whose beautiful editions were chiefly published between the years 1592 and 1681. During this period, covering scarcely a century, M. Willems has catalogued no fewer than 1600 works, all such as were doubtful having been rigorously excluded. The difficulty of determining what are genuine Elzevirs depends partly on there having been a good number of printers who bore the name, and on their having had three or four principal places of business. But above all, they were booksellers as well as printers, hence many works were attributed to them which were hardly published, and certainly not printed, by them; while imitations were constantly being made, and they themselves issued many books under pseudonyms, or other printers' or publishers' names. Louis, the first to make the name famous, is said to have been born at Louvain about the year 1540, and, driven by the religious commotions of the time, to have settled as a bookbinder and bookseller in Leyden, where he died about 1617. The first work issued by him bears the title *Drusii Ebraicorum Quæstionum ac Responsionum Libri Duo*, and the date 1583. The first work, however, really published by him at his own risk, was a Eutropius by P. Merula (1592). From this time till his death he published over a hundred books, his typographical mark (first used in 1595) being the arms of the United Provinces—an eagle on a column, holding in its talons a sheaf of seven arrows, with the inscription *Concordia res parvæ crescunt.*

Five out of Louis's seven sons continued to carry on their father's business. Their names were Matthias, Louis, Ægidius (Giles), Jodocus (Joost), and Bonaventura. The last, in conjunction with his nephew Abraham Elzevir (a son of Matthias), prepared the smaller editions of the Latin classics, in 12mo and 16mo, which are still valued for their beauty and correctness. Among the finest examples of these are the Livy, Tacitus, Pliny, and Cæsar (1634–36). Equally celebrated were their 24mo editions of French historical and political authors under the name of the *Petites Republiques*, and their 12mo French and Italian classics. The handiness and cheapness of these duodecimos, of which a volume of no less than 500 pages was sold for but one florin, found approbation from all but a few pedants who believed there could be no scholarship save in folios. The printing was long supervised by Abraham, while Bonaventura managed the publication and sale; the learned David Heinsius wrote the Latin introductions and dedications to many of the books. In 1625 they acquired the printing business established at Leyden by Isaac, the second son of Matthias, who had become printer to the university there. His typographical mark was an elm surrounded by a vine-branch bearing clusters of fruit, below which stands a solitary figure, with the motto *Non solus*. M. Willems has proved that the Elzevir type designs were due to Cornelius van Dyck. The two heads of the house died near each other in 1652, and their successors were Joannes Elzevir, Abraham's son, and Daniel, Bonaventura's son, who nobly maintained the traditions of the press. Their finest works were an *Imitatio* without date, and a psalter of 1653. In 1654 Daniel settled at Amsterdam, where he united with Louis, eldest son of Joost, who had already settled there in 1638, and distinguished himself by his editions of the works of Cartesius. The masterpieces of the new partnership were the *Corpus Juris* in folio (1663) and the French Bible (1669). Their typographical mark was a Minerva with the ægis, an owl, and olive-branch, and the motto *Ne extra oleas.* The last representatives of the house were Peter, grandson of Joost, who flourished at Utrecht from 1670 to 1672, and Abraham, son of the first Abraham, who was university printer at Leyden from 1681 to 1712. The Elzevirs were clever men of business, and were none too liberal to many of the scholars on whose labours they rose to wealth. So valuable are some productions of Elzevir's press, by reason of rarity or otherwise, that an unimportant cookery-book called the *Pastissier* sold in 1877 for 3250 francs. See Pieter, *Annales de l'Imprimerie Elsévirienne* (Leip. 1852); Willems, *Les Elzevier* (Brussels, 1880); Andrew Lang, *Books and Booknen* (1886); and Goldsmid's *Complete Catalogue* (Edin. 1888).

Emanation, in Theology and Philosophy, is an important word in various systems which considered all things as *emanating* or flowing from a Supreme Principle. According to these, the origin of things is only an overflowing of the divine fullness—an outstreaming of the light from the necessity of its nature, and not any conscious exercise of will on the part of God. What is thus given off as a copy from original perfection departs more and more from its source, and gradually degenerates, which was thought to account for the origin of evil. This doctrine pervades ancient Egyptian and Indian mythology, Neoplatonism (q.v.), and Christian Gnosticism. See GNOSTICISM.

Emancipation, in the Roman law, was the act by which the *Patria Potestas* (q.v.), or paternal authority, was dissolved in the lifetime of the father. It took place in the form of a sale (*mancipatio*) by the father of the son to a third party, who manumitted him. The Twelve Tables required that this ceremony should be gone through three times, and it was only after the third sale that the son became *sui juris*, under his own law. In general, the son was at last resold to the father, who manumitted him, and thus acquired the rights of a Patron (q.v.), which would otherwise have belonged to the alien purchaser who finally manumitted him. In the case of daughters and grandchildren one sale was sufficient. In the law of Scotland, emancipation is called Forisfamiliation. See also SLAVERY, SERF, CATHOLIC EMANCIPATION.

Emanuel I., king of Portugal, styled THE GREAT, or THE FORTUNATE, was born 31st May 1469, and succeeded John II. in 1495. His reign has been termed the golden age of Portugal. He prepared the code of laws which bears his name, and made his court a centre of chivalry, of art, and

of science. Vasco da Gama's voyage round the Cape of Good Hope, Cabral's discovery of Brazil, and the expeditions under Albuquerque and others that extended the Portuguese possessions as far as the Moluccas, were all commissioned and encouraged by Emanuel. Through his exertions Portugal became the first naval power of Europe and the centre of the commerce of the world. He died 13th December 1521.

Emarginate. See LEAVES.

Emba (Russ. *Yemba*), a river of the Asiatic Russian government of Orenburg, in the Kirghiz territory, rises at the western base of the Mugadshar Mountains, and flowing south-west, enters the Caspian Sea after a course of about 450 miles.

Embalming (so named from the balm or balsam often employed), the art of preserving the body after death, invented by the Egyptians, whose prepared bodies are known by the name of mummies, and are called in the hieroglyphs *sahu*, and by St Augustine *gabbaroe*. This art seems to have derived its origin from the idea that the preservation of the body was necessary for the return of the soul to the human form after it had completed its cycle of existence of three or ten thousand years. Sanitary reasons may also have influenced the ancient Egyptians; and the legend of Osiris, whose body, destroyed by Typhon, was found by Isis, and embalmed by his son Anubis, gave a religious sanction to the rite. The art appears as old as 4000 B.C. at least, for the bodies of Cheops, Mycerinus, and others of the age of the 4th dynasty, were embalmed. One of the earliest

Egyptian Mummy.

embalmments recorded in literature is that of the patriarch Jacob; and the body of Joseph was thus prepared, and transported out of Egypt. The process has been described by Herodotus and Diodorus; but their accounts are only partially confirmed by an examination of the mummies. A scribe marked with a reed-pen a line on the left side beneath the ribs, down which line the *paraschistes*, or ripper of the district (an officer of low class), made a deep incision with a rude knife of stone; he was then pelted with stones, and pursued with curses. The *taricheutes*, or salter, next proceeded to remove the entrails and lungs, with the exception of the heart and kidneys, while a colleague extracted the brain through the nose. The body was ready for the salts and spices necessary for its preservation, the quality of which depended upon the sum to be expended. When Herodotus visited Egypt, three methods prevailed: the first, accessible only to the wealthy, consisted in passing peculiar drugs through the nostrils into the cavities of the skull, rinsing the belly in palm-wine, and filling it with myrrh, cassia, and other substances, and stitching up the incision in the left flank. The mummy was then pickled in natron for seventy days, and then washed and elaborately bandaged up in rolls of linen, cemented by gums, and set upright in a wooden coffin against the walls of the house or tomb. This process cost a silver talent, perhaps equal to £725 of our money. A cheaper process, by means of an injection of cedar-oil, cost a *mina*, relatively worth about £243. The poorer classes washed the corpse in myrrh, and salted it for seventy days. When thus prepared, and covered with a pictorial representation of the deceased, attired as a labourer in the world to come, and duly labelled as a 'justified Osiris,' the mummy was placed in a costly coffin (see SARCOPHAGUS) ready for sepulture, but was frequently kept some time before being buried—often at home—and even produced at festive entertainments, to recall to the guests the transient lot of humanity. All classes were embalmed, even malefactors; but various methods were employed besides those mentioned by Herodotus. Some mummies are found merely dried in the sand; others salted by natron, or soaked in bitumen (Jew's pitch) with or without the flank incision, having the brains removed through the eyes or base of the cranium, with the viscera returned into the body, placed upon it, or deposited in jars in shapes of the genii of the dead, the skin partially gilded, the flank incision covered with a tin plate, the fingers cased in silver, the eyes removed and replaced. So effectual were some of these processes that after 2000 or 3000 years the soles of the feet are still elastic and soft to the touch. The sacred animals were also mummied, but by simpler processes than men. It has been computed that since the practice began in 4000 B.C., down to 700 A.D., when it practically ceased, probably as many as 730,000,000 bodies were embalmed in Egypt; of which many millions are yet concealed. Important finds are made from time to time, as in 1881, when upwards of thirty mummies of potentates, including that of Rameses II., were discovered together at Deir-el-Bahari. Mummies, it may be observed in passing, were used in the 15th and 16th centuries of the Christian era for drugs and other medical purposes, and as nostrums against diseases, and a peculiar brown colour, used as the background of pictures, was obtained from the bitumen.

Mummy Case of Queen Ahmés Nofretari: Height 9 feet. (From Maspero's *L'Archéologie Egyptienne.*)

Other less successful means of embalming were used by nations of antiquity. The Persians employed wax; the Assyrians, honey; the Jews, aloes and spices; Alexander the Great was preserved in wax and honey, and some Roman bodies have been found thus embalmed. The Guanches, or ancient inhabitants of the Canary Isles, used an elaborate process like the Egyptian; and desiccated bodies, preserved by atmospheric or other circumstances for centuries, have been found in France, Sicily, England, and America, especially in Central America and Peru. In Burma the bodies of priests are stuffed with spices and honey and coated with wax and gold-leaf. The art of embalming was probably never wholly lost in Europe; De Bils, Swammerdam, Clauderus, Gooch, Bell, and others attained great success in the art; and a mode of embalming by incisions all over the body is detailed by Penicher. Ruysch, and after him William Hunter, injected essential oils through the principal arteries into the body. Boudet embalmed the bodies with camphor, balsam of Peru, Jew's pitch, tan, and salt. The discovery of Chaussier of the preservative power of corrosive sublimate, by which animal matter becomes rigid, hard, and grayish, introduced a new means of embalming by Beclard and Larrey; but owing to the desiccation, the features do not retain their shape. The discovery of the preservative power of a mixture of equal parts of acetate and chloride of alumina, or of sulphate of alumina, by Gannal in 1834, and of

that of arsenic by Tranchini, and of pyroxilic spirits by Babington and Rees in 1839, and of the antiseptic nature of chloride of zinc, have led to the application of these salts to the embalming or preparation of bodies required to be preserved for a limited time. The latest method, by injection of a fluid into the arteries, is described by Dr B. W. Richardson, who has himself embalmed fifty bodies. The process is very common in the United States.

See Pettigrew, *History of Mummies* (1834); Gannal, *Traité d'Embaumement* (1838); Magnus, *Das Einbalsamiren der Leichen* (1839); Richardson, *The Asclepiad* (1888); and the article HEART-BURIAL.

Embankments, in Engineering, are masses of earth, rock, or other materials artificially formed, and rising above the natural surface of the ground. They are chiefly formed either (1) to carry railways, common roads, canals, &c. over depressions of the country; or (2) for hydraulic purposes, such as the formation of reservoirs for storing water, or as defences against the overflowing of rivers and the encroachments of the sea or of lakes.

In the formation of canals, railways, and other roads, embankment and *excavation* go hand in hand, and, under the name of Earthwork, form—especially in modern times, and since the development of the railway-system—a vast branch of industry, giving employment to many thousands of labourers, known in England as 'navvies.' See CANAL, DYKE, ROAD, RAILWAY, RESERVOIR.

Embargo (from the Spanish *embargar*, 'to inbar,' 'to arrest') is a temporary order from the Admiralty to prevent the arrival or departure of ships. It may apply to vessels and goods, or to specified goods only; it may be general or special; it may apply to the entering only, to the departure only, or to both entering and departure of ships from particular ports; and lastly, although issued by the Admiralty in England, it would be equally an embargo if issued by any other competent authority. Such embargoes are generally connected in some way or other with a state of war between two countries.

Embassy, in its stricter sense, is a mission presided over by an ambassador, as distinguished from a mission or legation intrusted to an envoy, or other inferior diplomatic minister. See AMBASSADOR.

Embattled. See CRENELLÉ.

Ember Days, in the Roman and Anglican churches, are three days appointed four times in the year to be observed as days of fasting and abstinence; being the Wednesday, Friday, and Saturday after the first Sunday in Lent, after the feast of Pentecost, after the 14th September, and after the 13th December. The name is probably derived from the Saxon *ymb*, 'about,' and *ryne*, a 'course' or 'running,' and applied to these fasts because they came round at certain set seasons in the year. In the breviary and missal these days, as recurring in each quarter of the year, are called *quatuor tempora* (the canonists' *jejunia quatuor temporum*, or 'fasts of the four seasons'); and another derivation would make the term only a corruption of this title, perhaps through the German form, *quatember*. The ember days date from an early period in the church's history, and were introduced into England by Augustine. Originally they were only in part devoted to beseeching the grace of the Holy Ghost, as periods when ministers were admitted to holy orders; but it is to this purpose that the ember days are now particularly devoted, Roman Catholic clergy being ordained only on the Saturdays of the ember weeks, while the whole church fasts and prays, and a generally similar usage prevailing in the Church of England, which has appointed special prayers for use at these seasons.

Emberiza. See BUNTING.

Embezzlement, the felonious appropriation by clerks, servants, or others in a position of trust, of goods, money, or other chattels intrusted to their care, or received in the course of their duty, on account of their employers. It is essential to the crime of embezzlement that the article taken should not have been in the actual or constructive possession of the employer; for if it were, the offence would amount to Larceny (q.v.). Embezzlement is not a felony at common law; hence, persons guilty of this crime sometimes escaped punishment. In consequence of a flagrant instance of this immunity, the Act 39 Geo. III. chap. 85, was passed, whereby embezzlement was made a felony. This act has been repealed, but the law has since been fixed by subsequent enactments, and is now included in the Act 24 and 25 Vict. chap. 96.

Embezzlement by clerks or servants is punishable by penal servitude or imprisonment. If the offender be a male under sixteen, he may also be ordered to be privately whipped, at the discretion of the judge. Questions of much nicety often arose as to whether the facts proved constituted the crime of embezzlement or that of larceny; but this distinction has ceased to be of any importance under recent acts, whereby it is made competent, on an indictment for embezzlement, to convict a man of larceny, and *vice versâ*. And hence, whichever of the two offences is charged against the servant, if the evidence shows he committed the other offence, then he may be found guilty of that other offence, and punished accordingly.

Embezzlement by bankers, brokers, factors, and other agents is now regulated by the statute cited above. Almost every conceivable species of fraudulent misappropriation by bankers and others is now a punishable offence. In particular, by the latter statute, embezzlement by a Bailee (see BAILMENT) is now indictable. A shopkeeper, for example, appropriating goods intrusted for repair, may be tried and convicted (see also FRAUD).

Embezzlement by bankrupts, or rather the pawning or disposing within four months before the bankruptcy of goods or any kind of property obtained on credit, is punishable by two years' imprisonment. See BANKRUPTCY.

Embezzlement of letters and newspapers by servants of the Post-office is also made highly penal by 7 Will. IV. and 1 Vict. chap. 36. The embezzlement of newspapers is punishable by fine or imprisonment; for embezzling a letter the extreme penalty is penal servitude for seven years, or (if the letter contain money or valuables) for life.

Embezzlement of the Queen's stores is punishable by penal servitude for fourteen years. In regard to this species of embezzlement, summary authority was given to comptrollers and other officers named, on proof of embezzlement of government stores below the value of twenty shillings, to fine the offenders to the amount of double the value of the article taken.

The American law is, in principle, the same as the English, but it seems that a person indicted for larceny cannot be convicted of embezzlement, or *vice versâ*. Embezzlement of national property is punishable by the law of the United States; other forms of embezzlement and fraudulent breach of trust are dealt with by the laws of the several states.

In Scotland, the crime of embezzlement, or breach of trust, is punishable at common law. The distinction between this crime and that of theft is substantially the same as between embezzlement and larceny in England. In both countries, the criterion relied upon to distinguish these crimes is

the question of possession by the owner; but in Scotland the tendency of the decisions of late years has been to regard the appropriation of articles intrusted for a temporary purpose as amounting to theft. In this respect the law of Scotland agrees with that of England in regard to embezzlement by a bailee.

Emblem. By many writers on this subject symbols and emblems are regarded as almost convertible terms, and hence the former is often used in a sense synonymous with the latter. But, according to Claude Mignault, the famous commentator on the emblems of Andreas Alciatus, in his tract 'Concerning Symbols, Coats of Arms, and Emblems,' there is a clear distinction between emblems and symbols, which, as he says, 'many persons rashly and ignorantly confound together.' This writer maintains that 'the force of the emblem depends upon the symbol, but they differ as man and animal;' his meaning being, that as all men are animals, but all animals are not men, so all emblems are symbols, but all symbols are not emblems. Hence he argues the two possess affinity but not identity, they have no absolute convertibility of the one for the other (H. Green, *Shakespeare and the Emblem Writers*, 1–3). But for all practical purposes there is little difference between the two terms. Of the many definitions given of emblem may be quoted that of Francis Quarles, who says 'an emblem is but a silent parable;' and Cotgrave describes it as 'a picture and short posie, expressing some particular conceit.' For printer's Emblems, see BOOK.

Emblements, growing crops of cereal and vegetable productions raised by the labour of the cultivator. Fruits of trees growing on the land, and grass, are not emblements. See LANDLORD AND TENANT, LEASE.

Emblica, a genus of Euphorbiaceæ. *E. officinalis* is an Indian tree whose acid, astringent fruit (*Myrobalani emblicæ*) is a source of tannin.

Embolism. See ARTERIES (DISEASES OF).

Embossing. When a raised pattern is produced by blows or pressure upon sheet-metal, leather, cloth, paper, gutta-percha, &c., it is said to be embossed. A vase or dish formed of thin sheet-metal is sometimes decorated in relief by beating it up from the inner or under side. This operation is called beating up, bossing, or *repoussé*, and may be considered as an example of embossing by hand. A somewhat similar result is obtained by the use of a die and counter-die worked in a screw-press or by a falling weight, but this is usually called stamping (see DIE-SINKING, and METAL-WORK (ARTISTIC). The term embossing is not applicable to decoration in relief produced by carving or chiselling, or by casting. Writing-paper and card are embossed with a steel die, the counter-die being formed of millboard or leather, faced with gutta-percha. The paper or card is damped, and a fly-press or lever-press is generally used.

Leather is embossed in several ways. For book-covers, even in the case of patterns in comparatively bold relief, like those used for photographic albums, brass dies and millboard counter-dies are used along with a lever or screw-press (see BOOK-BINDING). When for other purposes the ornament is to be in high relief, moulds or reverses of metal or wood are required, or separate ornaments of wood or papier-maché, fixed to a board, may be used. The leather is first softened with water, and then pressed with tools of various kinds into the moulds, or spread over the fixed ornaments, and worked into all their cavities with the fingers and a pointed tool. The hollows of the more deeply relieved portions are filled in with paper pulp and other substances.

At the present time, imitations of embossed leather for wall-decoration are very much in fashion. These are made of canvas, leather, paper, and various other substances. Even so fine a material as satin is embossed for this purpose. Embossed linen canvas made of a durable nature is coming much into use for decorative purposes. It is manufactured by passing the damped canvas over a metal roller, heated internally with steam, upon which the pattern is cut or engraved in intaglio. As the web passes over the roller, brushes or pads are applied to press the canvas into the indentations. By means of additional rollers, a backing of paper is pasted on, and when the whole is dry it is stiff and retains its shape. Japanese wall-papers, which are embossed in a somewhat similar manner to the linen canvas just described, but by the use of flat instead of cylindrical moulds, are now a good deal used in England. The patterns are often beautiful, the paper is strong, and the surface is made durable by coatings of oil and lacquer. Embossed canvas, paper, and leather for wall-decoration are commonly coloured and gilt.

Calicoes and other textiles are embossed by means of deeply engraved metal cylinders fitted into calender frames. The counter-roller is covered with felt, which yields sufficiently to allow the fabric to be pressed into the hollows of the die-cylinder. Sometimes the pattern is on two cylinders, being sunk on the one and raised on the other, after the plan of a die and its counterpart.

There is a method of embossing wood by saturating it with water, in which state a red-hot cast-iron mould is forcibly pressed upon it. Generally the wood is re-wetted, the mould re-heated, and the pressure applied several times before a complete impression of the mould is obtained. A curious mode of embossing wood was invented about 1830 by J. Straker. The design is drawn upon the surface to be thus decorated, and all the parts intended to be in relief are then carefully depressed by a blunt tool. The wood is next planed down to the level of the depressed portions. On being steeped in water, these will rise to their former level, forming an embossed pattern ready, when the wood is dry, to receive the finishing-touches of the carver. By a process recently invented in America, veneers of wood are embossed with metal dies. See DIE-SINKING.

The process of etching ornamental patterns with hydrofluoric acid on plate-glass, for the panels of lobby-doors, &c., is called 'embossing.'

Embowed, the heraldic term for anything bent like a bow—as, for example, the arm of a man.

Embracery, in the law of England, the offence of influencing jurors by corrupt means to deliver a partial verdict; the offence is punishable by fine and imprisonment.

Embrasures, in Fortification, are openings in the parapets, flanks of bastions, and other parts of the defence-works, through which cannon are pointed. See FORTIFICATION.

Embroidery (Fr. *broderie*) is the art of producing ornamental patterns by means of needle-work on textile fabrics, leather, and other materials which can be sewed over. The art is closely allied to tapestry-work, which is in fact intermediate between embroidery and weaving. The essential distinction is that, while embroidery is always worked upon an already woven texture, the basis of tapestry is a series of parallel strings or cords forming a kind of warp, to which the various coloured yarns required for the pattern form the weft; and thus the cloth-making and the building-up of the pattern are one operation.

The art of embroidery, arising out of the universal craving for ornamentation, may be said

to be coeval and co-extensive with the use of clothing and furniture. It is practised with interesting and characteristic variations by the rudest tribes; and it is held in high esteem by the most gifted and highly cultured of nations. That it was early practised in oriental nations we have abundant evidence. It is most probable that the coat of many colours bestowed by Jacob on his favourite Joseph was a triumph of needlework, as looms at that period were capable of producing simple striped and checkered patterns only. Remains of Egyptian embroidery, as ancient as the days of Jacob, exist still; and of the art as practised by the early Egyptians Sir J. Gardner Wilkinson remarks, 'the many dresses painted on the monuments of the 18th dynasty show that the most varied patterns were used by the Egyptians more than 3000 years ago, as they were at a later period by the Babylonians, who became noted for their needlework.' The knowledge and skill acquired in Egypt by the Israelites enabled them to embroider the elaborate priestly robes and tabernacle furniture, 'the cherubim of cunning work,' 'the pomegranates of blue and of purple and of scarlet,' and the other needlework enumerated in the Book of Exodus. The 'goodly Babylonish garment' secreted by Achan at Jericho was probably an example of Babylonian skill in needlework; and indeed the frequency of allusion to embroidery in Scripture, as well as in the works of classical writers from Homer downward, testifies to the high appreciation and importance of the art in early times. Then, as in later ages, the triumphs of the art were reserved for priestly robes and for temple adornment.

The knowledge of artistic embroidery came to Europe from the nations of the East, where the art had its early home, and where it still is most largely appreciated and practised. To the Greeks and Romans it came from Phrygia, whence at Rome the embroiderer was known as *phrygio*, and gold embroidered work was called *auriphrygium*, from which we have the ecclesiastical English term *orphrey*. It was in medieval times that the embroiderer's art attained its greatest perfection in Europe; and it is remarkable that the most highly appreciated examples of work were of English origin. The finest existing specimen of medieval embroidery—the Syon Cope, now in South Kensington Museum—is English work of the 13th century. It is richly charged with scriptural subjects, and carries the armorial bearings of several of the most illustrious English families of the period. In historical interest, however, this cope falls far behind the Bayeux Tapestry (q.v.). Under the influence of the Oxford movement, and along with a revival in church architecture and glass-painting, has come a great revival of church embroidery as applied to altar-cloths, vestments, banners, &c.

Practically, embroidery is divided into two distinct classes of work: (1) that which embraces all kinds of artistic needlework done by the hand; and (2) the manufacturing industry which includes all embroidery done by machinery, and also such hand-needlework as is done on the large scale by following patterns mechanically impressed on the fabric to be ornamented.

In art embroidery the materials employed are fine coloured worsted yarns called crewels, tapestry wools, embroidery silks, gold and silver threads, spangles, and plates or discs of metal. There may also be used portions of feathers, the elytra of beetles, pearls, and precious stones; but these find their place principally in oriental embroideries. The textile basis may be any cloth, but the fabrics principally used are stout makes of linen, silks, satins, velvets, and flannels. Small work is done without any special mounting, but for elaborate designs the fabric is fitted and tightly stretched on a frame. The variety of embroidery stitches is considerable, and must vary with the nature of the outline to be formed and the texture or subject to be imitated; and colours have, of course, to be carefully varied according to the necessities of the design when a coloured pattern is being worked. The principal stitches are the stem stitch, the satin stitch, the knotted stitch, the button-hole or blanket stitch, the chain or tambour stitch, the feather stitch, and the cushion or Berlin-work stitch, all of which may be best learned from practical manuals. In frame-work, 'couching' is largely employed, which consists in laying lengths of thread on the surface, and securing them by stitches through the cloth brought up at various points, variety of effect being obtained by the different disposition of these securing stitches. A distinct class of embroidery consists of appliqué or cut work, in which designs of different materials and colours are cut out and sewed down on the surface of the fabric to be ornamented. Inlaid appliqué consists of cutting precisely the same pattern out of two different fabrics, and inserting the one into the cut space in the other.

In its purely mechanical side, the embroidery trade embraces several distinct sections, of which may be enumerated (1) white embroidery, known also as Swiss or Scotch sewed work, for which work the muslin or other fabric is printed with a pattern made up of holes of different dimensions, which are either cut or punched out, and their edges sewn over with a button-hole stitch; (2) embroidery in gold, silver, and coloured silks, for official costumes, civil and military, badges, &c.; (3) embroidery in crewels, or other coloured wools, coloured silks, &c., mostly done for furniture decoration, such as borders of tablecovers, &c.; and (4) there may be included ornamental braiding with braids of various colours, principally for ladies' costumes. To a great extent these various kinds of embroidery can be worked by one or other of the machines which have been devised for embroidering. The first successful embroidery machine was that invented by M. Josué Heilmann, of Mülhausen, patented in England in 1829. With Heilmann's machine, or the modifications of it which have since been introduced, one person can guide from 80 to 140 needles working simultaneously, and producing so many repeats of the same design. The details of the construction of the machine are complex, but the principle of its action may be easily understood. The needles, with their eyes in the middle, are pointed at each end, so that they may pass from both sides of the work without being turned. Each needle is worked by two pairs of artificial fingers or pincers, a pair on each side of the work, and these grasp and push the needle through from one side of the work to the other. A carriage or frame connected with each series of fingers does the work of the human arm, by carrying the fingers to a distance corresponding to the whole length of the thread. The frame then returns to exactly its original place, and the needles are again passed through to the opposite set of fingers, which act in like manner. Were the work which is mounted in a frame to remain stationary, the needles would thus pass merely backwards and forwards through the same hole. But the frame is mounted to move in every direction, and according to its motion stitches varying in length and in direction are made corresponding to the lines of the design. The motion of the frame is governed by a pantagraph machine (see PANTAGRAPH), the free end of which, moving over an enlarged copy of the design, moves the frame at each successive stitch into the position required for the production of

the various repeats of the pattern. Embroidery patterns, in a variety of knotted, tambour, and other stitches, and ornamental braiding, are now very largely done by means of the Bonnaz machine, the invention of M. Antoine Bonnaz, first patented in Britain in 1868. This apparatus is in appearance and construction like the ordinary sewing-machine, but in place of a needle, it is furnished with a hooked looper which passes down through the work and brings the thread up from below, looped around it to make a knotted stitch on plain for the ordinary tambour stitch. It is further provided with a universal feed-motion, so that with the utmost ease the work can be guided to follow the lines of the most intricate and sharp-turning pattern. A modification of this machine, invented by M. E. Cornely, is in extensive use for ornamental braiding.

The following works may be consulted: Caulfield and Saward, *Dictionary of Needlework* (1881); E. Glaister, *Needlework* ('Art at Home' series, 1880); Gay et Dupont Auberville, *Catalogue des Broderies au Musée des Arts Décoratifs* (Paris, 1880); L. Higgin, *Handbook of Embroidery*, edited by Lady Marian Alford (1879); *Drawings of Ancient Embroidery*, by Mrs Mary Barber (1881); Lefébure's *Embroidery and Lace* (Eng. trans. 1888).

Embrun, a fortified town in the French department of Hautes Alpes, crowns a rock-platform on the right bank of the Durance, and at the base of Mont St Guillaume (8344 feet), 23 miles E. of Gap by rail. It looks better from without than within; but its cathedral has a lofty Romanesque tower. Pop. 3812. Embrun occupies the site of *Ebrodunum*, capital of the Caturiges, and an important Roman station. It was the seat of a bishopric from 374 to 1802.

Embryo (Gr.), a term usually restricted (*a*) to the unborn young animal, or (*b*) to the rudimentary young plant, especially when within the seed. The term *fœtus* is equivalent to embryo, but is restricted to mammalian development. The term *larva* is also applied to a young animal which is more or less markedly different from the adult form. See EMBRYOLOGY, REPRODUCTION, SEED.

Embryology is that department of biology which reads the development of the individual organism. It is a succession of studies in anatomy and physiology which, when read into unity, give the history of the organism from its earliest individual appearance on to that vague point when it may be said to exhibit all the main features of adult life. The investigation necessarily takes two forms: a description of the structure of successive stages (*morphological*), and an analysis of the vital processes associated with each step (*physiological*). Nor is any embryological investigation complete which does not link the everyday development of individuals with the historical evolution of the race.

History.—Although the development of the chick, so much studied in embryological laboratories today, was watched 2000 years ago in Greece, it was only in the scientific renaissance of the 17th century that observation began to grow strong enough to wrestle with conjecture. Harvey, who towered as a strong genius above his contemporaries, and saw much farther, sought in 1651 to establish two main propositions: (1) that every animal was produced from an ovum—*ovum esse primordium commune omnibus animalibus;* and (2) that the organs arose by new formation (*epigenesis*), not from the mere expansion of some invisible preformation. These valuable generalisations were not, however, accepted, and even observations like those of Malpighi seemed for the time to tell against Harvey's prevision. The time was past for absolutely fanciful theories, and yet the dominant doctrine which persisted even into the 19th century was mystical enough. The germ, whether egg or seed, was believed to be a miniature model of the adult. 'Preformed' in all transparency, the organism lay *in nuce* in the germ, only requiring to be 'unfolded.' Just like a bud which hides within its hull the floral organs of the future, so was every germ. 'There is no becoming,' Haller said; 'no part of the body is made from another; all are created at once.' But the germ was more than a marvellous bud-like miniature of the adult; it included all future generations. That germ lay within germ, in ever smaller miniature, after the fashion of an infinite juggler's box, was the logical corollary of the theory of preformation and unfolding. One of the controversies of the time was whether ovum or sperm was the more important. The ovists asserted the claims of the ovum, which only required to be awakened by the spermatozoon to begin its unfolding. The animalculists, on the other hand, maintained that the male element contained the preformed germ, and that the ovum was merely for its preliminary nutriment.

All this was virtually shattered by Wolff (1759), who reasserted Harvey's epigenesis, and showed that the germ consisted of almost structureless material, and that the process of development was a gradual organisation. Yet Wolff's work had not the effect of entirely demolishing preformationist conceptions. They lingered on, and had this much truth in them that the germs are indeed potential, though not miniature, organisms. To some extent Wolff reacted too far against the mystics in his emphasis on the simplicity of the germ, so that a correction was necessary when the cellular character of the reproductive elements was realised about a hundred years later. The observation of structural progress was slow in gaining self-confidence, for it was not till 1817 that Pander took up Wolff's work virtually where he left it. He was immediately reinforced and soon left behind by Von Baer, whose results laid a firm foundation for modern embryology. Since the establishment of the Cell-theory (see CELL) in 1838–39, and the associated researches which showed that the organism starts from a fusion of two sex-cells, and that development consists in the division of the fertilised ovum and differentiation of the results, progress has been both sure and rapid. The more modern demonstration of the fact of evolution has afforded a fresh impulse by its interpretation of the present as the literal child of the past.

The egg-cell or ovum is in all organisms the starting-point of the embryo, but development can rarely begin till this female element is supplemented by the male cell or spermatozoon. These sex-cells are liberated units of the parent-organism, but in most cases they stand in marked contrast to the great congeries of cells which form the 'body.' All the component units of the organism are indeed lineal descendants of a fertilised ovum, but the 'body'-cells become greatly changed into muscle, nerve, skeleton, and the like, while the reproductive cells retain with more or less intactness the characters of the original parent germ. It is this fact which makes the reproduction of like by like possible.

The unicellular animals or Protozoa, having obviously no 'body,' are directly comparable to the sex-cells of higher animals. The 'body' is the addition which makes the difference. In a few Protozoa, however, the results of the division of a unit remain associated together, and a loose colony of cells arises. Such a Protozoon behaves like an ovum or like a primitive male-cell in any of the higher animals. The loose colony may be very unstable, and may soon resolve itself into its

component units, exactly as the primitive male-cell, which has divided into a clump of spermatozoa, breaks up and sets these active units free. But the colony may be more stable and retain its continuity (like a segmented ovum), thus bridging the gulf between unicellular and multicellular organisms. In such cases certain cells are set apart as reproductive, and eventually set adrift to start a fresh colony. This is the beginning of the differentiation of special reproductive cells. At first these were probably all alike and able to develop of themselves, but in a manner which does not concern us here (see SEX) they became differentiated as male and female elements, mutually dependent and complementary.

The ovum has all the essential characters of an ordinary animal cell. The cell-substance consists of Protoplasm (q.v.) and of material ascending to or descending from that climax. As in other cases, the cell-substance may be traversed by a network, —one of the intricacies which modern microscopic technique has revealed. Like other cells, the ovum includes a central differentiation or nucleus, technically called the germinal vesicle. This exhibits the essential nuclear elements in the form of rods, bands, or network, and other minute features described in the article CELL. The nucleus plays a most important part in the history of the ovum, and is believed to be the bearer of the hereditary characteristics.

As to the precise origin of the ova, it is enough here to state that in sponges they are simply well-fed cells in the general substance (middle stratum) of the sponge; that in Cœlenterates they may originate from outer or from inner layer; while in other animals they are almost always associated with the middle layer of the body, and as we ascend are more and more restricted to a distinct region or to a definite organ—the *ovary*.

The very young ovum is often at least like an Amœba (q.v.), and in Hydra (q.v.) this character persists. The first chapter in its history is one of nutrition and growth. This often occurs at the expense of neighbour cells, and the ovum may be the successful survivor of a clump. In other cases the nutriment, for immediate or future use, may be derived from the vascular fluid of the animal, or from special glands, which are sometimes simply degenerate portions of an originally larger ovary. The capital of nutriment thus derived is distinguished as the yolk. It varies greatly in quantity and disposition, and has great influence in determining the precise form which the future division of the ovum will take. It may be small in quantity and uniformly diffused through the cell, as in mammalian ova; there may be a larger quantity, which sinks to the lower part, as in frog spawn; there may be a very large amount, which quite dwarfs the genuine living matter, as in birds' eggs; or there may be a central accumulation, as in crustaceans and insects. The egg is very generally surrounded with some membrane, sheath, or shell, made by itself, or contributed by surrounding cells, or the product of special glands. In such envelopes there is often a special aperture (micropyle) through which alone the spermatozoon can enter. Hard shells like those of birds' eggs must obviously be formed after fertilisation has taken place.

The Male-cell or Spermatozoon.—In the unicellular organisms, among which we find the key to all beginnings, two cells, unable apparently to live independently, unite, and thus make a fresh start. In such cases the two units are usually similar in appearance, though doubtless different in chemical state. Sometimes, however, a small active cell unites with a larger and more passive neighbour, and here we find the first hint of the profound difference between the sexes—a difference of which the contrast between spermatozoon and ovum is literally a concentrated expression.

The spermatozoon is a true cell, though the nuclear portion often predominates over the cell-substance. It is one of the smallest animal cells,

Fig. 1.—Organisms:
a, ovum showing egg membrane, granules, and germinal vesicle; *b*, spermatozoon; *c*, hermaphrodite gland of snail, with ova and sperms; *d*, amœboid ovum; *e*, coalescence of sperm-cell and egg-cell.

as the ovum is one of the largest; it is highly active, while the ovum is peculiarly passive; it rarely bears any nutritive material, while the ovum is very generally weighted with yolk. In its minute size, active locomotor energy, and persistent vitality, the sperm-cell resembles a flagellate Monad among Protozoa, while the ovum is strictly comparable to an Amœba or to one of the yet more passive or encysted forms. In most animals the spermatozoon exhibits three distinct parts: (*a*) the 'head,' or essential portion, consisting almost wholly of nucleus; (*b*) the mobile 'tail' of contractile protoplasm which drives the 'head' along; and (*c*) a small middle portion connecting the head and tail.

In its origin the male-cell resembles the ovum, and the two cells are of course the physiological complements of one another. In history, however, the ovum is strictly comparable not to the sperm, but to the cell which divided to give rise to the sperms. The primitive-male-cell, or mother-sperm-cell, is the homologue of the ovum. Just as the latter divides in segmentation, so the mother-sperm-cell divides, and the divisions exhibited in what is technically called spermatogenesis are closely parallel to the various modes of segmentation exhibited by ova. The mother-sperm-cell segments, but the results have no coherence; they go asunder as spermatozoa. Thus, though all cells may be said to rank as equals, the sperm-cell has a longer history behind it than the ovum. The differences both in form and history express the great differences in chemical constitution which are summed up in the words male and female.

Maturation of the Ovum.—The egg-cell having attained its definite size or limit of growth, usually exhibits a somewhat enigmatical phenomenon known as the extrusion of polar globules. In the great majority of cases it buds off two tiny cells, by a true process of cell-division, in which the nucleus plays its usual orderly part. This extrusion is probably universal, but has not yet been observed in bird or reptile eggs. The polar cells come to nothing, though they may linger for a while in the precincts of the ovum. Their expulsion usually takes place before fertilisation has even begun, but sometimes is subsequent to the entrance of the spermatozoon into the ovum. The result of the twofold budding is that the *mass* of the nuclear elements is reduced by three-fourths, though their number appears to remain constant. In many parthenogenetic ova, which develop without fertilisation, Weismann has recently shown that only one polar globule is formed, and this he believes to be constant, and essentially associated with parthenogenesis.

The import of the process is much disputed.

Cells do indeed usually divide at the limit of growth (see CELL), but the division here is peculiarly unequal so far as cell-substance is concerned. The marked inequality suggests the theory proposed by Minot, Balfour, and Van Beneden, that the polar globules are male extrusions from the predominantly female egg-cell. The retention of one in parthenogenetic ova is supposed to be what makes independent development possible. The retained polar globule replaces the otherwise necessary sperm. Bütschli looks at the matter rather historically than physiologically, and interprets this premature division of the ovum as the survival of an ancient habit which the mother-sperm-cell still retains. The polar cells are thus rudimentary or abortive female germs. This, however, hardly explains why they should so constantly occur. Weismann supposes the two polar globules to be very different from one another: the first extrudes a nuclear substance which was only useful while the egg was a-making; the second gets rid of half of the essential germ-plasma, the bearer of hereditary characteristics, all in order to make room

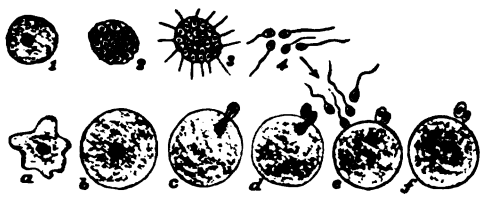


Fig. 2.—Development of Sperms; maturation and fertilisation of Ova (diagrammatic):

1–4, Division of a mother-sperm-cell or primitive-male-cell into a ball of spermatozoa which breaks up; *a–f*, maturation and fertilisation of ovum: *a*, amœboid young ovum; *b*, later stage; *c*, budding off of a first polar cell; *d*, budding off of a second; *e*, spermatozoa round ovum, one entering; *f*, male and female nuclei about to fuse on completion of fertilisation.

for the addition of a corresponding quantity by the spermatozoon. Parthenogenetic ova only give off the first, and retain all their germ-plasma. Thus they are as able to start in development as fertilised ova which exhibit the circuitous process of first giving half of their germ-plasma away and then getting a similar quantity back from another source. There is no proof that the two extrusions are different in character, and Weismann's theory seems to invest ova with a prevision of the benefits of fertilisation. The simplest view is that the ovum divides at the limit of growth, that the inequality of division expresses an opposition between what is extruded and what is retained, and that this means the getting rid of some waste or male elements. In the differentiation of the male elements both among plants and animals, a parallel but reverse antithesis is often demonstrable.

Fertilisation.—The 'ovists' thought that the ovum was all-important, and only required the sperm's wakening touch to unfold its preformed model. The 'animalculists' were equally certain that the spermatozoon was all-important, and only required to be fed by the ovum. Even after the mutual dependence of the sex-elements had been recognised, the opinion prevailed that contact of the two was unessential, and that by an *aura seminalis* fertilisation was possible. In 1677 Hamm and Leeuwenhoek first distinctly saw spermatozoa; in 1780 Spallanzani showed by artificial fertilisation that the eggs must come into contact with the seminal fluid; in 1843 Martin Barry observed the spermatozoon in union with the ovum of the rabbit; in 1846 Kölliker proved the cellular origin and nucleated character of the male elements; and in 1872–75 Bütschli and Auerbach observed two nuclei in fertilised eggs. The dates of these representative discoveries show how gradually the result has been reached that the essence of fertilisation is the intimate union of a male and female cell.

It is needless to cite the numerous investigators who have made the following statements possible: (1) Only one male element really unites with the egg-cell. By a sudden change after the entrance of one sperm the ovum usually ceases to be receptive. The entrance of more than one occasionally occurs, but the result is pathological. (2) The union is very intimate; the nuclei are at least as important as the protoplasm, and according to most authorities much more so. (3) The two nuclei are attracted or drawn to one another, and fuse intimately to form a single nucleus of double origin. (4) Intimate as the union is, its orderliness is not less conspicuous; half of the result is still traceable to the male and half to the female.

While these are the demonstrable structural facts, what the union means is another matter. Some compare the action of the sperm to a ferment, others to stimulating waste products, while Weismann virtually denies sex differences altogether, and maintains that the union is a mere quantitative addition of the amount of germ-plasma lost in extruding the second polar globule. That the spermatozoon furnishes half of the architectural nuclear substance and thereby half of the hereditary characteristics is certain, that it also affords a chemical stimulus to division it is difficult to doubt. In single-celled animals fertilisation is essential to the continued vitality of the species; in all cases the intimate mingling of sex-elements, different in constitution and past experience, secures both an average constancy and minor variations.

Segmentation.—Soon after the essential act of fertilisation has been accomplished in the intimate union of the nuclei, the egg begins to divide. What physical and chemical attractions and repulsions operate in this process we do not know. It is certain that the nuclear elements, which play a very important part throughout, have what we cannot but call a strong individuality of behaviour. It is certain too that the cell-substance plays an important part, and that it is not merely passive material with which the nucleus operates. Recent observers, led by Van Beneden, have elucidated something of the marvellous interaction between nuclei and cell-substance. It would seem that there is an intracellular muscular system, that from certain centres in the protoplasm strands radiate which moor themselves to the nuclear elements and move them about. It has been further established that the double nucleus of the fertilised ovum is accurately composed half of female and half of male elements. When the egg divides into two, the nucleus of each daughter-cell is again half male and half female, and it is probable that this exact dualism persists yet further.

The different ways in which ova divide depend mainly upon the quantity and disposition of the passive yolk-material. (1) When there is very little nutritive capital, and that uniformly diffused, the whole ovum divides, vertically and horizontally, till a sphere of approximately equal cells is formed. This total segmentation occurs for instance in the ova of sponge, starfish, lancelet, and mammal. (2) In the ova of the frog, where the actual process of division may be most conveniently watched, there is more yolk, which has chiefly sunk to the lower hemisphere of the egg. Division is still total, but after a few segmentations it will be seen that the upper hemisphere cells are dividing more rapidly and are becoming markedly smaller than those in the lower part. The segmentation is total but unequal. (3) In the ova of birds and reptiles

and many fishes there is a large quantity of yolk, and the formative substance lies like a drop on the upper surface of the nutrient mass. Division is

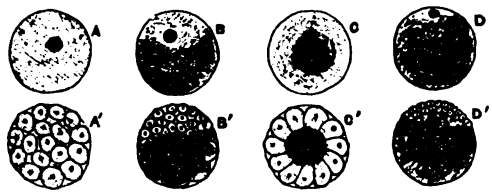


Fig. 3.
Relation of Yolk to division of Ovum (diagrammatic):
A, little and diffuse yolk. A', total equal division.
B, more yolk at lower pole. B', total unequal division.
C, central yolk. C', peripheral division.
D, much yolk. D', partial division.

restricted to the formative protoplasm, and thus the segmentation is conspicuously partial. (4) In the ova of crustaceans, insects, and their allies, the yolk usually accumulates in the centre of the ovum as a more passive, nutritive core, surrounded by the active, formative protoplasm. The latter divides, and forms a sphere or ellipsoid of cells around the less markedly divided yolk. In Peripatus—the survivor of ancestral insects—the whole ovum segments, but the cells are not for a while defined off from one another, so that the result looks like a giant Protozoon with numerous nuclei. Hints of this are seen in other cases.

Morula and Gastrula.—The result of segmentation is a ball of cells, differing according to the above described modes of division. When a wide cavity has been left, between the cells as they multiplied, a hollow sphere is formed, technically called a *blastosphere;* if no such conspicuous 'segmentation cavity' has been left the result is an almost solid mulberry-like ball of cells—a *morula.* When the division is partial, mainly confined to an area of formative protoplasm lying upon a nutritive mass, the result is a disc of cells which by and by spreads round the yolk. Such a segmented area is generally known as the *blastoderm.* (See D', fig. 3.)

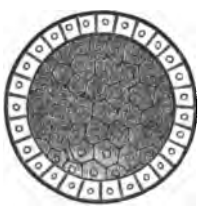


Fig. 4. — Section of hollow ball of Cells or Blastosphere.

The next decisive chapter is one of infolding, or the formation of a *gastrula.* In the simplest cases one hemisphere of a hollow ball of cells is dimpled or invaginated into the other. More accurately, the one hemisphere sinks into and becomes surrounded by the other. The sphere becomes a two-layered sack or gastrula, with an opening technically called the *blastopore.* In many other cases—e.g. fishes, reptiles, and birds—owing to the yolk, complete invagination is not possible. An infolding still occurs, but it is no longer conspicuous, and the gastrula-stage is thus disguised. It must also be noted that the two-layered condition may arise by *arrangement* of the cells, without there being any process that can be called invagination. Thus, in the oval ciliated embryo or *planula* of most Hydrozoa, the two layers have been frequently observed to arise by a process of internal differentiation, known as *delamination.*

Fig. 5. Gastrula: Showing ectoderm, ciliated endoderm, blastopore, and central cavity.

The Germinal Layers.—Even in a simple colony of cells like a Volvox all the units do not remain alike. Inside cells are in different conditions from outside cells, and division of labour with consequent difference of structure is bound to occur. So again, in the ball of cells into which the ovum divides, the one hemisphere with heavier material is usually different from the upper hemisphere, which is specifically lighter and less encumbered with reserve material. Even in the morula or blastosphere differentiation has begun.

But we have just seen that by the folding of one hemisphere into the other, or in other ways, a gastrula often more or less modified arises. The embryo thereby attains definitely differentiated layers—outer and inner. The preformationists spoke of development as an unfolding; we now insist on an infolding. The layered character of the embryo was early recognised by Wolff, and yet more clearly by Pander and Von Baer, but its fundamental import can hardly be said to have been realised till Huxley in 1849 compared the outer and inner cell-layers of Cœlenterates (hydroids, jelly-fish, &c.) to the outer and inner layers which embryologists had begun to demonstrate in development. Soon afterwards Allman gave to the outer and inner layers of Cœlenterates the names *ectoderm* and *endoderm*, which are now universally used for the outer and inner layers of every embryo. The results reached by Huxley and Haeckel, Kovalevsky and Ray Lankester, and many others, have made it certain that the formation of these two germinal layers is constant in animals, that they are exactly comparable throughout the series, and that with few exceptions they give rise to precisely the same adult structures.

In sponges and Cœlenterates only two genuine layers of cells are developed. A middle stratum, seen in faint suggestion in the common Hydra, may indeed appear between outer and inner layers, and may be of the greatest importance in the structure of the animal, but embryologists are not inclined to allow this middle stratum—the so-called *mesoglœa*—to rank as a distinct layer beside the other two.

In higher animals, however, there is a definite middle layer or *mesoderm* between the other two. Its history involves much greater difficulty than that of the ectoderm and endoderm; it seems as if it might arise in some half-dozen different ways. One common mode of origin has been emphasised by the brothers Hertwig in what they call the 'Cœlome-theory.' The inner layer arises by an infolding of the outer, and a primitive gut-cavity (*archenteron*) thus results. Now begins an out-folding. From the gut-cavity two sacks (*cœlome-pockets*) grow out, one on either side, insinuating themselves between the first two layers. The cavities of the sacks form the future body-cavity of the animal; the outer and inner walls form the corresponding two divisions of the mesoderm. However this middle layer arises, it finally exhibits an inner and an outer division, so that the Hertwigs speak of *four* germinal layers. The outer (parietal or somatic) portion of the mesoderm clings to the external body-wall, forming muscles and the like; the inner (visceral or splanchnic) portion cleaves to the internal organs.

Origin of Organs.—With few exceptions, the same organs and structures arise from the same layers—e.g. the nervous system from the ectoderm, the lining of the mid-gut from the endoderm. (*a*) *The ectoderm* or *epiblast* gives origin to outer skin or epidermis, external skeleton, superficial glands, sense-organs, nervous system, the infoldings at both ends of the gut, and probably to the primitive excretory (segmental) duct. (*b*) The *endoderm* or *hypoblast* forms the lining of the mid-gut, and necessarily, too, of outgrowths from it, such as the lungs and various glands. In verte-

brates it also gives rise to that important skeletal axis—the notochord—which always precedes the 'backbone.' (*c*) The *mesoderm* or *mesoblast* gives rise to all the rest. That is to say, the under-skin, the muscles, the connective tissue, the internal skeleton, the lining of the body-cavity, the heart and the blood, and the like are all mesodermic. The reproductive organs, though to some extent structures by themselves, also arise, in the great majority of cases, in connection with the mesoderm. It must be noted, further, that while the main part of a structure is referable to one of the three layers, the entire structure is very often composite. Thus, the eye of vertebrates mainly arises as an outgrowth from the brain, but some of the less essential parts are furnished by the mesoderm. The outgrowths from the mid-gut are in origin endodermic, but they too are always aided by the middle layer.

Physiological Embryology.—The immense progress of embryology within recent years has been almost wholly morphological. Of the physiological conditions of development we know relatively little. The later stages of embryonic life in higher animals have been studied by Preyer and others with much success, but this is but the threshold of investigation. A few luminous results as to the architectural conditions are due to the courage of His and Rauber, who have followed the earlier suggestions of Pander and Lotze. The task, which is involved in stupendous difficulties, has been continued in the experimental investigations of O. Hertwig, Fol, Pflüger, Born, Roux, Schultze, Gerlach, and others. Observations as to the actual dynamics of cell-division, such, for instance, as those of Van Beneden and Boveri, are beginning to appear; while the title of a recent work by Berthold—*Protoplasmic Mechanics*—shows how the biologist persistently seeks the aid of the student of physics in order to explain the architecture of the living organism. 'To think that heredity will build organic beings without mechanical means' is, according to His, 'a piece of unscientific mysticism;' while Pflüger insists on the conception of development as 'an organic crystallisation.' The laws of growth, which express how each fertilised egg-cell must divide, and how the resulting units must arrange themselves first in layers and thereafter into organs, must be expressed in terms of physical and chemical conditions. But this is the task of the future.

Generalisations.—(1) *The Ovum-theory.*—In all cases of ordinary sexual reproduction among plants or animals the offspring develops from a fertilised egg-cell. This is the ovum-theory prophesied by Harvey in 1651, again almost realised by Wolff in 1759, but only demonstrated about a hundred years later when the organism was at length analysed into its component cells (see CELL). The fact that every plant or animal begins at the beginning again, at the level of the Protozoa or single-celled organisms, Agassiz does not hesitate to call one of the greatest discoveries in the natural sciences in modern times.

(2) *The Gastræa-theory.*—The simplest animals are single cells; these occasionally form loose colonies or balls of cells; next come sack-like two-layered organisms, such as the simplest sponges. These are the first three grades among living animals, but they also correspond to the first three chapters in the life-history of each organism. The single cell (the ovum), the ball of cells (the morula or blastosphere), the sack of cells in two layers (the gastrula), we have seen to be the first three stages in development. As this gastrula-stage always occurs, though sometimes disguised by the yolk, in the life-history of animals, Haeckel justly emphasised it as the individual's recapitulation of an ancestral state. The simplest, stable, many-celled animal he believed to be like a gastrula (see fig. 5), and he called this hypothetical ancestor of all higher animals a gastræa. A few living animals are still almost at this level; all animals pass through it in

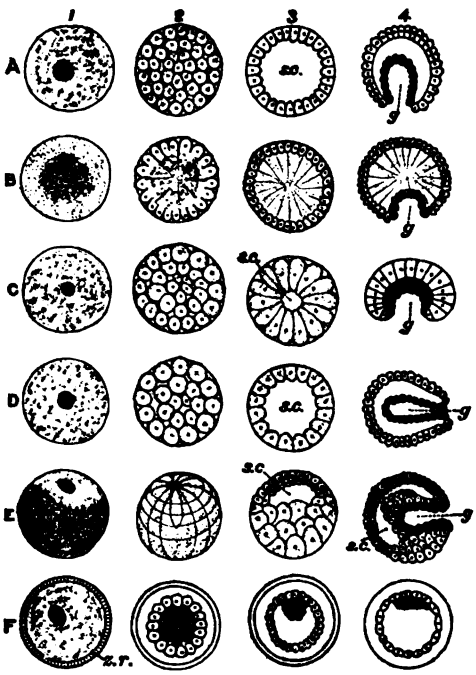


Fig. 6.

The First Stages in Development (not drawn to scale):

1, fertilised ovum; 2, ball of cells; 3, the same still more divided, or in section; 4, the gastrula (except in F): A, sponge, coral, earthworm, or starfish; B, crayfish, or other arthropod; C, river snail, or other mollusc; D, lancelet, tunicate, &c.; E, frog, or other amphibian; F, rabbit, or other mammal; *s.c.*, segmentation cavity; *g*, gastrula invagination; *z.r.*, zona radiata, or porous envelope. Darkly shaded cells are endoderm, lighter are ectoderm, dots are yolk granules.

their gastrula-stage. The gastrula is a recapitulation of the ancestral gastræa. Rival conceptions of what the first stable, many-celled animal was like have been since proposed, but the gastræa-theory still holds the field.

(3) *The Fact of Recapitulation.*—The gastræa-theory is only a special case of a more general proposition—that the individual recapitulates the history of its kind. That the past lives in the present, or that we individually retread, for instance in our intellectual development, the paths made by our ancestors, is a familiar idea which it is one of the charms of embryology to realise in the life-history of each organism. At an early date Von Baer expressed this in his law, that structural progress or differentiation in development was from a general to a special type. 'In its earliest stage,' he said, 'every organism has the greatest number of characters in common with all other organisms in their earliest stages; at each successive stage the class of embryos which it resembles is narrowed.' In the life-history of a mammal it is possible to trace how the germ at first lingers as it were among the Protozoa; how it divides and passes quickly through the transitional 'ball of cells' stage; how the embryo undergoes its first great differentiation, like all other multicellular animals, in becoming a two-layered gastrula, taking its place beside the ancestral Metazoa; how it by-and-by acquires some of the characters of a young worm, and then of a very simple backboned animal, like a primitive

fish; how with increasing complexity it ranks with reptilian embryos; and lastly, how the fœtus acquires mammalian features, vague and general at the outset, but gradually becoming like those of nearly related forms. Von Baer himself confessed, as every embryologist would do, that with three embryos of higher Vertebrates at the same stage before him, he could not, without close examination, tell one from the other. The accompanying

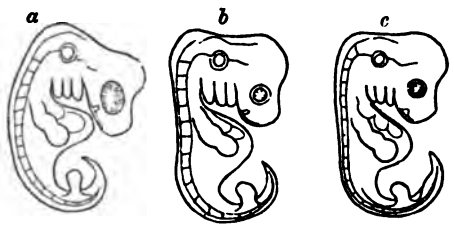


Fig. 7.—Embryos of fowl (*a*), dog (*b*), and man (*c*). (After Haeckel.)

figure of the embryos of a bird, a mammal, and the human species clearly illustrates this close resemblance in early life.

Spencer expressed the progress from simple to complex, from general to special, as a differentiation from homogeneous to heterogeneous, in which the individual history runs parallel to that of the race. The most luminous reading of the fundamental fact is that of Haeckel. The individual development is a recapitulation of the historic evolution of the race. A curve symbolising the turns and twists in the life-history of one of the higher Vertebrates, for instance, is seen to be a reflection of the great bends and branches of the genealogical tree which expresses the historic lineage. The development of the individual microcosm is a summary—often a shorthand summary—of the evolution of the macrocosm of the race. Most pithily, though most technically, he sums up his 'fundamental biogenetic law' in the words 'Ontogeny recapitulates phytogeny.' The fact is very vividly illustrated in many of the more patent life-histories, such as those of crustaceans, insects, and amphibians, where the hatched young follow the rails laid down by their respective ancestors (see AMPHIBIA, CATERPILLAR, CRUSTACEA). Parker happily compares watching development—in which he is one of the modern masters—to reading a palimpsest; below the superficial script there are older and ruder characters, and below these more primitive still. Two cautions must be emphasised. The development is often shortened in its path; circuitous twists, in what we believe to have been the historic course, are skipped by the individual; the momentous steps, however, are always paralleled in the two histories. The individual development may be said to follow the main line of progress, but does not go off into side-lines. Thus the resemblance is between embryos. The embryo bird is hardly like a reptile, but it is always in its development like an embryo reptile. Nor must it be imagined that this fact of recapitulation exactly explains itself. That the present is child of the past does indeed shed great light on the individual's recapitulation of ancestral stages, but the metaphors are apt to suggest that the developing organism has somehow a feeling for history, or that the hand of the past is literally upon it as it grows. It is necessary to get beyond mere metaphors of unconcious memory and the like, and to realise that the same internal conditions which in the long past led to certain momentous changes are still really present doing the same for the individual. The fundamental problem is to elucidate the chemical and physical conditions which represent the living hand of the past upon the development of the present, or to understand how the living matter of the embryo is at each stage both the material and the architect of its upbuilding.

(4) *Continuity of Germinal Protoplasm.*—In flowering plants there is a conspicuous contrast between the reproductive system and the general 'body.' In all organisms this antithesis is fundamental, and the recognition of the fact has shed much light upon the problems of development and heredity. In the simplest animals a portion of the cell is separated off to start a new individual; and as this is virtually continuous with the parent the reproduction of like by like is natural and necessary. In a few animals (some worm-types, crustaceans, insects, &c.), when the ovum has multiplied to a limited extent, by the usual process of division, certain of its descendants, as yet very like the original ovum, are set apart to form the reproductive cells of the offspring, and take no share in building up the 'body.' The germ-cells of the offspring, thus early insulated, are in a real sense continuous with the parental ovum; they retain some of the living capital intact, continue the protoplasmic tradition unaltered, and when themselves liberated will naturally do what the original germ-cells did. Thus the reproduction of like by like becomes more intelligible, and we reach the conception of a continuous necklace-like chain of immortal germ-cells from which the mortal bodies of successive generations are budded off. This conception has been more or less clearly suggested by numerous naturalists—Owen, Haeckel, Jäger, Brooks, Galton, Nussbaum, and others, but has been elaborated by Weismann in his theory of the continuity of the 'germ-plasma.' A continuous chain of germ-*cells* is only demonstrable in a few cases; often they become distinct only at a relatively late stage in the development of the offspring. Therefore Weismann insists not on a continuity of germ-cells from those of the parent to those of the offspring, but only on a continuity of 'germ-*plasma*.' 'In each development a portion of the specific "germ-plasma" which the parental ovum contains is not used up in the formation of the offspring, but is reserved unchanged for the formation of the germ-cells of the following generation.' The germ-plasma which keeps up the continuity has its seat in the nucleus, is a substance of definite chemical and special molecular constitution, has an extreme power of persistence and enormous powers of growth. The general idea is simple enough—an offspring starts with a capital of living matter which is virtually the same as that from which its parents started. Therefore the results are in a general way the same, and the constancy of the species is sustained. How this is modified by variations is not here relevant.

See BIOLOGY, CELL, EGG, FŒTUS, HEREDITY, PLACENTA, REPRODUCTION, SEX; also F. M. Balfour, *Comparative Embryology* (2 vols. Lond. 1880); M. Foster and F. M. Balfour, *The Elements of Embryology* (2d ed. by Sedgwick and Heape, 1883); A. C. Haddon, *Introduction to the Study of Embryology* (Lond. 1887); E. Haeckel, *The History of Creation* (trans. Lond. 1876), and *Anthropogeny* (trans. Lond. 1878); W. His, *Unsere Körperform und das physiologische Problem ihrer Entstehung* (Leip. 1874); O. Hertwig, *Lehrbuch der Entwicklungsgeschichte des Menschen und der Wirbelthiere* (2d ed. Jena, 1888); W. Preyer, *Spezielle Physiologie des Embryo* (1883–84).

Emden, the chief commercial town in the Prussian province of Hanover, is situated a little below the embouchure of the Ems into Dollart Bay, 77 miles WNW. of Bremen by rail. Emden, which strikingly resembles a Dutch town, is surrounded by walls and moats, is well built, has spacious and well-paved streets, with several lofty

antique houses in the Dutch style, and is intersected by numerous canals, which are crossed by about thirty bridges. A canal runs south from the town to Dollart Bay, a distance of about two miles; but it is navigable at high-water only, and then by vessels of not more than 14 feet draught. The harbour accommodation has been improved in connection with the making of the canal from the Ems (q.v.) to the Jade. The finest building is the town-hall (built in 1574–76), containing a library and a curious collection of ancient arms and armour. Emden has a large shipping trade, especially in corn, cattle, butter, cheese, and bricks, and several manufactures; the principal industry, however, is shipbuilding. Several vessels leave this port every year for the herring-fishery. Pop. (1875) 12,874; (1890) 13,695. Emden belonged originally to East Friesland, and after various vicissitudes was created a free imperial town under the protection of Holland in 1595, and remained so until 1744, when it passed to Prussia. After belonging successively to Holland, France, and Hanover, it again became Prussian in 1866.

Emerald (Span. *esmeralda*, Fr. *émeraude*, Ger. *smaragd*, Gr. *smaragdos*), a mineral generally regarded by mineralogists as merely another variety of the same species with the Beryl (q.v.), with which it essentially agrees in composition, crystallisation, &c., differing in scarcely anything but colour. The emerald, which, as a gem, is very highly esteemed, owes its value chiefly to its extremely beautiful velvety green colour. It is composed of about 67–68 per cent. of silica, 15–18 of alumina, 12–14 of glucina, and minute proportions of sesquioxide of chromium, magnesia, and carbonate of lime. Its colour is ascribed chiefly to the oxide of chromium which it contains. Its specific gravity is 2·70–2·76. In hardness it is rather inferior to topaz. The localities in which the emerald is found are very few. The finest have long been brought from Colombia (q.v.), where they are obtained from veins traversing clay-slate, hornblende slate, and granite; and valuable stones also come from the Upper Orinoco, in Venezuela. Stones of inferior quality are found in Europe, imbedded in mica-schist, in the Henbach Valley, in Salzburg. They also occur in the Urals; and some old mines in Upper Egypt have been found to yield them. This gem, known from very early times, was highly prized by the ancients. Pliny states that when Lucullus landed at Alexandria, Ptolemy offered him an emerald set in gold, with his portrait engraven on it. Many wrought emeralds have been found in the ruins of Thebes. Nero, who was near-sighted, looked at the combats of gladiators through an eye-glass of emerald, and concave eye-glasses of emerald seem to have been particularly esteemed among the ancients. As a precious stone, the emerald is rarely without flaw. Its value also depends much on its colour. A very perfect emerald of six carats has been sold for £1000. It appears not improbable that emeralds have been found in the East, in localities not at present known, but the name Emerald or Oriental Emerald is often given to a very rare, beautiful, and precious green variety of Sapphire (q.v.).

Emerald Copper is a beautiful and very rare emerald-green crystallised mineral, also called Dioptase, found first and chiefly in limestone in the hill of Altyn-Tübe (Altai Mountains), and also obtained in the Urals and the South American Cordilleras. It is composed of about 39 parts silica, 50 protoxide of copper, and 11 water.

Emeritus (Lat.), a term applied originally to a Roman soldier who had *served out* his time, and been discharged on something equivalent to our half-pay. It is now commonly employed to designate certain functionaries, such as professors, who have been honourably relieved from the duties of their office, on account of infirmity or long service, and who are usually granted a retiring allowance.

Emerson, Ralph Waldo, poet and essayist, born in Boston, United States of America, May 25, 1803; died in Concord, Massachusetts, April 27, 1882. He came of what his own people would call the best New England stock, namely, from a long line of educated and respected ministers. His father was settled over a Boston congregation: an able preacher and an accomplished man of letters. His mother was a woman of high qualities and dignified bearing; his aunt, Mary Moody Emerson, who influenced him very strongly, was a strikingly original and a very cultivated woman. He was the third of seven children; two of his brothers, Edward and Charles, were distinguished for ability, but both died before middle age. His birthplace was within a few minutes' walk of that of 'the great Bostonian,' Benjamin Franklin. His father died when he was six years old, leaving his family in a straitened condition. At eight years old he entered the public grammar-school, and soon afterwards the Latin school. At the age of ten or eleven he was turning Virgil into English heroic verse, was fond of reading history, loved the study of Greek, and was given to frequent rhyming. He thinks the idle books under the bench at the Latin school were as profitable to him as the regular studies. One of his early schoolmates remembered him as 'a spiritual-looking boy in blue nankeens,' whom he loved when he looked upon him, he thought him 'so angelic and remarkable.'

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Emerson did not take a very high rank in his college class, that which graduated at Harvard in 1821. He took a second prize, however, for an essay in English, and was chosen class poet after several others had declined. His college career had nothing of the singular brilliancy which characterised that of his brothers Edward and Charles. After graduating he kept school in different places, at the same time studying divinity under the direction of Dr Channing, and attending some of the lectures given at the Harvard Divinity School, the chief Unitarian theological seminary. He was grave, gentle, dignified as a teacher, never punishing except by words. He used to give the boys selections for reading—something from Plutarch's *Lives*, for instance—to carry home with them. In 1826 he was 'approbated to preach' by the Middlesex Association of Ministers, and after preaching in several pulpits—at the south, where he was obliged to go for his health, at New Bedford, at Northampton—he was, on the 11th of March 1829, settled as colleague with the Rev. Henry Ware, minister of the Second Church in Boston. In September of the same year he was married to Miss Ellen Louisa Tucker, who died, without leaving any children, in 1832. In this same year he preached a sermon in which he announced certain views with regard to the Lord's Supper which were disapproved by the larger part of his congregation. This sermon is the only one of his ever printed. In consequence of the difference of opinion between himself and his parishioners, he found it impossible to continue in the relation which had been harmonious and happy, and thus, with the most friendly feelings on both sides, he left the pulpit of the Second Church, and found himself obliged to make a beginning in a new career.

In 1833 he made a first visit to Europe, of which he has given a brief account in the work entitled *English Traits*. On his return he preached in different pulpits, and began devoting himself to delivering lectures and writing essays. His first

subjects were 'Water' and 'Relation of Man to the Globe'—hardly such as we should have expected from the spiritual philosopher and poet, his acquaintance with the physical sciences being apparently very limited. But he wished to make good the loss of his salary, and lectured on branches of knowledge in which he knew he could interest the public. After a short experience he ventured on subjects more congenial to his past studies and habits of thought—Michael Angelo, Milton, Luther, George Fox, and Edmund Burke. In 1834 Emerson fixed his residence at Concord, a pleasant farming town in Middlesex county, Massachusetts, famous for having been the scene of the opening conflict of the revolution. He lived at first in an old 'gambrel-roofed' house built by his grandfather, the Rev. William Emerson, and afterwards celebrated as the 'Old Manse' of one of Hawthorne's stories, and the place where for a time he resided. In 1835 he married his second wife, Miss Lydia Jackson of Plymouth, Massachusetts. After this marriage, Mr and Mrs Emerson removed to the house which he purchased, where he passed the rest of his days, and where his widow and one of his daughters are still living (1889).

During several successive years he delivered courses of lectures in Boston; in 1835 ten lectures on English literature, in 1836 twelve lectures on the philosophy of history, in 1837 ten lectures on human culture.

Emerson made the personal acquaintance of Carlyle during his first visit to Europe in 1833. Carlyle was then living at Craigenputtock, where Emerson sought him out, and passed time enough with him for some conversation, of which he has given an account in the first chapter of *English Traits*. In the next year, 1834, a letter from Emerson to Carlyle began a correspondence which continued nearly forty years, closing with the letter from Carlyle to Emerson, dated April 2, 1872. This correspondence, which has been carefully edited by Professor Charles Eliot Norton, shows the two men with all their characteristics; different as optimist and pessimist, yet with many profound sympathies with each other. Emerson was very desirous of having Carlyle come to stay with him at Concord. It would have been a dangerous experiment in vital chemistry—hydrofluoric acid in a vessel of glass. The deaths of Emerson's younger brothers, Edward in 1834, and Charles in 1836, produced a very deep impression on his affectionate nature. He had a true admiration for both of them, which they well deserved. The youngest, Charles Chauncy Emerson, well remembered by the present writer, stands apart from all the young men he has known for the elevation and beauty of his intellect and character.

In 1836 a thin volume was published, entitled *Nature*, which, though appearing anonymously, was at once known as coming from Emerson. Like his early poems, it was read by few, understood by fewer still, little thought of or cared for by the general reading public, but made much of by a small circle of admirers. It is a kind of poetical rhapsody—prose with wings growing, but not strong enough to lift it into the atmosphere of rhythmical music. To those who like naturally, or have acquired the taste for, the Emersonian modes of thought and expression, it is fascinating. But it took twelve years to sell five hundred copies. The germs of many of Emerson's thoughts, afterwards expanded in his essays and poems, may be found in this dreamy little volume.

Nature was followed by 'The American Scholar,' an oration delivered before the Phi Beta Kappa Society of Harvard University. Few anniversary addresses have attracted so much attention. Mr Lowell says of it that 'its delivery was an event without any former parallel in our literary annals, a scene to be always treasured in the memory for its picturesqueness and its inspiration.' This grand oration was our intellectual declaration of independence. The orator did not spare his fellow-countrymen. 'We have listened too much,' he says, 'to the courtly muses of Europe. The spirit of the American freeman is already suspected to be timid, imitative, tame. The scholar is decent, indolent, complacent.' The young men of promise, he says, are discouraged and disheartened. 'What is the remedy? If the single man plant himself indomitably on his instincts and there abide, the huge world will come round to him. Patience—patience; with the shades of all the good and great for company; and for solace the perspective of your own infinite life; and for work the study and the communication of principles, the making those instincts prevalent, the conversion of the world.'

These two publications, the first in the series of his collected works, strike the keynote of his philosophical, poetical, and moral teachings. The 'Address before the senior class in Divinity College, Cambridge, July 1838,' which follows them, defined his position in, or out of, the church in which he had been a minister. Two or three sentences will sufficiently show where he stood: 'One man was true to what is in you and me. He saw that God incarnates himself in man, and evermore goes forth to take possession of his world. He said in this jubilee of sublime emotion, "I am divine. Through me God acts; through me speaks." . . . There is no doctrine of the Reason which will bear to be taught by the Understanding. The Understanding caught this high chant from the poet's lips and said, in the next age, "This was Jehovah come down out of heaven. I will kill you if you say he was a man."' In its simplest and broadest statement this discourse was a plea for the individual consciousness as against all historical creeds, bibles, churches; for the soul of each man as the supreme judge in spiritual matters. The delivery and publication of this address produced a great sensation in the religious world, especially among the Unitarians. Professor Andrews Norton attacked Mr Emerson's position in an article entitled 'The Latest Form of Infidelity.' Much controversy followed, in which Emerson took no part. He was not in the habit of defending his oracular statements. Delphi is not given to argument and explanation.

Whosoever has read carefully and lovingly these three essays, *Nature*, the *Phi Beta Kappa Oration*, and the *Divinity School Address*, can almost say of Emerson what he makes the Sphinx say of herself:

> Who telleth one of my meanings
> Is master of all I am.

These three essays take up about one-third of the first volume of his collected works, which are eleven in all. The titles of these volumes are as follow: Vol. i. *Nature; Addresses and Lectures;* ii. and iii. *Essays*, first and second series; iv. *Representative Men;* v. *English Traits;* vi. *The Conduct of Life;* vii. *Society and Solitude;* viii. *Letters and Social Aims;* ix. *Poems;* x. *Lectures and Biographical Sketches;* xi. *Miscellanies.* These titles, and the more special ones which are included within them, give a very imperfect and unsatisfying idea of the contents of the eleven volumes. If these were taken to pieces, and their leaves thrown into a basket or barrel and shaken up, they might be taken out and rearranged in a dozen different ways, and yet have cohesion enough to make almost as intelligible consecutive reading as they are in their present order. Their arrangement under their different heads is nearly as

arbitrary as that of certain stars which are grouped under the name of Corona, or Lyra, or Andromeda. His son, Dr Edward Emerson, gave this account of his way of building his lectures in a paper, to the reading of which I had the privilege of listening: 'All through his life he kept a journal. . . . This book, he said, was his "Savings Bank." The thoughts thus received and garnered in his journals were indexed, and a great many of them appeared in his published works. They were religiously set down just as they came, in no order except chronological, but later they were grouped, enlarged or pruned, illustrated, worked into a lecture or discourse, and after having in this capacity undergone repeated testing and rearranging, were finally carefully sifted and more rigidly pruned, and were printed as essays.'

We can easily understand that in adjusting his mosaic fragments to each other there are likely to be occasional misfits which puzzle weary eyes and brains. Still, there are subtle connections oftentimes in thoughts which at first sight seem unrelated, and the pious reader of Emerson will always find it worth while to seek for them, though some of them may be 'hard for the non-elect to understand.'

Emerson wrote occasionally in verse from his schooldays until he had reached the age which used to be known as 'the grand climacteric,' sixty-three. *Terminus*, which he read to his son in 1866, is, so far as I know, the last poem he wrote. It is a farewell to his literary life, though he made some efforts in after-years. His poems are to his prose what the corolla is to the calyx. Both spring from the same root; both are modifications of the same growth; the sepal often shows the delicacy and colour of the petal, and the petal often lapses into the homelier texture and complexion of the sepal. His poems are not and hardly can become popular; they are not meant to be liked by the many, but to be dearly loved and cherished by the few. Such poems as *The Problem*, *Fate*, and *Days*, once rightly read, are never forgotten. The influence of Marvell, of George Herbert, of the Persian poets, of whom he was very fond, may be frequently traced; but the writer he most reminds us of, whatever he writes, is—Emerson. His occasional lawlessness in technical construction, his sometimes fantastic expressions, his enigmatic obscurities hardly detract from the pleasant surprise his verses so often bring with them. His teachings have not always had a wholesome effect on his train of imitators and followers in poetry, or what was meant for poetry. It was very well for him to find fault with 'the tinkle of piano-strings,' and say that

> The kingly bard
> Must strike the strings rudely and hard
> As with hammer or with mace;

but if a self-crowned 'kingly bard' undertakes to play on the harp or piano with his fists instead of his fingers, we must beg leave to stop our ears. The magnificent lawlessness of 'Lord' Timothy Dexter in punctuation is a bad precedent for poets to follow in composition. The poetic license which we allow in the verse of Emerson is more than excused by the noble spirit which makes us forget its occasional blemishes, sometimes to be pleased with them as characteristic of the writer.

The idealist in philosophy, the rationalist in religion, the bold advocate of spiritual independence, of intuition as a divine guidance, of instinct as a heaven-born impulse, of individualism in its fullest extent, making each life a kind of theocratic egoism; all this may be seen in every one of his larger utterances. For him nature is a sphinx, written all over with hieroglyphics for which the spirit of man is to find the key. To interpret nature is the province of the thinker, and especially of the poet—not as Bacon intends, by the analysis of phenomena—'natural philosophy'—but by detecting the higher, hidden significance of all natural appearances. He had learned from his wise relative, Aunt Mary Moody Emerson, to 'scorn trifles;' he bettered his lesson by teaching that man is made to scorn heaven itself if a higher empyrean is offered to him.

> The fiend that man harries
> Is love of the Best. . . .
> The heaven that now draws him
> With sweetness untold
> Once found—for new heavens
> He spurneth the old.

Throughout his lectures and essays are scattered wise sayings, shrewd observations, delicate strokes of wit, curious gleanings from his widely discursive reading, and eloquent imaginative passages. But above all the special virtues to be found in his writings in prose and in verse we must recognise the sense of being in relation with a pure and lofty spiritual nature. 'Love of the Best' breathes in every expression of his thought. His writings must be read for their inspiring influence, their stimulus to high thought and endeavour, the noble manhood which pervades them. Recognising these as the chief claims of Emerson's essays and poems, we can delight in their singular and distinctive beauty of expression, their delicate wit, their iridescent variety of unexpected suggestions, their unaffected and often unconscious archaisms, which carry the reader's imagination back to his favourite Montaigne, their happy illustrations, their self-sustaining wisdom.

Emerson loved his quiet Concord life, the repose of which was, however, constantly broken by more or less welcome visitors, who sought him as an oracle. He was long-suffering with those 'devastators of the day,' as he called them, each of whom thinks of himself or herself as a privileged intruder. He travelled far and wide as a lecturer. In *English Traits* he has recorded not so much what he saw as what he thought while visiting England and Scotland, and in reflecting on his tour after his return. At home he was, according to village evidence, 'a first-rate neighbour, and one who always kept his fences up.'

Emerson was strongly opposed to slavery, but not conspicuous as an abolitionist. He would have bought out the slave-holders, and if men did not cling closer to their money than they do to their lives, his idea might have had some reason in it. He looked on at the 'Brook Farm' experiment with a kind of amused interest, but took no active part in the project. He listened to the long-haired reformers who swarmed at one time about the Chardon Street Chapel with a kindly curiosity, but his sense of humour as well as his good judgment was his safeguard, and he was not to be betrayed into any fanatical extravagance.

His personal appearance was that of the typical New Englander of college-bred ancestry. Tall, spare, slender, with sloping shoulders, slightly stooping in his later years, with light hair and eyes, the scholar's complexion, the prominent, somewhat arched nose which belongs to many of the New England sub-species, thin lips, suggestive of delicacy, but having nothing like primness, still less of the rigidity which is often noticeable in the generation succeeding next to that of the men in their shirt-sleeves, he would have been noticed anywhere as one evidently a scholarly thinker astray from the alcove or the study, which were his natural habitats. His voice was very sweet, and penetrating without any loudness or mark of effort. His enunciation was beautifully clear, but he often hesitated as if waiting for the right word to present

itself. His manner was very quiet, his smile was pleasant, but he did not like explosive laughter any better than Hawthorne did. None who met him can fail to recall that serene and kindly presence, in which there was mingled a certain spiritual remoteness with the most benignant human welcome to all who were privileged to enjoy his companionship.

Much has been written about Emerson during his life and since his death. Some of the principal sources of information about him are *A Memoir of Ralph Waldo Emerson*, by James Elliot Cabot (Houghton & Mifflin, Boston and New York, 1887), which is the authoritative Life of Emerson, by his literary executors; *Ralph Waldo Emerson, Life, Writings, and Philosophy*, by G. W. Cooke (James R. Osgood & Co., Boston, 1882); *Emerson at Home and Abroad*, by Moncure Daniel Conway (James R. Osgood & Co., Boston, 1882); *Ralph Waldo Emerson, a Biographical Sketch*, by Alexander Ireland (Simpkin, Marshall & Co., Lond. 1882); *Ralph Waldo Emerson*, in 'American Men of Letters,' by Oliver Wendell Holmes (Houghton, Mifflin & Co., Boston, 1885); *Emerson in Concord*, by his son Edward Waldo Emerson, a most interesting personal memoir (Houghton, Mifflin & Co., Boston, 1889). Emerson's complete works, edited by James Elliot Cabot, are published in a uniform edition, making eleven duodecimo volumes, by Messrs Houghton, Mifflin & Co., Boston, U.S., and by Macmillan & Co., London, in six volumes, with preface by John Morley.

Emery, the 'Armenian whetstone' of Theophrastus, is a variety of Corundum (q.v.), the mineral species which embraces ruby, sapphire, and other oriental precious stones, variously named according to their colour. The precious stones mentioned consist of nearly pure alumina in a crystalline condition, while emery is an amorphous admixture of alumina with varying proportions of oxide of iron and silica. Next to the diamond, these minerals are the hardest substances found in nature; but the hardness of emery is modified by the amount of iron and silica which enter into its composition. In external appearance, emery has nothing in common with the brilliant stones to which it is related, being a dense, opaque, dull, bluish-black substance, like a fine-grained iron ore. It occurs in large boulder-like masses on Naxos and some of the other islands of the Greek Archipelago, these being the principal commercial sources of the material.

It is prepared for use by first breaking it into lumps about the size of a hen's egg, then crushing these to powder by stampers. It is then sifted to various degrees of fineness, which are numbered according to the meshes of the sieve. Plate-glass manufacturers and others separate emery-powder into different degrees of fineness by the method of Elutriation (q.v.). Emery thus prepared is used for a great many important purposes in the arts. Being next in hardness to diamond-dust and crystalline corundum, the lapidary uses it for cutting and polishing many kinds of stone. Glass stoppers of all kinds are ground into their fittings with it. Plate-glass is ground flat by its means; it is also used in glass-cutting, and in grinding some kinds of metallic fittings. When employed for the polishing of metals, it has to be spread on some kind of surface to form a sort of fine file. *Emery-paper*, *emery-cloth*, *emery-sticks*, *emery-cake*, and *emery-stone* are various contrivances for such purposes. Emery-wheels are also largely used for smoothing and polishing the surface of iron castings, and in engineering work generally. These wheels consist principally of a mixture of emery-powder and hard vulcanised india-rubber. The polishing and buffing wheels employed by cutlers are also fed with emery-powder. See POLISHING.

Emesa. See HEMS or HOMS.

Emetics, medicines given for the purpose of producing Vomiting (q.v.). They are given when it is desirable to relieve the stomach of some noxious or indigestible substance, such as a narcotic poison, or excess of food, or some special article of diet which has disagreed. Emetics are also administered in cases of fever, where the copious secretion they produce from the glands of the stomach and intestines is supposed to have a directly curative effect, aided, perhaps, by the sedative action of emetics upon the circulation and nervous system. There is a considerable amount of evidence to show that emetics have the power of cutting short typhus and other fevers in the earliest stage, and afterwards of making the attack of the disease less severe. In diseases of the respiratory organs, emetics are given as the quickest and safest method of removing accumulated mucus from the air-passages; and in Croup (q.v.) their action is especially favourable, being often followed by expectoration and a rapid improvement in the suffocative symptoms. Emetics are to be given with great caution, however, in all very depressed states of the system, as their primary action is to produce nausea, which is attended always with more or less diminution of the vital power, and often with great depression of the heart's action, amounting to syncope or fainting. Emetics may produce vomiting either by their local action on the throat, gullet, and stomach, or by their action through the blood on the nervous mechanism regulating the movements of the stomach. They are thus divided into two groups, *local* and *general* emetics; and the depressing effect of the former is much less than that of the latter. Some substances will produce vomiting in either way; so that the distinction between the two classes is not very definite. Among the chief emetics in use are mustard (two tablespoonfuls), common salt (a tablespoonful or more), alum (a teaspoonful), in a tumblerful of water, repeated after a quarter of an hour if necessary. These, with sulphate of copper or zinc, are mainly local in their action; ipecacuanha and emetin, squills, senega, tartar emetic and other soluble salts of antimony, apomorphia, are mainly general in their action. The production of vomiting is aided, whatever emetic is used, by copious draughts of warm water. Tickling the throat with a finger or feather is often an effective mechanical means to produce vomiting.

Emetin is the alkaloid which forms the active principle of ipecacuanha-root. It may be obtained by drying the powdered root-bark with milk of lime, and then exhausting with boiling chloroform. It is a white powder, becoming brown on exposure to light, slightly soluble in water, but readily in alcohol. When taken internally, it exhibits violent emetic properties, $\frac{1}{10}$th of a grain sufficing to cause vomiting. The wood of the root contains no emetin, so that the virtue of ipecacuanha-root entirely resides in the bark.

Emigration literally means going from one place to another; but in its established signification it implies (1) permanently leaving a place to make a home elsewhere; (2) going out of one country to another, and generally to a distant part of the world; (3) going out from a community and leaving the bulk behind—in this sense the word is opposed to migration, which implies the movement of whole tribes or nations; (4) going out spontaneously, not as part of some systematic scheme of settlement—in this sense the word has been sometimes opposed to colonisation. In the country which people leave they are called emigrants or wanderers out; in that in which they settle they are usually called immigrants. Jacob and his family were immigrants to Egypt, and their descendants became emigrants from that country when they went to inherit the Promised Land.

Among the principal causes which have led to emigration at different times in history may be noticed the pursuit of wealth, the pressure of population at home, and political, social, or religious discontent. The Spaniards went to America to get gold. Many of the Greeks in old times, like many of the English in our own, emigrated because of over-population. Political and social discontent, as well as over-population, accounts in great measure for the large numbers of Irish emigrants. The burden of compulsory military service is supposed to be, and to have been, one determining cause of German emigration. And religious oppression led to the emigration of the Huguenots from France to England, and of the Puritans from England to North America.

In ancient times, when the Mediterranean was the centre of the world, the Greek race sent out most emigrants. The Phœnicians were rather traders than settlers, and the Roman colonies were mainly military stations, carefully designed by government. The Greeks emigrated because their space was limited at home compared with their numbers, and because in the small towns which made up Greece party spirit ran high, and often led to large bodies of citizens leaving for a new home. Greek emigrants settled along the shores of the Mediterranean, from Cyprus in one direction to Marseilles in another, and these settlements were quite independent of, and in many cases greater than, the mother-cities.

Between ancient and modern times there intervenes a long period of the world's history, during which there was a perpetual ebb and flow of races throughout Europe; but the movements of the barbarians who overran the provinces of the Roman empire, and even the later and more organised enterprises of such peoples as the Normans, fall rather under the head of migration, invasion, or conquest, than under that of emigration. At the end of the 15th century, the opening of the passage to India round the Cape of Good Hope by Vasco da Gama, and the discovery of America by Columbus, at once disclosed new lands to which Europeans might emigrate, and stimulated the restless spirit which prompts to emigration. The Spaniards went to the west, the Portuguese to the east; and, being natives of the south of Europe, they were better fitted than the more northerly nations to make their homes in hot climates. Large numbers of Spaniards emigrated to the West Indies and to Central and South America. The Portuguese were fewer in numbers, and the East Indies, to which at first they chiefly went, were less suitable than America for European settlement; still, at the present day, their descendants are left in India, Ceylon, and elsewhere. To Brazil, which was outside their beat, they found their way by accident, and that country became the home of many Portuguese. Among the nations who followed the Portuguese and Spaniards to the east and west were the Dutch, the French, and the English. The Dutch, though great traders, did not send out many emigrants compared with other colonising peoples; but in addition to those who were attracted to the East Indies by commerce, Dutchmen emigrated to what is now known as New York, and still more to the Cape of Good Hope. The French were rather conquerors than settlers, but many Frenchmen emigrated to various parts of the world, as to the islands of Mauritius and Bourbon, to some of the West Indian islands, to Louisiana, and notably to Canada, where their descendants are now multiplying very fast. The English emigrated principally to the West Indies, to North America, and later to Australasia and South Africa.

European emigration has been greatest in the 19th century, because the population of Europe has increased so enormously. It is necessary to consider (1) the countries to which the emigrants go; (2) the countries from which they come. As regards the former, it is obvious that the favourite fields for European emigration must always be (*a*) countries with a suitable—i.e. a temperate climate; (*b*) countries which have not an over-large population already; (*c*) countries which have large resources—i.e. large facilities for making wealth. Tried by these tests, it is clear that, as has actually been the case, the United States and British North America, the Australasian colonies of Great Britain, South Africa (though there the native population is large), and the more temperate parts of South America—e.g. the Argentine Republic—would be the places which would attract most emigrants.

As regards the countries from which the emigrants come, the Teutonic nations have supplied the largest number, including English, Germans, and Scandinavians. The Germans have gone in great measure to the north central districts of the United States, the Swedes to Minnesota and Canada. Latterly there has been a large emigration from Iceland to Canada. Of the Celtic peoples the Irish have emigrated in largest numbers, mainly to the United States. There, in 1880, according to the census, the number of inhabitants of Irish origin formed 3·70 per cent. of the total population, as against 3·92 per cent. German born, while in the city of New York the Irish element amounted to 16·5 per cent. of the population. In the record of Welsh emigration, mention may be made of the interesting Welsh settlement on the Chubut (q.v.) River in Patagonia. Of the Latin peoples, France sends out but few emigrants, owing mainly to the absence of any marked increase in her population; on the other hand, there is a large stream of Italian emigration to the Argentine Republic.

Great Britain not only furnishes a very large proportion of the total number of European emigrants, but is also a place through which very many foreigners pass on their way to America. The returns issued by the Board of Trade show that during the thirty-six years 1853–88, 8,675,475 emigrants left British ports for places out of Europe. Of these 6,650,055 were of British and Irish origin, 49 per cent. being English, 10 per cent. Scotch, and 41 per cent. Irish. Of the total number, 6,012,043 went to the United States, 912,477 to British North America, 1,324,018 to Australasia, 426,937 to all other places. Emigration from British ports is subject to the Passengers Acts, which are administered by the Board of Trade, and which contain provisions for the proper food, accommodation, and medical care of emigrants. For many years there was a Colonial Land and Emigration Board, subordinate to the Colonial Office; but with the gift of responsible government to the larger colonies, the consequent handing over of the public lands to the colonial governments, and the growing number of settlers, the functions of the board became necessarily curtailed, and such work as remained to it, consisting mainly of the supervision of coolie emigration from India to some of the tropical Crown Colonies, has been transferred to the Colonial Office. In 1886 a small office, managed by a voluntary committee, but subsidised by the government, and under the general control of the Colonial Office, was established at 31 Broadway, Westminster, SW., for giving accurate and useful information to intending emigrants to the British colonies. The number of written and verbal applications made to this office is a proof of the great interest which attaches to the question of emigration at the present time. There are various acts in existence authorising the application of public funds to purposes of emigration. Powers are given to the guardians in England and Wales to apply money to this purpose under certain

conditions, and the Local Government Bill of 1888 authorises a County Council to advance money for emigration or colonisation, if the repayment is guaranteed by a local authority in the county, or by the government of a colony. State aid to emigration has also been sanctioned under certain Irish acts and in the case of the crofters of Scotland.

Writing of emigration from Great Britain in 1889, we may summarise the main points of interest as follows: (1) There is a growing movement in favour of supplementing the efforts of voluntary emigration societies by state aid given directly or indirectly on a large scale. This movement is due to the great growth of population at home, the distress caused till quite lately by bad trade, and the congestion of labour in the large towns. (2) Colonisation as opposed to emigration is attracting much attention—i.e. the sending out large bodies of people, on a well-defined system, to a particular place and a fixed employment, as opposed to the sending out isolated individuals or families to take their chance in a new country. (3) While the interest in emigration is growing rather than declining at home, the feeling in the countries which are the main fields of labour is not so favourable to efforts in this direction. But little assistance to emigrants is now given by the colonial governments, Queensland being the most liberal; and the assistance, when given, is mainly confined to farmers, farm-labourers, and female domestic servants. The feeling against emigrants in the United States and in the British—notably the Australasian—colonies (as to which see also under IMMIGRATION) is due partly to the jealousy of imported labour felt by the working-classes on the spot, partly to past experience of the many unsuitable emigrants sent out in former years; fortunately (4) it is now being recognised that the quality of the emigrants is more important than the quantity, that paupers and vicious or infirm persons are not desirable settlers, that among able-bodied men of good character country-people rather than townspeople are wanted in the colonies, and that it may be possible at once to meet the requirements of the colonies and to relieve the pressure at home by sending out those who would otherwise flock into the towns from the country-districts. (5) It only remains to point out that among British colonies there has latterly (up to the end of 1888) been a falling off in the numbers of emigrants to Australasia, and on the other hand an increase in the number of emigrants to Canada; that the discovery of gold in the Transvaal has given a stimulus to emigration to South Africa; and that the Argentine Republic is now attracting much attention as a field for British settlers, an information office for emigrants having been established in London by the Argentine government.

What has been said above refers exclusively to emigration from Europe. A few words should be added as to Chinese and Indian emigration. The opposition offered to unrestricted Chinese immigration in the United States and in the Australasian colonies shows the importance which is attached to the question of Chinese labour, and the dimensions to which it is anticipated that Chinese immigration might attain. Taking the British dependencies, Chinese emigrants have gone to British Columbia, to Queensland and other parts of Australia, to Labuan and North Borneo, and most of all to the Straits Settlements and the protected states of the Malay Peninsula, in the mining districts of which they now far outnumber the native Malays. Hong-kong is the main outlet for Chinese emigration, and at one time some difficulty was experienced by the government in checking abuses connected with indentured coolie emigration to South America. Speaking of Chinese emigration generally, the most noticeable points are (1) the numbers which emigrate; (2) the disproportion of the sexes, the enormous bulk of the emigrants being males; (3) the absence, to a certain extent, of the permanent element, as a large number of the emigrants return to China. Indian emigration is for the most part indentured emigration, whereas Chinese emigration is in great measure quite independent of any contract to employers. Under the contract system, Indian coolies have been imported into various parts of the British colonial empire, the West Indies, Fiji, the Malay Peninsula, and Mauritius. In some of the West Indian dependencies, in British Guiana, and in Mauritius, the system has led to a large resident Indian population; in Mauritius its results are that, after fifty years of Indian immigration, two-thirds of the population of the island are Indians. It need hardly be said that the system required to be, and has been, carefully kept under government control, in order to preclude the possibility of this species of emigration becoming a modified form of slavery. See under IMMIGRATION, COOLIES; and the article COLONY.

Émigrés, the name given more especially to those persons who quitted France during the Revolution. After the insurrection at Paris, and the taking of the Bastille, 14th July 1789, the princes of the royal family departed from France. They were followed, after the adoption of the constitution of 1791, by all who considered themselves aggrieved by the destruction of their privileges, or who were exposed to persecution. Nobles quitted their châteaus; officers, with whole companies, passed the frontiers. Crowds of priests and monks fled to escape the oath of allegiance to the constitution. Belgium, Piedmont, Holland, Switzerland, and, above all, Germany, were overrun with fugitives of every age. Only a few had been able to save their property; the greater portion were in a state of destitution, and sank into utter demoralisation. A court had formed itself round the princes at Coblenz; a government, with ministers and a court of justice, had been established, and communication was kept up with all the foreign courts unfavourable to the Revolution. This conduct embittered France, aggravated the position of the king, and drove the revolutionary party forward in their sanguinary career. Under the command of the Prince of Condé, a body of émigrés was formed, which followed the Prussian army into Champagne. The result was that the severest laws were now put in force against the émigrés; their lands were confiscated; the penalty of death was proclaimed against any one who should support or enter into communication with them; thirty thousand persons were placed upon the list of émigrés, and exiled for ever from the soil of France, although many of them had refused to bear arms against their country. Not until after the failure of their attempt to land at Quiberon in 1795 did the émigrés abandon all thoughts of penetrating into France by force of arms. Condé's corps, after the peace of Lunéville, was obliged formally to dissolve, and sought an asylum in Russia. Even under the Directory, however, many had endeavoured to obtain permission to return to France. The general amnesty proclaimed by the First Consul was therefore joyfully hailed by the greater portion of the émigrés, though many did not return home till after the downfall of Napoleon. Dignities, pensions, and offices were now showered upon these faithful adherents; but, according to the charter of 1814, they were unable to recover either their estates or their privileges. Finally, on the motion of the minister Villèle, the émigrés who had lost their landed estates received, by the law of the 27th April 1825, a compensation of 30 million francs yearly on the capital of 1000 million francs. After

the July revolution, however, the grant was withdrawn. See Saint-Gervais, *Histoire des Émigrés Français* (1823), and the works by Montrol (1825), Forneron (3d ed. 1884), and Puymaigre (1884).

Emilia, a name now employed to designate a compartimento of Central Italy, comprising the provinces of Bologna, Ferrara, Forli, Modena, Parma, Piacenza, Ravenna, and Reggio Emilia. The name is derived from the ancient *Via Æmilia* (a continuation of the *Via Flaminia*, or great northern road), which passed through these territories. See ITALY.

Eminence, a title given by Urban VIII., in 1631, to cardinals, who up to the period of his pontificate had been called Most Illustrious.

Eminent Domain, a phrase which occurs more commonly in its Latin form, *dominium eminens*, denotes the universal right in the public over property, by virtue of which the supreme authority in a state may compel a proprietor to part with what is his own for the public use. Thus a private owner may be compelled to give up part of his land that a public highway may be made through his ground. For the just exercise of this right there must be a necessity or clear public utility in the work proposed; and the expropriated owner must be compensated for his loss. The right is now exercised only under well-defined statutory regulations, as in the Lands Clauses Consolidation Act, 1845, which regulates the purchase of lands for railways and other public undertakings.

Emin Pasha. See SCHNITZER (EDUARD).

Emir (plur. *Omrah*), an Arabic word, equivalent to 'ruler,' is a title given in the East, and in the North of Africa, to all independent chieftains, and also to all the actual or supposed descendants of Mohammed through his daughter Fatima. The latter are very numerous throughout the Turkish dominions, but, although entitled by birth to be classed among the first of the four orders of society, they enjoy no particular privileges or consideration, and are found engaged in all sorts of occupations. Their privileges are confined to a few unimportant matters, chiefly to the exclusive right to wear turbans of a green colour, that having been the favourite colour of the Prophet. They are placed under the supervision of the Emir-Beshir. The title Emir, in connection with other words, likewise designates different offices. *Emir-el-Mumenin*, 'Prince of the Faithful,' is the title assumed by the califs themselves, while *Emir-al-Omrah*, 'Prince of Princes,' was the title of their first minister. The Turkish master of the horse is styled *Emir-Achor;* the standard-bearer, *Emir-Alem;* and the leader of the caravans of pilgrims to Mecca, *Emir-Hadji*. *Amir*, *Ameer*, and *Amere* are other spellings of the same word. Admiral (q.v.) is a derivative.

Emission Theory. See LIGHT.

Emmanuel, or IMMANUEL (Heb., 'God with us'), was the symbolical name of the child announced by Isaiah to Ahaz and the nation (Isa. vii. 14), and applied by St Matthew to the Messiah born of the Virgin (Matt. i. 23).

Emmaus, a village of Judea, not far from Jerusalem (Luke, xxiv. 13), which after the Jewish war was colonised with 800 Roman veterans. A writer in the quarterly statement of the Palestine Exploration Fund (January 1883) identifies it with the valley of the Urtas, 7 miles from Jerusalem, and south of Bethlehem, where costly baths have been discovered.

Emmenagogues, medicines intended to restore, or to bring on for the first time, the menses in women. See MENSTRUATION.

Emmerich, an old walled town of Rhenish Prussia, on the Rhine, near the borders of Holland, 94 miles by rail E. of Rotterdam. It has manufactures of iron, glass, tobacco, &c., besides an active river trade. From a small Roman colony the town grew in importance until, in the 15th century, it had 40,000 inhabitants; from 1592 to 1811 it was the seat of a famous Jesuit seminary. Pop. (1875) 8117; (1885) 9759; (1890) 9622.

Emmet, ROBERT, an ill-fated Irish patriot, was born in Dublin in 1778, the youngest son of the physician to the viceroy. At fifteen he entered Trinity College, where Moore was a fellow-student, but an academic career of exceptional promise was soon cut short by his joining the United Irishmen. He next travelled on the Continent, interviewed Napoleon and Talleyrand in 1802 on behalf of the Irish cause, and returned the next year to devote his own fortune of £3000 to buying muskets and manufacturing pikes. With a few confederates he laid a plot to seize Dublin Castle, and secure the person of the viceroy, but the rising proved a complete failure, and Emmet, who had arrayed himself for the occasion in a green coat, white breeches, and cocked hat, had the mortification to see nothing result from his enterprise but a few ruffianly murders. He escaped to the Wicklow Mountains, but returning for a last interview with his sweetheart, Sarah Curran (q.v), the daughter of the orator, was arrested, put on trial on 19th September 1803, condemned to death, and hanged the following day. Just before receiving sentence he delivered a speech which still thrills the reader by its noble and pathetic eloquence. See the biography in Madden's *Lives of the United Irishmen*, 3d series, vol. iii. (1846).

Emmet. See ANT.

Emollients (from Lat. *mollis*, 'soft'), substances used to soften the textures to which they are applied, as poultices, fomentations, &c., externally, and Demulcents (q.v.) internally.

Emotion, a word used in philosophy with some considerable variety of meaning. The phenomena of the mind may be divided into three groups—cognitions, emotions, and volitions, into intellect or thought, feeling, and will. The emotions taken in this sense constitute one of the great groups of mental activities. They may be pleasurable, painful, or neutral, and may be arranged according as they arise directly out of the senses, movements, and appetites or not. In the latter case they comprise feelings of freedom and restraint, wonder, terror, love, self-complacency, the sense of power, anger, love of knowledge, artistic emotions, the moral sense, &c. As they combine and pass into one another by infinite gradations, a systematic and exhaustive classification is impossible. Sometimes emotion implies that the feeling is keenly experienced, so as to occasion mental disturbance. The expression of the emotions, especially in the face, was carefully studied by Sir Charles Bell; and Darwin's *Expression of the Emotions in Man and Animals* (1873) is a monument of patient observation and insight. The emotions act powerfully on the organic functions of the body, as illustrated in blushing, quicker or slower pulsation of the heart, cold perspiration, &c. The term *feeling* is used with even greater laxity than emotion. It is sometimes the perception we have of extreme objects, of their being hard or soft, hot or cold, in which case it is the intellectual function of sensation, or the sensation itself. Again, it may be specifically pleasure, pain, or the neutral emotion, or emotion in the widest sense. Or it may be used loosely for almost any kind of consciousness, as by James Mill. The higher feelings, as the appreciation of the sublime and beautiful, approval and disapproval, are often termed sentiments. See the manuals of psychology, such as Bain's *The Emotions and the Will*.

Empecinado, Don Juan Martin Diaz, el, one of the leaders of the Spanish revolution of 1820, was born in 1775, and entered the Spanish army in 1792. He carried on a guerilla warfare against the French during the Peninsular struggle, and acquired great distinction. In 1814 he was appointed colonel in the regular army, and the king himself created him field-marshal; but in consequence of petitioning Ferdinand, in 1815, to reinstitute the Cortes, he was banished to Valladolid. On the outbreak of the insurrection in 1820 he took a prominent part on the side of the constitutionalists; after the triumph of the absolutists in 1823 he was arrested, exposed in an iron cage to the contumely of the passers-by, and finally, while struggling with his executioners, stabbed by one of the soldiers.

Empedocles, a Greek philosopher of Agrigentum, in Sicily, lived about 450 B.C. So great was the estimation in which he was held by his fellow-citizens as a physician, a friend of the gods, a predicter of futurity, and a magician, that they are said to have offered him the sovereignty. But being an enemy of tyranny, he declined it, and was the means of delivering the community from the dominion of the aristocracy, and bringing in a democracy. There was a tradition that he threw himself into the crater of Etna in order that his sudden disappearance might beget a belief in his divine origin; this, however, can only be regarded as a mere fable, like the story told by Lucian, that Etna threw out the sandals of the vain philosopher, and thus destroyed the popular belief in his divinity. In Matthew Arnold's poem, *Empedocles on Etna*, the philosopher is represented as superior to vanity and superstition, but moody and out of sympathy with his contemporaries.

In Empedocles philosophic thought is bound up with poetry and myth even more closely than in Parmenides (q.v.). His general point of view is determined by the influence of the Eleatic school upon the physical theories of the Ionic philosophers. He assumed four primitive independent substances —air, water, fire, and earth, which he designates often by the mythical names Zeus, Hera, &c. These four *elements*, as they were called, kept their place till modern chemistry dislodged them. Along with material elements he affirmed the existence of two moving and operating powers, love and hate, or affinity and antipathy, the first as the uniting principle, the second as the separating. The contrast between matter and power, or force, is thus brought out more strongly by Empedocles than by previous philosophers. His theory of the universe seems to assume a gradual development of the perfect out of the imperfect, and a periodical return of things to the elemental state, in order to be again separated, and a new world of phenomena formed. Of his opinions on special phenomena may be mentioned his doctrine of emanations, by which, in connection with the maxim that like is known only by like, he thought to explain the nature of perception by the senses. He attempted to give a moral application to the old doctrine of the transmigration of souls, his views of which resembled those of Pythagoras. The fragments of Empedocles have been edited by Sturz (1805), Karsten (1838), and Stein (1852). See monographs by Lommatsch (1830), Raynaud (1848), and Gladisch (1858).

Emperor (Lat. *imperator*), a title formerly borne by the heads of the Roman empire, and which in the modern world has become the highest title of sovereignty. In Rome the *imperium* of a magistrate, whether king or consul, was the power which he possessed of bringing physical force into operation for the fulfilment of his behests. This power was conferred by a *lex curiata*, and it required this authorisation to entitle a consul to act as the commander of an army. In the case of the kings also the imperium was not implied in their election, but was conferred separately, by a distinct act of the national will. Now it was in virtue of this imperium that the title imperator was given to its possessor. Far from being an emperor in the modern sense, he might be a consul or a proconsul; and there were, in fact, many imperatores, even after the title had been assumed as a prænomen by Julius Cæsar. It was this assumption which gradually gave to the title its modern signification. In republican times it had followed the name, and indicated simply that its possessor was *an* imperator, or one possessed of the imperium; now it preceded it (see Cæsar), and signified that he who arrogated it to himself was *the* emperor. Nor was it, as has often been mistakenly asserted, merely a military command; it included also the supreme judicial and consequently also the administrative power; and under the empire the office was free from the temporal and local limitations which had accompanied its enjoyment during the republic. From the emperors of the West the title passed to Charlemagne, the founder of the Holy Roman Empire. When the Carlovingian family expired in the German branch, the imperial crown became elective, and continued to be so until, in 1806, Francis II. resigned the title, and withdrew to the government of his hereditary dominions, under the title, assumed in 1805, of Emperor of Austria. The title of *imperator*, like that of *basileus* (Gr., 'king'), was frequently assumed in England by the Anglo-Saxon monarchs in imitation of their Roman and Byzantine contemporaries. In addition to the Emperor of Austria, there are now in Europe the Emperor of Russia (since 1547; see Czar) and Emperor of Germany (1871); and in 1876 the Queen of England assumed the title of Empress of India, in addition to those which she bore previously. The First and Second Empires in France were established in 1804 and 1852; in America there have been Haitian emperors and Mexican, and the empire of Brazil existed from 1822 to 1889. Also, modern usage applies the title to sundry semi-civilised monarchs, such as the rulers of Morocco, China, and Japan; and the Turkish sultans assumed it on the fall of the Eastern Empire (q.v.) in 1453.

Emperor Moth (*Saturnia carpini*), nearly related to the silkworm moths (Bombycina). With the exception of the Death's Head, it is the largest

Emperor Moth, with Caterpillar, Pupa, and Cocoon.

British moth. Its expanse of wings is about three inches; the female is mainly gray, the male from reddish-brown to orange-yellow; each wing bears

a large black eye, with surrounding rings. The caterpillar is green, with short hair, black cross bands, and yellow or reddish tubercles. The cocoons are formed internally of stiff convergent elastic threads, which resist intrusion, but readily admit of egress. The Great Peacock Moth (*Saturnia pyri*) is a very large European form about twice the size of the Emperor. See SILK.

Emphysema, in Medicine, an unnatural distension of a part with air. Emphysema of the cellular texture is usually caused by a wound of the lungs or upper air-passages, from which air escapes during respiration into the cellular tissue. It may be confined to the immediate neighbourhood of the wound, or may extend all over the body. Emphysema is rarely produced otherwise than mechanically; but in gangrene and after death collections of fluid in a state of decomposition sometimes give out gases, which penetrate and distend the textures with which they are in contact.

Emphysema of the lungs is the name applied to two distinct conditions. (1) *Interlobular* or *cellular* emphysema, allied to the form described above in that it depends on a wound of the delicate lining-membrane, and that air occupies the interstices of the cellular tissue, is not common, and occurs only in childhood. (2) *Vesicular* emphysema consists in an unnatural distension of some of the natural air-cells or *vesicles* of the lungs, and is almost invariably present in those who have long suffered from chronic bronchitis or asthma, or have in any way been obliged to make excessive respiratory efforts—e.g. in the blowing of large wind-instruments. The walls of the affected vesicles become thinned, and may ultimately disappear between two or more in contact with each other, so that though the apparent size of the lung increases, the surface available for aeration of the blood is actually much diminished, and great shortness of breath results. The same process is common in the horse, and familiar under the name of 'broken wind.' The only treatment possible is that of the condition to which the emphysema is due; for the affected vesicles cannot be restored to their original condition.

Emphyteusis (Gr., 'implanting'), in Roman law, a perpetual right in a piece of land, for which a yearly sum was paid to the proprietor. It much resembled a feudal holding. See FEU, FEUDALISM.

Empiricism, the name applied to a school in philosophy which admits of nothing as true but what is the result of experience, rejecting all *a priori* knowledge. It arose out of the system of Heraclitus which is elaborately refuted in the *Theætetus* of Plato, and was abhorrent to the lofty idealism of Socrates. Aristotle was an empiricist in so far as experience (*empeiria*) was to him the realisation of the ideal or formal. The philosophy of Descartes established a kind of compromise between one part of knowledge regarded as innate, and another part as empirical or imparted from without. The founder of modern empiricism was Locke, who makes experience the basis of all knowledge, comprehending alike sensation and reflection. Condillac and the other French *philosophes*, rejecting reflection, pushed to an extreme the sensational side of Locke's philosophy, while Berkeley and Hume developed it on other lines to widely differing conclusions. The Common Sense school maintained that the ground of all knowledge was certain primary beliefs or first principles; Kant, on the other hand, found in the *a posteriori* facts of experience the first form of a consciousness which in its ultimate development must become *a priori*. The two elements are inseparably united; thus the *a posteriori* element, the facts, exist for us only under *a priori* conditions. This may almost be said to mark the turning-point of the new philosophy which has demonstrated that the distinction itself is not absolute, or rather that the distinction is itself transcended in the essential unity of knowledge.

The name *empiric* is applied also to one who depends on the accumulations of experience in any branch of knowledge, as in medicine, rather than on the strictly scientific methods of inference and deduction. See, on the one hand, MEDICINE, Vol. VII. pp. 115–16; and, on the other, QUACK DOCTORS.

The term *Empirical Laws* is applied to such as express relationships, which may be merely accidental, observed to subsist among phenomena, but which do not suggest or imply the explanation or cause of the production of the phenomena. They are usually tentative, and form stages in the progress of discovery of causal laws. Bode's law of the distances of the planets from the sun is an example.

Employers' Liability. See LIABILITY OF EMPLOYERS, MASTER AND SERVANT.

Em'poli, a town of Italy, in a beautiful and fertile district on the left bank of the Arno, by rail 22 miles WSW. of Florence and 27 E. of Pisa. The collegiate church (1093), with a fine original façade, though the rest of the building was considerably altered in 1738, contains some good paintings and sculpture. Pop. 6719.

Emporia, capital of Lyon county, Kansas, on the Neosho, a tributary of the Cottonwood River, 61 miles SSW. of Topeka by rail. It has a foundry and several flouring-mills. Pop. (1890) 7751.

Empson, SIR RICHARD, the unpopular agent of Henry VII., was the son of a wealthy citizen of Towcester, Northamptonshire, and was trained for the bar. In 1491 he became Speaker of the House of Commons, and in 1504, now a knight, High Steward of Cambridge University, and Chancellor of the Duchy of Lancaster. Throughout Henry's reign he was employed like Edmund Dudley (q.v.) in exacting taxes and penalties due to the crown. His conduct, defended by himself as strictly legal throughout, was by the people regarded as infamous and tyrannical, and in the second year of Henry VIII.'s reign he was convicted of tyrannising and of constructive treason, attainted, and beheaded on Tower Hill with his partner Dudley, 17th August 1510.

Emption. See (under Sale) SALE OF GOODS.

Empye'ma (Gr.), an internal suppuration, a word now applied exclusively to a collection of pus in the pleura. See PLEURISY.

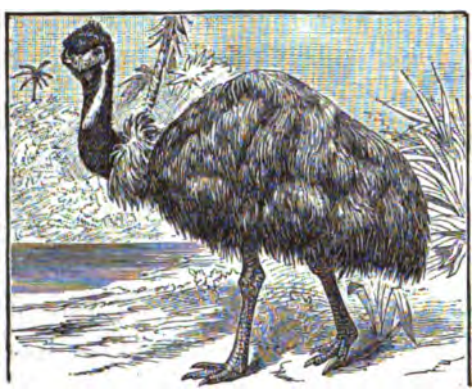
Empyre'an, a word used by the old metaphysical natural philosophers to designate the highest region of light, where the purest and most rarified elements of fire (Gr. *pyr*) existed; and by medieval and modern poets to indicate heaven, the source of light and the home of the blessed.

Empyreuma (Gr. *empyreuō*, 'I kindle'), the burned smell and acrid taste which result when vegetable or animal substances are decomposed by a strong heat. The cause of the smell and taste resides in an oil called *empyreumatic*, which does not exist naturally in the substance, but is formed by its decomposition.

Ems, a river in the north-west of Germany, rises in Westphalia, on the south-west slope of the Teutoburger Wald, flows first in a north-west and then through a moory region in a northern direction, and empties itself into Dollart Bay, an estuary of the German Ocean, after a course of 205 miles. It is navigable as far as Greven (139 miles), and for ocean-going vessels as far as Halte. In 1818 it was connected by a canal with the Lippe, and thus with the Rhine. A canal uniting the Ems with the Jade was in 1889 in progress.

Ems, or BAD EMS, a bathing-place known to the Romans, and celebrated in Germany as early as the 14th century. It is situated on the river Lahn, 10 miles ESE. of Coblenz by rail. Pop. 6731, a number more than doubled by patients. Its warm mineral springs belong to the class containing soda; the only essential difference between the numerous springs is in the temperature, varying from 80° to 135° F., and in the greater or lesser amount of carbonic acid gas contained in them. Here in 1870 Benedetti got his final answer from King William.

Emu (*Dromæus*), a genus of running birds or Ratitæ in the cassowary family. There are two species, both Australian—viz. the Common Emu (*D. novæ hollandiæ*) and the Spotted Emu (*D. irroratus*). They differ from the Cassowaries (q.v.) in several marked features—e.g. the head and neck are feathered except on cheeks and throat, there is no 'helmet,' nor are there wattles on the neck, the bill is broad, and the claws of the three toes are almost of equal length. The emu is a large bird, standing about 6 feet in height. The plumage is like that of the cassowary; the colour is predominantly dull brown, darker on the head, neck, and middle line of the back, lighter beneath. The naked parts of head and neck are grayish-blue, the bill and feet brownish. The young are striped with black. The wings are of course rudimentary, but the legs serve the bird well both in running and kicking.



Common Emu (*Dromæus novæ hollandiæ*).

Timid and peaceful in character, the emu trusts to its speed for safety. It is valued on account of its beef-like flesh, abundant oil, and edible eggs, but is unfortunately being destroyed with too great carelessness. The plains of the interior are now the chief haunts; the food consists chiefly of roots, fruits, and herbage. The note is a curious booming sound. The emu is not polygamous like the Ostrich (q.v.); true pairing occurs. The eggs are placed in a scooped-out cavity in the earth; they have a dark-green shagreen appearance, and measure on an average 4 × 3½ inches. About forty are laid in a summer; the male incubates the first set, and is then relieved by the female, who has by that time finished her laying. The period of incubation is three months. The development has been recently studied by W. A. Haswell (Linn. Soc. New South Wales, 1887). The Spotted Emu, restricted to Western Australia, has often bred in captivity or attempted domestication in Britain and elsewhere.

Emulsin, or SYNAPTASE, is a peculiar ferment present in the bitter and sweet almond, which forms a constituent of all almond emulsions. When bitter almonds are bruised, and water added, the emulsin acts as a ferment on the amygdalin, and decomposes the latter into volatile oil of bitter almonds, prussic acid, grape-sugar, and water (see ALMONDS, Volatile Oil of). The vegetable albumen of almonds is almost entirely composed of emulsin, which, when separated, is a white substance, soluble in water, and is distinguished by its remarkable power of causing the fermentation of amygdalin. It consists of carbon, hydrogen, nitrogen, and oxygen.

Emulsion is the term applied to those preparations in pharmacy in which oleaginous substances are suspended in water by means of gum, sugar, carrageen, yolk of egg, &c. The production of these emulsions is often not an easy matter, and requires judgment and skill. In general it will be found that the bulk of the emulsifier must first be taken, while the oil should only be added little by little, rubbing together in a mortar, and taking care that it is completely absorbed or emulsified before further additions. Should too much be added, the effect is to throw out most of what has already been incorporated, and it is then almost impossible to remedy the error. The emulsion of cod-liver oil is probably known to all, but there are many emulsions in which solid substances have to be suspended, and to them the directions above given are not always applicable.

Emys, a genus of Marsh Tortoises, including *E. lutaria*, found in south and middle Europe, North Africa, and south-west Asia. The other species are oriental and American.

Enamel (Fr. *émail;* originally *esmail*, from the same root as *smelt*), the name given to vitrified substances applied chiefly to the surface of metals. Enamelling is practised (1) for purposes of utility, as in making the dial-plates of watches and clocks, coating the insides of culinary vessels, &c.; and (2) for producing artistic designs, portraits, and for ornamental purposes generally. The basis of all enamels is an easily fusible colourless glass, to which the desired colour and opacity are imparted by mixtures of metallic oxides. The mass, after being fused together and cooled, is reduced to a fine powder and washed, and the raw material thus obtained is variously applied to the surfaces to be covered according to the class of enamel being made. The whole is then exposed in a furnace (*fired*, as it is called) till the enamel is melted, when it adheres firmly to the metal. The metal most commonly used as a ground for enamel is copper; but for the finest kinds of enamel-work gold and silver are also used.

Artistic or Ornamental Enamelling.—This art is of great antiquity; it was to a limited extent practised by the Greeks; but enamels were more largely employed by the Romans, under whose dominion the art passed into Gaul and Britain. Enamelling has also been practised from a remote period in the East, Persia, India, China, and Japan, under a separate and distinct development; but there is nothing from which it can be inferred that the various methods were in use earlier than in Europe. As a decoration enamelling was more popular and attained to greater perfection in the middle ages than in classic times. It was extensively practised at Byzantium from the 4th until the 11th century, and afterwards in Italy, in the Rhenish provinces, and at Limoges in the south of France. The Byzantine and other early styles of enamel-work, down to the 14th century, were generally employed in ornamenting objects connected with the service of the church. Enamel was also greatly used in ornamenting jewelry, and vessels made for use or display in the mansions of the rich, such as salt-cellars, coffers, ewers, candlesticks, &c.; but these objects were principally made in the painted

enamels introduced in France towards the end of the 15th century.

Distinguished with reference to the manner of execution, enamel-work may be divided into four kinds: (1) *Cloisonée*, or inclosed, the method of the Byzantine school, in which the design is formed in a kind of metal case, generally gold or copper, and the several colours are separated by very delicate filigree gold bands, to prevent them running into one another. Of this style the grandest example extant is the famous *Pala d'oro* in St Mark's Church, Venice, some portions of which are Byzantine of the 10th century. (2) *Champlevé*, practised by the Rhenish and early Limoges schools. In this process the ornamental design, or the figures which were to be filled in with colour, were cut in the metal (generally copper) to some depth; and wherever two colours met, a thin partition of the metal was left to prevent the colours running into each other by fusion when fired. (3) Translucent enamel, which had its origin and was brought to great perfection in Italy, was composed of transparent enamel of every variety of colour, laid in thin coatings over the design, which was incised on the metal, generally silver, the figure or figures being slightly raised in low relief, and marked with the graver, so as to allow the drawing of the contours to be seen through the ground, instead of being formed by the coarse lines of the copper, as in the early Limoges enamels. (4) Surface-painted enamels, which may be divided into two stages. The first stage, which is known as the late Limoges style, sprang up about 1475, and flourished till 1630. In this the practice was to cover the metal plate with a coating of dark enamel for shadows, and to paint on this with white, sometimes having the hands and other parts of the figures completely coloured. The designs of the middle and best period were generally taken from well-known paintings or engravings of the period, and were strongly influenced by the Italian art of the time. This style soon degenerated, and gave place to the latest or *miniature* style, which was invented before the middle of the 16th century by Jean Toutin, a goldsmith at Châteaudun, and carried to the highest perfection by Jean Petitot, a miniature-painter, who was born at Geneva, 1607, and resided long in England, and then in Paris. On his method the plate is covered with a white opaque enamel, and the colours are laid on this with a hair-pencil, and fixed by firing. The paints are prepared by grinding up coloured enamels with oil of spike, and when fused by the heat, they become incorporated with the enamel of the ground. The earlier enamellers of this school occupied themselves with miniatures, snuff-boxes, watch-cases, and other trinkets, till the period of the Revolution, when the art fell into disuse in France. In England, however, it was carried on with much success; and copies of portraits and pictures on a much larger scale than the French miniatures were executed by Henry Bone (1755–1834), and the German, Karl Muss (died 1824). Works of this description possess the obvious advantage of durability; but those various qualities of texture, and the delicacy of colour for which good works in oil or water-colour are prized, cannot be attained in enamel copies. The greater part of the artistic enamel-work of the present day is of Japanese fabrication, and consists of elvisonné work on a copper basin. Both in Paris and in Birmingham enamel-work of this class has been attempted with success; but designs can be executed in Japan at prices which defy the competition of western traders. In China both cloisonné and painted enamels are made in characteristic Chinese designs. At Jeypore in India a limited quantity of enamel-work on gold is executed in translucent colours which possess incomparable brilliancy. Enamel incrustations of various kinds are very largely used in the jewelry, goldsmith, and silversmith trades of Europe. See Garnier, *Histoire de la Verrerie et de l'Émaillerie* (1886); Bowes, *Japanese Enamels* (1885); and for enamelled earthenware, see the article POTTERY.

Enamelled Iron.—Since the beginning of the 19th century many attempts have been made to cover iron with a vitreous surface, and several patents have been taken for such methods of enamelling. The chief difficulty in applying enamels to iron arises from the tendency of the metal to oxidise before it reaches the temperature at which the enamel fuses, and to become brittle from the oxide combining with the silica of the enamel. This action being superficial, the mischief is the greater in proportion to the thinness of the iron. Therefore it is much easier to enamel thick cast-iron vessels than thin vessels made of sheet-iron. A glass may be made by combining either silicic acid or boracic acid with a base; the latter fuses at a lower temperature than the former, but the glass is much dearer and not so durable as the silica glass. The enamels used for coating iron consist of a mixture of silica and borax, with various basic substances, such as soda, oxide of tin, alumina, oxide of lead, &c. Lead is not, or ought not to be, used in the enamel for coating culinary vessels.

A great variety of articles, many of them beautifully decorated in colours, such as grate-fronts, clock-dials, panels of different kinds, sign-boards, tablets, and name-plates, are now executed in enamelled iron at a moderate cost. It is also applied to corrugated roofing. The effect of heat on enamelled iron especially is to expand the metal more than the enamel, and cause the latter to peel off. Acids find their way through minute invisible pores, which exist in the best enamel; and when once they reach the iron, they rapidly spread between it and the enamel, and undermine and strip it off. This kind of action is curiously shown by filling an enamelled vessel with a solution of sulphate of copper. The acid attacks the iron wherever pores exist, and little beads of metallic copper are deposited at all such spots; these beads go on growing until they are large enough to be very plainly seen. This is the severest test for trying the continuity of enamelled surfaces to which they can be subjected, as sulphate of copper will penetrate the glaze and body of ordinary earthenware.

The enamel of teeth is the very hard translucent white layer covering the working surfaces of the Dentine (q.v.) or ivory of the teeth of most mammals. See TEETH.

Enara, a lake in the extreme north of Finland, with an area of 550 sq. m. and numerous islands. It discharges into the Arctic Ocean.

Enarea, or LIMMU, a kingdom of Africa, SW. of Shoa, with an area of over 1100 sq. m., and some 40,000 inhabitants. It is a land of forest-clad hills, rising beyond 8000 feet, with their slopes covered with the wild coffee-plant. Its people, belonging to a stem of the Gallas (q.v.), are mostly Mohammedans. The chief town is Saka, near the river Gibbe. See Cecchi, *Da Zeila alle Frontiere del Caffa*, vol. ii. (Rome, 1885).

Encænia. See COMMEMORATION.

Encalada, MANUEL BLANCO, born in Buenos Ayres in 1790, studied at Madrid and in the naval academy at Leon, and after deserting from the Spanish ranks, joined the Chilian revolutionary party, and served with distinction both in the artillery and in the navy. Appointed second to

Lord Cochrane, he became rear-admiral in 1819, and major-general of infantry in 1820; and in 1825 he was appointed head of the army of Chili. He was for two months president of the republic in 1826, governor of Valparaiso in 1847–52, and minister to France in 1853–58. He died in Santiago, 5th September 1876.

Encampment. See CAMP.

Encaustic Tiles. See TILES.

Enceinte (Fr.), in Fortification, denotes generally the whole area of a fortified place. See FORTIFICATION.

Encephalartos. See CYCADS.

Encephalocele (derived from the Greek *encephalon*, 'the brain,' and *kēlē*, 'a tumour') is the term applied to a tumour projecting through the skull in one of the parts where the bones are incomplete in infancy, and consisting of a protrusion of the membranes of the brain, containing a portion of brain itself. In *meningocele* the membranes only project. The most common situation of such tumours is in the middle line and at the back of the head. Surgical interference is scarcely ever justifiable, and all that can usually be done is to give uniform support to the tumour, and to defend it from injury.

Enchondroma is the term employed in Pathological Anatomy to signify an abnormal cartilaginous growth. These growths most commonly occur in connection with the bones, but they are not unfrequent in some of the glandular structures. See TUMOUR.

Encina, or ENZINA, JUAN DE LA, the founder of the secular drama in Spain, was born about 1469, not far from Salamanca, at the university of which town he was educated. He held successively the offices of secretary to the first Duke of Alva, musical director in Pope Leo X.'s chapel at Rome, and prior of Leon in Spain. He died at Salamanca in 1534. Besides his *Cancionero*, a collection of poems which went through six editions between 1496 and 1516, he wrote in 1521 a poor poetical account of a pilgrimage which he made to Jerusalem two years previously. But his fame rests on the fact that he wrote eleven dramatic poems (*Representaciones*), six of a religious cast, but the other five altogether secular, these last the first of the kind to be acted in Spain, in 1492. In themselves these pieces possess no great merit, being almost destitute of plot, and showing very little dramatic structure or spirit.

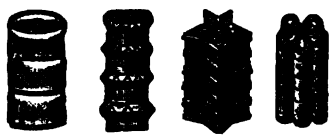
Encke, JOHANN FRANZ, astronomer, was born at Hamburg, September 23, 1791. After studying at Göttingen, he served, during the campaign of 1813–14, in the artillery of the Hanseatic legion, and in 1815 in the Prussian army, as lieutenant of artillery. On the establishment of peace he left the service, and became assistant, and afterwards principal astronomer, in the observatory of Seeberg, near Gotha. In 1825, chiefly at the instigation of Bessel, he was called to Berlin as secretary of the Academy of Sciences and director of the observatory. While at Gotha, the astronomical prize offered by Cotta was awarded to Encke by the judges Gauss and Olbers, for his determination of the orbit of the comet of 1680. This led him to solve another problem, which had been proposed along with the other—viz. the distance of the sun. The solution, by means of the two transits of Venus in 1761 and 1769, is published in two separate tracts (*Die Entfernung der Sonne*, Gotha, 1822–24). In 1819 he proved that the comet discovered by Pons, November 26, 1818, revolved in the hitherto incredibly short period of about 1200 days, and had been already observed in 1786, 1795, and 1805. It has since gone by the name of Encke's comet, and has appeared regularly; the period of its recurrence being 3·29 years, or about $3\frac{3}{10}$ years (see COMETS). Encke's researches on this subject are contained in the *Transactions of the Berlin Academy*. In 1830 he undertook to edit the Berlin *Astronomical Almanac*, in which he published a number of astronomical treatises (separately published, 3 vols. 1866). Four volumes appeared of his *Astronomical Observations at the Berlin Observatory* (1840–56). He died 2d September 1865. See his Life by Bruhns (Leip. 1869).

Enclosures. See COMMONS AND ENCLOSURES.

Encore ('again'), a French expression, generally used in England by the audience of a theatre or concert-room when requesting the repetition of the performance of a piece of music. It is not used by the French themselves, who, in similar circumstances, exclaim *bis* ('twice').

Encratites. See TATIAN.

Encrinites, fossil Crinoids, often known as stone-lilies. They occur very abundantly, and often seem as thick in a limestone or marble bed as straws in a corn-rick. See CRINOIDEA.



Encrinite Stems (Mountain Limestone).

Encumbered Estates Court. In 1849 a statute was passed to facilitate the sale of encumbered estates in Ireland, and constituting a court to which landlords of such estates might apply to direct the sale. Up till 1859 (when this court was superseded by the Landed Estates Court, dealing also with unencumbered estates) this court made 3457 sales, producing a sum of £25,190,839. See IRELAND.

Encyclical (*literæ encyclicæ*), a letter addressed by the pope to all his bishops, condemning current errors or advising the Christian people how to act in regard to great public questions. It differs from a Bull (q.v.) mainly in that the latter is usually more special in its destination. The famous encyclical, *Quanta Cura*, issued 8th December 1864 by Pius IX., was accompanied by a *Syllabus* condemning specifically eighty errors in religion, philosophy, and politics.

Encyclopædia (from the Greek *enkyklios*, 'circular' or 'general,' and *paideia*, 'discipline' or 'instruction') is in modern usage a work professing to give information in regard to the whole circle of human knowledge, or in regard to everything included within some particular scientific or conventional division of it. The character of such works has of necessity varied from generation to generation, with changing conceptions of the scope and value of our knowledge and of the mutual relations of one department with another. An encyclopædia as such cannot rise above the general culture of its time; the medieval encyclopædia will be as medieval in the distribution and perspective of its subjects as in the selecting and presenting of its facts. As knowledge has increased it has become more and more necessary, in order to say something (and the most important something) about everything, to be content not to say everything about anything. And while, in the 10th century, one laborious student might undertake to give the world a conspectus of all that was of worth in its literature and science, a modern work of

similar scope demands the co-operation of hundreds of intellects. For the history of the word, see Boeckh's *Encyklopädie und Methodologie der phil. Wissenschaften* (1866, pp. 34–37).

Though several of the ancient philosophers of Greece, and notably Aristotle, carried their investigations into every department of inquiry within their intellectual horizon, none of them seems to have compiled exactly what we now call an encyclopædia. Speusippus, indeed, is credited with something of the sort; but his works exist only in fragments. The great Latin collections of Terentius Varro (*Rerum humanarum et divinarum Antiquitates* and *Disciplinarum libri ix.*), dating from 30 B.C., and the so-called *Historia Naturalis* of the elder Pliny (23–79 A.D.), may thus be considered as the first specimens of their class. The 5th century saw the production of a curious and oddly written encyclopædia by Martianus Capella; in the 7th, Isidorus Hispalensis compiled his *Originum seu Etymologiarum libri xx*, which was afterwards abridged and recast by Hrabanus Maurus. Under the calif of Bagdad, Alfarabius or Farabi, in the 10th century, wrote an encyclopædic work, *Ihsa Alulum*—remarkable for its grasp and completeness; but this has hitherto been left in manuscript (a fine copy is preserved in the Escurial). Vincent of Beauvais (Vincentius Bellovacensis), who probably died in 1264, gathered together, under the patronage of Louis IX. of France, the entire knowledge of the middle ages in three comprehensive works—*Speculum Historiale*, *Speculum Naturale*, and *Speculum Doctrinale*, to which an unknown hand soon after added a *Speculum Morale*. About the same time Brunetto Latini was engaged on his *Livres dou Tresor* (printed in Italian in 1474, and in the original French in *Documents inédits*, 1860). The *De proprietatibus rerum* of Bartholomeus de Glanville deserves mention as being of English origin and highly successful in its day. Written about 1360, this became exceedingly popular in the translation (1398) by the Cornishman John Trevisa. In 1541 the name Cyclopædia is first used as the title of a book by Ringelberg of Basel, and in 1559 Paul Scalich styles his work *Encyclopædia seu orbis disciplinarum tum sacrarum tum profanarum*. Among the numerous encyclopædias of the 17th century it is enough to mention Antonio Zara's (Venice, 1615) and Alsted's (7 vols. fol. Herborn, 1630), both in Latin; Moreri's *Grand Dictionnaire historique* (Lyons, 1674), which reached a 20th edition in 1759; Hofmann's *Lexicon Universale* (2 vols. fol. Basel, 1677; 4 vols. fol. Leyd. 1698), which was the first attempt to bring the whole body of science and art under the lexicographic form; Thomas Corneille's *Dictionnaire des Arts et des Sciences* (2 vols. Paris, 1694; and most famous of all, Bayle's *Dictionnaire historique et critique* (4 vols. Rotterdam, 1697), which was mainly designed as corrective and supplementary to Moreri. This last appeared in several English editions generally more or less expurgated or modified, as in that issued at London (10 vols. fol. 1734–41); and J. G. de Chaufepié published a *Nouveau Dictionnaire* as a supplement (4 vols. Amsterdam, 1750). It was in the course of the 17th century that encyclopedists began regularly to employ the vulgar tongues for their work, and to arrange their material alphabetically for convenience of consultation. Of the vast *Bibliotheca Universale*, planned by Coronelli to fill 45 folio volumes, only a small portion saw the light (Venice, 1701–6). The series of great encyclopædic works in modern English practically began by the anonymous *Universal, Historical, Geographical, Chronological, and Classical Dictionary* (2 vols. 1703), and the *Lexicon Technicum* of Dr John Harris (Lond. 1704). Ephraim Chambers followed in 1728 with his *Cyclopædia, or an Universal Dictionary of Arts and Sciences* (2 vols. fol.), which presents a distinct advance in the construction of such works, the author endeavouring to give to his alphabetically arranged materials something of the interest of a continuous discourse by a system of cross references. A sixth edition of this popular work appeared in 1751–52, and a supplement in 2 fol. vols. in 1753. Dennis de Coetlogon published *An Universal History of Arts and Sciences* (2 vols. fol. Lond. 1745). A revised and enlarged edition of Chambers's was published in 1778–88 by Abraham Rees, who, besides incorporating the supplement with the main body of the work, added a large amount of original matter.

It was a French translation, by John Mills, of Chambers's *Cyclopædia* which originally formed the basis of that famous *Encyclopédie* which, becoming in the hands of D'Alembert and Diderot the organ of the most advanced and revolutionary opinions of the time, was the object of the most violent persecution by the conservative party in church and state, and suffered egregious mutilations at the hands not only of hostile censors but of timorous printers. So thoroughly was it identified with the philosophic movement of the time that the term *Encyclopédiste* became the recognised designation of all attached to a certain form of philosophy. Appearing at Paris in 28 vols. between 1751 and 1772, it was followed by a supplement in 5 vols. (Amst. 1776–77), and an analytical index in 2 vols. (Paris, 1780). Voltaire's *Questions sur l'Encyclopédie* (1770) formed a kind of critical appendix. La Porte's *Esprit de l'Encyclopédie* (Paris, 1768) gave a résumé of the more important articles, and under the same title Hennequin compiled a similar epitome (Paris, 1822–23). Numerous editions of the whole work, more or less expurgated or recast, were issued outside of France; and many minor encyclopædias, such as Macquer's *Dictionnaire Portatif des Arts et Métiers* (1766), Barrow's *New and Universal Dictionary of Arts and Sciences* (1 vol. fol. 1753), and Croker, Williams, and Clerk's *Complete Dictionary of Arts and Sciences* (3 vols. fol. 1766), were to a considerable extent quarried out of their massive predecessor, or moulded according to the method expounded by D'Alembert in his preliminary dissertation. In 1780 a privilege was obtained by C. J. Panckoucke for the publication of an *Encyclopédie Méthodique, ou par Ordre des Matières*, which was at first intended to be little more than a rearrangement and supplementing of the matter of Diderot's work; each main subject having a separate 'dictionary' for itself. But its method was too much for it; the scheme, though 166 vols. had been issued by 1832, was never completely realised.

Between 1768 and 1771 there appeared at Edinburgh in 3 vols. 4to the first edition of the *Encyclopædia Britannica*, which was from the beginning a kind of compromise between the alphabetical and the scientific distribution of subjects. Colin Macfarquhar, Andrew Bell, and William Smellie share the credit of the plan. Biographical and historical articles were first introduced in the 2d edition (10 vols. 4to, 1776–1784). The third edition (18 vols.) was completed in 1797; the fourth (20 vols.) in 1810; the fifth, a mere reprint, in 1817. To the sixth edition (1823) Constable, the publisher, prefixed the well-known volume of preliminary dissertations by Dugald Stewart, Playfair, &c. The seventh edition, edited by Macvey Napier, was published by Messrs Black between 1830 and 1842. The eighth (21 vols. and index) appeared 1853–61, under the editorship of Dr Thomas Stewart Traill; and the ninth, edited by Professors Thomas S. Baynes and W. Robertson Smith, was completed in 24 vols. in 1875–88 (Index, 1889). This last

edition was issued in America both by its Scottish publishers and by a so-called 'piratic' firm which also brought out the *Encyclopædia Americana* (4 vols. 1883–89) for the purpose of giving additional information about matters of 'American' interest.

During the period that the *Encyclopædia Britannica* has thus been growing from edition to edition, numerous important encyclopædias have appeared in English—the *Edinburgh Encyclopædia* (18 vols. 1810–30), edited by Sir David Brewster; Wilkes's *Encyclopædia Londinensis* (24 vols. 4to, Lond. 1810–29); *Encyclopædia Perthensis* (23 vols. Edin. 1816), a striking proof of the energy of its compilers, Aitchison of Edinburgh and Morison of Perth; the *Encyclopædia Metropolitana* (30 vols. 1818–45), arranged, according to a philosophic plan by Coleridge, in four divisions: (1) pure sciences, (2) mixed and applied sciences, (3) biography and history, and (4) miscellaneous and lexicographic articles; the *Penny Cyclopædia*, edited by Charles Knight for the Society for the Diffusion of Useful Knowledge (29 vols. (2 supplemental) 1833–46); and the *English Cyclopædia* (22 vols. 1853–61; a synoptical index, 1862; four supp. vols. 1869–73), founded on the copyright of the *Penny Cyclopædia*, but rearranged into four divisions—viz. geography, natural history, biography, and arts and sciences. In spite of the value of much of its material, this last encyclopædia, like Panckoucke's vast enterprise and Coleridge's ingenious scheme, furnished another proof that no encyclopædia can well be thoroughly popular which is not executed on the plan of a single alphabet. It is partly their rigid adherence to this method that has given their success to the popular German encyclopædias.

The encyclopædia now known as Brockhaus's *Conversations-Lexikon*, which was started by Löbel at Leipzig in 1796, and passed into the hands of F. A. Brockhaus in 1808, gave a great impetus to the production of similar works. It is still one of the most popular of German encyclopædias (13th ed. illust. 16 vols. 1882–87; supp. 1887). Its principal rivals are Pierer's, and Meyer's *Konversations-Lexikon*. The former (Altenburg, 1822–36, 26 vols., with 14 supplemental vols. 1840–56) has somewhat lost ground as a work of general reference; while the latter has become in completeness and compression the best work of its kind (1st ed. 15 vols. Leip. 1857–60; 3d ed. 1874–78; 4th ed. 1885, &c.), a striking characteristic being the free use made of maps, tabular conspectuses, woodcuts, and lithographic illustrations. The Brockhaus *Lexikon* became the basis, more or less entirely, of encyclopædias in most of the civilised languages of Europe—*Encyclopedia Española* (Madrid, 1848–51); *Nuova Enciclopedia Popolare Italiana* (Turin, 1841–51); *Nordisk Conversations-Lexikon* (5 vols. Copenhagen, 1858–63; 3d edition, 1883, &c.); *Svenskt Konversations-Lexikon* (4 vols. Stockholm, 1845–51; since re-issued with supplements). Four English works were professedly founded on it—*Encyclopædia Americana* (14 vols. Phila. 1829–1846); *New American Cyclopædia* (16 vols. New York, 1858–64), edited by Ripley and Dana, and frequently quoted as *Appleton's* from the name of the publisher (new ed. 16 vols. 1873–76); the *Popular Cyclopædia* (7 vols. Glasgow, new ed. 1883); and *Chambers's Encyclopædia* (10 vols. Edin. 1860–68, edited by Dr Andrew Findlater; new ed. 10 vols., edited by David Patrick, 1888–92). In this, the new edition, *Chambers's Encyclopædia*, already the best-known book of its class in the English-speaking world, has been entirely recast and rewritten.

Other English cyclopædias that require mention are Colange, *National Encyclopædia* (New York, 1872, &c.); Johnson's *Illustrated Universal Cyclopædia* (4 vols. New York, 1874–78); the *Globe Cyclopædia*, edited by Dr J. M. Ross (4to, 6 vols. Edin. 1879; afterwards issued in London under the title of *Students' Encyclopædia of Universal Knowledge*); Heck and Baird, *Iconographic Encyclopædia* (4 vols., 2 vols. plates, New York, 1860); Brand and Cox, *Dict. of Science, Lit., and Art* (3 vols. 1865–67; new ed. 1875); the *National Encyclopædia* (Lond. 1884, &c.); and Blackie's *Modern Cyclopædia* (8vo, Lond. 1889, &c.). Nor should we omit Larousse, *Grand Dict. du XIX^e^ siècle* (4to, Paris, 1878); Chevreuil, *Grand Dict. illustré* (4to, Paris, 1883); and Dreyfus, *La Grande Encyclopédie* (4to, 1885, &c.). Parry's *Encyclopædia Cambrensis* (1862–63) is of interest.

Among all European encyclopædias (and a few only have been mentioned; for every leading language could furnish a list) one stands out as a unique example of protracted production. A defect inherent in the constitution of every large encyclopædia brought out in successive volumes is that, as regards literature and the progressive sciences, the earlier portions are passing out of date before the later portions have come into existence. This characteristic is almost caricatured in the famous *Allgemeine Encyclopädie der Wissenschaften und Künste*, which was originally undertaken by Professors Ersch and Gruber in 1818, and has since continued slowly to appear in three several sections of the alphabet up to the present time. There have already appeared some 170 volumes, many of them containing the most elaborate monographs on individual subjects to be found in literature. Even this work looks small when compared with the great Chinese cyclopædia in 5020 Chinese volumes (6109 general headings), printed at Pekin in 1726 by command of the Emperor Kang-Hi. It was restricted to a hundred copies, one of which reached the British Museum in 1878.

An attempt to remedy the defect of protracted production has frequently led to the issue of supplemental volumes, planned so as to bring up the earlier articles to the same time-level as the later articles. And in more than one instance (notably Brockhaus's and Meyer's *Konversations-Lexikon*, and Appleton's *American Cyclopædia*) this has culminated in the issuing of an *Annual Cyclopædia* on the same general lines.

In contrast with the larger encyclopædias may be mentioned the modern attempts to boil down the circles of the sciences into portable form. Thus Brockhaus issued a *Kleineres Conversations-Lexikon* (4 vols. Leip. 1854–56; 4th ed. 2 vols. Leip. 1885); Meyer's *Konversations-Lexikon* is admirably epitomised in Meyer's *Handlexikon* (4th ed. 2 vols. Leip. 1888); and Spemann issues a pocket encyclopædia (Kürschner's) which is a model of compression. Similar English productions are Beeton's *Encyclopædia* (2 vols. 8vo, Lond. *n.d.*); Beeton's *Dictionary of Science* (8vo, Lond. *n.d.*); Champlin's *Young Folks' Cyclopædia of Common Things* (New York, 1879), with the English re-issue known as Cox's *Little Encyclopædia of Common Things* (8vo, Lond. 1882; 3d ed. 1884); Champlin's *Young Folks' Cyclopædia of Persons and Places* (1880); Hazell's *Annual Cyclopædic Record* (4th ed. 1889); Sampson Low's *Pocket Cyclopædia* (1889); Phillip's *Million of Facts* (8vo, 1836; and later without date).

Special Encyclopædias.—This class has naturally become more and more numerous; though in many cases the works are neither designated encyclopædia nor dictionary. A valuable series is Meyer's *Fach-Lexika* (general history, ancient history, philosophy, geography, &c.), which applies the method of the 'dictionary' to the treatment of individual subjects in separate volumes; thus differing from Lardner's *Cabinet Cyclopædia*, and the *Encyclopædia Metropolitana*, which were practically a series of treatises.

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Endemic (from *en*, 'among,' and *dēmos*, 'the people'), a term applied to diseases which affect numbers of persons simultaneously, in such manner as to show a distinct connection with certain localities. Endemic diseases are usually spoken of as contrasted with Epidemic (q.v.) and Sporadic (q.v.); endemic indicating that a disease infests habitually the population within certain geographical limits, and also that it is incapable of being transferred or communicated beyond those limits; while, on the other hand, a disease is termed epidemic if it is transmitted without reference to locality, and sporadic if it occurs in isolated instances only. It should be mentioned, however, that it is quite possible for an endemic disease afterwards to become epidemic, and many of the best known forms of complaint, such as cholera, yellow fever, &c., have a well-defined local habitat or place of incubation, in which they originate and subsequently spread to surrounding districts. The theory, accordingly, of endemic diseases is, that they are in some way or other connected with the soil—the result of terrestrial influences, or *miasms*—of poisons generated within the earth, or near its surface, and diffused through the air, so as to be weakened in proportion to the distance from the source of the poison. Such poisons are always observed to be more virulent in summer than in winter—more dangerous at night, when the vapours are concentrated on the surface of the soil, than in the daytime—more abundant in the plains, and in close confined places, than at a certain degree of elevation—more easily carried in the direction of the wind than in the opposite—and very often arrested altogether by water, or by a belt of forest or other luxuriant vegetation. In all these particulars, *endemic* are different from *epidemic* diseases, which bear no very obvious relation to the soil, and are not observed to be considerably modified either by the prevailing winds or the period of the day or night at which exposure to their influence takes place.

The most marked type of an endemic disease is Ague (q.v.) or Intermittent Fever, which has all the habits mentioned above, and is to so marked a degree a denizen of particular tracts of country as to lead to their being in some instances almost depopulated. Many places in Italy are a prey to the *aria cattiva* or *Malaria* (q.v.), as it is popularly called; and hence, no doubt, even more than for protection from human foes, the custom so prevalent in that country of building the villages on the tops of hills, so as to secure immunity from the poisonous vapours raised by the solar heat from the plains lying on either side at the base of the Apennines. Terrestrial *miasms*, or such poisons as generate endemic diseases, are usually found in the neighbourhood of marshy flats, or of uncultivated tracts of land at the confluence of rivers, or where a *delta*, or a wide channel subject to overflow, is formed at the upper end of a lake. In proportion, too, as the heat of the sun is greater, the tendency to malarious emanations is increased; and in the tropics, accordingly, large tracts of jungle and forest are often rendered absolutely uninhabitable and almost impassable at certain seasons by the invisible and odourless germs of intermittent, remittent, and even continued Fevers (q.v.), which are more fatal and unmanageable than the most terrible epidemic pestilences to those who are exposed to them. Such diseases are almost always sudden in their mode of attack, and they indicate the range of their influence by the number of persons attacked; but they are wholly free in most cases from the suspicion of communication by Contagion (q.v.), which is so frequent in the case of epidemic diseases. The precise nature of the malarious poison, though generally believed to be of the germ order, has never yet been discovered with any approach to exactness. It is known, however, to be almost invariably checked by drainage and cultivation of the soil; and hence many places in Europe, formerly very productive of endemic diseases such as ague, have now ceased to be so, as in the case of the Tuscan Maremma, and some parts of Kent and Essex, and of the Lothians in Scotland. The Eucalyptus-tree (*Eucalyptus globulus*) is said by several authorities to have a very beneficial influence on malarial districts, but this is a disputed point, and at best is probably quite as much due to the rapid growth and widespreading nature of the roots of the Eucalyptus, which thus efficiently drain the soil, as to any effect produced by the essential oils given off in a vaporous condition from the branches.

Enderby Land lies in 65° 57′ S. lat., 47° 20′ E. long., discovered by John Briscoe in 1831, on a whaling voyage, and named in honour of his employer, Samuel Enderby, an adventurous London merchant, and the maternal grandfather of Chinese Gordon. His fleet of whalers first rounded the Horn, and actually opened up the Southern Ocean, discovered the Auckland Islands, and carried the first batch of convicts to Botany Bay. Briscoe, from stress of weather and extreme cold, could not approach Enderby Land within 20 or 30 miles, and was thus unable to say whether it was an island or a strip of continental coast.

Endicott, JOHN, colonial governor of Massachusetts, was born at Dorchester, England, in 1589, and landed as manager of the plantation of Naumkeag (Salem) in 1628. Giving place in 1630 to John Winthrop, he headed a sanguinary expedition against the Indians in 1636, was deputy-governor in 1641–44, 1650, and 1654, and governor in 1644, 1649, 1650–53, and 1655–65. Endicott was an austere Puritan, choleric, benevolent, and brave. He died at Boston, March 15, 1665.

Endive (*Cichorium Endivia*), an annual or biennial plant, of the same genus with Chicory (q.v.), has been in cultivation since classic times as a garden vegetable, its blanched leaves being much used as a salad. The green-curled variety is the staple one, the white-curled is good for summer and autumn, and the broad-leaved is used for stews and soups. In Britain the seed is usually sown from the middle of May to the end of June, and by a little care and protection plants may be kept fit for use throughout most of the winter.

Endlicher, Stephen Ladislas, a systematic botanist, was born in Hungary, June 24, 1804. He was destined for the priesthood, but in 1827 commenced botanical and linguistic studies, and in 1840 he became professor of Botany in Vienna. Much disturbed by the events of 1848, he fell into melancholy, and in 1849 put an end to his own life. His *Genera Plantarum* (1836–40) has had great influence on succeeding botanists.

Endocarditis, disease of the internal surface of the heart, resulting in the deposit of fibrin upon the valves. See Heart (Diseases of).

Endocarp. See Fruit.

Endoderm. See Embryology.

Endogamy. See Marriage.

Endogenous Plants, or Endogens, a name applied by Lindley to monocotyledons to express an erroneous view of the difference in their usual mode of stem-thickening from that of dicotyledons, and now wholly disused by botanists. See Monocotyledons; also Dicotyledons, Bark.

Endomorph is the name given to a mineral which is inclosed within another mineral, the latter being termed a *perimorph*. Such inclusions are very common in the constituent minerals of crystalline schistose and igneous rocks.

Endophagy. See Cannibalism.

Endophyte. See Entophytes.

Endor, a village of Palestine, 4 miles S. of Tabor, now a poor mud hamlet, was the place which Saul visited (1 Sam. xxviii. 7) to consult the 'woman with a familiar spirit' previous to his fatal engagement with the Philistines.

Endosmose. See Osmose.

Endy'mion, a youth in Greek Mythology, celebrated for his beauty and his perpetual sleep. As he slept on Mount Latmos, in Caria, his beauty warmed the cold heart of Selēnē (the moon), who came down to kiss him and lie by his side. Different reasons were given for his sleep, the most general as well as the most poetic being that Selēnē had sent him to sleep that she might kiss him without his knowing. The story inspired the fresh fancy of the young Keats, who shaped it into an imperishable poem.

Ene'ma. See Clyster.

Enemy. According to the doctrine of the civil law, as formulated by Ulpian (Digest 49. 15, 24), those alone are enemies 'who have publicly declared war against us or we against them; all others are thieves and robbers.' In the earlier ages of the Roman republic such a declaration was most solemnly made to the foreign state by the feciales or priests, who acted as guardians of public faith, and was always attended by elaborate religious rites. So now, in order to constitute an enemy, there must be a public declaration of war made by a duly organised state or kingdom. Jurists are, however, divided in opinion in respect to the necessity of a previous declaration *to the enemy* in the case of an offensive war. Grotius and Vattel recommend such a previous declaration of war to the enemy, as being required by justice and humanity, and the latter specially commends the fecial law of the Romans, as giving a sanction and solemnity to acts of belligerency. Bynkershoek, on the other hand, maintains that such a declaration is not required by the law of nations, and that, though it may very properly be made, it cannot be demanded as a matter of right. Since the time of Bynkershoek the practice of a solemn declaration made to the enemy has fallen into disuse, and the nation now contents itself with making a public proclamation of war within its own territory and to its own people. Some such formal public act is necessary to announce to the people at home their new relations and duties growing out of a state of war, and to apprise neutral nations of the facts, in order that they may conform their conduct to the new state of things. Under the British constitution, the sovereign alone declares war, but this prerogative of the crown is practically ineffectual, since, without the consent of parliament, the money requisite to carry on the war cannot be raised. It is still an open question whether war can be jurally waged by states only in their corporate capacity and with their corporate resources, or whether it embraces the individual members of the states at war, and the property which belongs to them as private persons. The tide of modern opinion, however, seems to have set in the direction of the former and more humane theory. The doctrine of the older jurists was that, on the formal declaration of hostilities, all the subjects of the one nation became enemies to all the subjects of the other. From this principle there has been deduced the important consequence, as a recognised rule of international law, that the property of alien enemies residing in either of the hostile states, may be confiscated, and even that such persons may be detained as prisoners of war. The Americans, during the war with England, asserted this right in regard to British property found in their territory. But the usage of civilised nations for a long period has much modified the stern rule of law. It is provided in Magna Charta that, upon the breaking out of war, foreign merchants found in England, and belonging to the country of the enemy, should be attached 'without harm of body or goods,' until it should be known how English merchants were treated by the enemy; 'and if our merchants,' said the charter, 'be safe and well treated there, theirs shall be likewise with us.' The statute of staples, 27 Edw. III. chap. 17, made a still more liberal and precise enactment in favour of such foreign merchants residing in England. Forty days were allowed them, after the proclamation of war, to remove from the kingdom themselves and their goods, and if by reason of accident that time were not enough, forty days more were to be conceded to them. Vattel, among others, denounces the practice of confiscating the goods of alien enemies, and maintains that a state, having permitted foreigners to enter its territory, and to continue there, has tacitly promised them full liberty and security for their return. In modern times it has become the usual practice of nations thus to respect the property of individuals on the outbreak of war. Stipulations to this effect are an established *formula* in all commercial treaties, and, even when there is no treaty, such a liberal provision is often announced in the declaration of war itself.

According to ancient usage, the utmost cruelty was lawful towards enemies. In modern times more humane principles prevail, and men recognise that, by taking up arms against one another in public war, they do not cease on this account to be moral beings, and responsible to one another and to God. Warfare is now carried on subject to certain general rules, which are intended, as much as may be, to abridge the calamities of war, and to protect

the rights of individuals. An admirable summary of these rules may be found in the Instructions for United States Armies, issued in 1863. These instructions were prepared by the celebrated jurist Francis Lieber, and have served as a basis for most of the subsequent compilations. In 1874 an International Conference held in Brussels devoted much time to the elaboration of rules for military warfare. Still more recently, the Institute of International Law, at its meeting at Oxford in 1880, prepared and adopted a *Manual of the Laws of War on Land*, in which minute rules for the conduct of hostilities are succinctly set forth. Military necessity admits of all direct destruction of life or limb of *armed* enemies, and of other persons where destruction is unavoidable in the armed contests of the war; it allows of all destruction of property, and obstruction of the ways and channels of traffic, and of all withholding of sustenance or means of life from the enemy. Such military necessity does not, however, admit of cruelty—i.e. the infliction of suffering for the sake of suffering, nor of maiming or wounding except in fight, nor of the use of poison in any way, nor of the wanton devastation of a district. It admits of deception, but disclaims all acts of perfidy. In the case of the occupation of a country by the enemy, the persons of the inhabitants, especially of women, are respected, and the maxims of religion and morality are acknowledged. Private property, unless forfeited by crimes, can be seized only on the ground of military necessity, and if the proprietor has not fled receipts are usually given, which enable the spoliated owner to obtain indemnity. Trade between the subjects of two hostile powers is absolutely suspended during hostilities, unless permitted by express sanction, and the importation of articles particularly useful in war is contraband. All such material, whether supplied by subjects of the enemy or of another state, is seized and confiscated. For other information on the rules and usages which regulate the relations of belligerent states, reference is made to the articles CONTRABAND OF WAR, BLOCKADE, NEUTRALITY, PRIZE, PRISONERS OF WAR, GENEVA, &c. As to the right of individuals to fit out vessels for the annoyance of the enemy, see PRIVATEER, and PIRACY.

Grotius, *De Jure Belli et Pacis*, lib. iii. chap. 3–7; Kent's *Commentaries*, vol. i. chap. 3; Bluntschli, *Das moderne Völkerrecht*; Sir Travers Twiss, *Law of Nations in Time of War* (Oxf. Clar. Press, 2d ed. 1875).

Energumen. See DEMONOLOGY.

Energy. The term *energy* as applied to a material system is used to denote the power of doing work which is possessed by that system. There is no manifestation of energy apart from matter. In consequence of this, matter is sometimes defined as the vehicle or receptacle of energy. A bullet projected vertically upwards possesses a great amount of energy; it can do work in overcoming obstacles to its motion. But the higher it rises the less resistance can it overcome; and at last, having reached the greatest height it can attain, it seems incapable of doing work. Yet it is not really incapable of doing work. It will gradually acquire speed in the downward direction, and will finally (the resistance of the air being neglected) reach the ground with the same speed as it had at first, and is thus capable of doing the same amount of work. Therefore, when at its highest position and seemingly incapable of doing work, it really possessed energy as at first. Hence we are led to recognise two leading types of energy —energy of *motion* and energy of *position*; or, as they are usually called, *kinetic* energy and *potential* energy. We have many examples in nature of both types. Currents of air or of water possess kinetic energy; a stone resting on the brow of a cliff, and water at the edge of a fall, possess potential energy.

But although energy may be classed under one or other of these two types, there are many forms in which it is manifested. There is energy of *visible motion* and energy of position in *visible arrangements* of bodies, as in the bullet moving upwards or downwards, or at rest at its highest position. A bent spring evidently possesses potential energy. An oscillating pendulum possesses alternately kinetic energy and potential energy. At the extremity of its swing the energy is entirely potential; at the middle of its range the energy is entirely kinetic; at intermediate positions it is partly of one kind, partly of the other. *Heat* is another form of energy. The particles of a hot body are in rapid motion, and the hotter the body the more rapid is the motion. The motion is on an invisibly small scale, but it can be communicated to other matter in such a way as to produce visible motion. Thus the invisible motions which constitute heat are applied in the steam-engine or air-engine to produce visible motion of a piston, and so to perform mechanical work. When Heat (q.v.) becomes *latent* in a body, part at least of the energy is spent in overcoming molecular forces, and the relative distances of the molecules of the body are altered; and so we have potential energy stored up in the molecules. Again we have the so-called *radiant energy*—energy propagated by means of undulations through the ether. This includes light as well as radiant heat, the two differing merely as regards wave-length. So also it includes the electro-magnetic undulations recently experimentally demonstrated by Hertz, the wave-length of which may be many feet instead of $\frac{1}{40000}$ of an inch as in orange-coloured light. The vibrations of the particles of a hot or luminous body are communicated to the ether, and propagated by wave-motion through it at the rate of 186,000 miles per second. In the ether, therefore, the energy is partly potential, partly kinetic (see ETHER). There is also energy of *chemical separation*. Carbon and oxygen combine in the burning of ordinary fuel, and the energy which they contain in their separated state is used to produce mechanical work, as in the steam-engine; and in the explosion of gunpowder visible energy of motion is produced even more directly from the energy of chemical separation of the constituent substances. We have also potential energy of *electrical separation*, for if two conductors be charged with electricity, one positively and the other negatively, an attraction between them becomes apparent. In approaching each other the charged bodies can be made to do work. Again, when we have *electricity in motion* in a conductor, we have another means of producing work. The current of electricity produces heat and also tends to produce motion of other conductors in which electric currents flow. The attraction or repulsion between magnets can also be made to produce work, and so also we can get work from the mutual action between magnetised bodies and conductors in which electric currents flow.

Thus we see that energy may be manifested to us in a number of different forms; but as we do not yet know the ultimate nature of matter or of electricity, we cannot assert that the forms which we have just considered are all essentially distinct. It is not impossible that the energy of chemical separation is due to electrical separation, or that energy resulting from magnetisation is due to motion of electricity.

In the above remarks we have spoken not only of the production of work from energy, but of the

production of one form of energy from another, and of the passage of potential energy into kinetic energy. This change of energy from one form to another is known as the *Transformation of Energy*, and distinguishes it from matter. While matter is passive or inert, energy is continually in process of transformation—indeed we are cognisant of energy only in virtue of its change. We should never know that a moving cannon-ball possessed energy if we did not see its destructive effects; we should never know that electrified clouds possessed energy did we not see damage done by lightning.

Of the transformation of energy a few examples must suffice. We cause carbon and oxygen to combine in the furnace of a steam-boiler, or hydrogen and oxygen to combine in the cylinder of a gas-engine. This produces invisible motion of molecules, which in turn produces visible mechanical motion of the piston and connected mechanism. This motion may be communicated to a 'dynamo,' causing conducting wires to move in a magnetic field. Thus electric currents are produced in the wires. These currents may produce heat in, and cause radiation from, a highly resisting carbon filament. Or they may produce magnetic effects, and finally mechanical motion, in a motor. Thus energy may be applied by means of the dynamo and motor to the production of mechanical work in a place where it would not be easy to use an engine directly.

In the case of the telephone, the condensations and rarefactions of the air (which produce sound when they impinge on the ear) cause vibrations of the telephone diaphragm. As this motion occurs in the near neighbourhood of the pole of a magnet, electric currents of varying intensity and direction are produced in a coil of wire surrounding the pole. These currents pass round the magnet of the receiving telephone, and produce magnetic effects similar to those occurring at the sending instrument. Therefore similar mechanical effects are caused, and so like sounds are heard.

In the voltaic battery energy of chemical separation is transformed into energy of current electricity. The electric current may be passed through slightly acidulated water. The water is thus broken up into its constituents, so that energy of chemical separation is again obtained.

Many other examples of the transformation of energy might be given, but it is sufficient to remark that any form can be directly or indirectly transformed into any other form. A matter of greatest importance to us is the determination of the sources or source from which ultimately we derive mechanical work. The work obtained from animal labour is derived from the chemical energy of the food supplied to the animal. This food is vegetable food either actually or ultimately; for, even if it be actually animal, the energy of such food is ultimately traceable to the vegetable world. Now all vegetables grow by means of solar radiation, which decomposes carbonic acid in their tissues, so that energy obtained from animal labour is obtained actually from the sun. And if we use fuel in an engine, the energy of the fuel is in the same way due to the sun. If we use wind-power to drive our machines, the energy is also solar, for it is the sun which causes the atmospheric currents. So also the work obtainable from moving water, except in the case of tidal currents, is due to the heat radiated from the sun. Thus the sun is the great source of our energy; and, if he ceased to supply us with it, we could no longer produce work, except indeed in so far as he has already supplied us with a store in potential forms.

We have already stated that the energy of a material system is sometimes exhibited in one form, sometimes in another, but this statement may be greatly extended. If no energy leaves the system, and if no new energy enters it, the quantity which disappears from one form reappears entirely in another. This is known as the principle of the *Conservation of Energy*. In the case of the bullet projected upwards, the potential energy in the highest position would be the exact equivalent of the original kinetic energy, if none were communicated to the air or other bodies. The same would hold in the case of the pendulum, if no energy were given from the system to the air or the supporting arrangement. [At one time the expression conservation of *force* was used instead of conservation of *energy*, but the word 'force' meant then what we now call 'energy.' The conservation of force, as we now use the word, means something totally different. See FORCE.]

The law of conservation of energy may be stated as follows: The total amount of energy in a material system cannot be varied, provided the system neither parts with energy to other bodies nor receives it from them. This law is merely a generalisation from observed facts; a single known exception would cause us to abandon or modify the statement. But the amount of positive proof in favour of the law is now exceedingly great, perhaps the strongest proof being afforded by the accuracy of scientific predictions founded upon the assumption of its truth. As an example, we may refer to the prediction of the lowering of the freezing-point of water by pressure. The assertion of the principle of conservation of energy is equivalent to a denial of the possibility of the 'Perpetual Motion' (q.v.).

In a scholium to his third law of motion, Newton asserts that 'if the action of an external agent is estimated by the product of its force into its velocity, and the reaction of the resistance in the same way by the product of the velocity of each part of the system into the resisting force, arising from friction, cohesion, weight, and acceleration, the action and reaction will be equal to each other, whatever be the nature and motion of the system.' Now the product of a force into the velocity produced by it is simply the rate at which the force does work. Hence, as was first pointed out by Thomson and Tait in their work on Natural Philosophy, this statement of Newton's is almost a complete statement of the principle of conservation of energy. Newton did not know what becomes of work spent in overcoming friction; he believed that it disappeared from the system. Had he known that it was converted into an exact equivalent in the form of heat, his statement would have been complete. It was not until long after Newton's time that Heat (q.v.) was recognised to be a form of energy. The experiments of Rumford and Davy first led to this result. Rumford's experiments were made in 1798 and 1799, on the work done, and the heat produced, in the boring of cannon. He concluded that heat must be due to motion. Davy's experiments on the melting of ice by friction were also made about the same time, but it was not until 1812 that he came to the conclusion that 'the immediate cause of the phenomenon of heat is motion, and the laws of its communication are precisely the same as the laws of the communication of motion.' From data given by Rumford, it may be calculated that 940 foot-pounds of work are necessary to produce heat sufficient to raise the temperature of one pound of water by 1° F.—the foot-pound being the work done in raising a pound through one foot against gravity. The researches of Colding and Joule, however, have given a far better determination of the mechanical equivalent of heat; and Joule's experiments, especially, extend to all forms of energy, and prove their exact

equivalence. His experiments on the heating of water by friction gave results varying from 770 to 774 foot-pounds as the *mechanical equivalent* of heat. His final result was 772, the possible error being much less than 1 per cent. Many indirect methods have also been used by Joule and others. Thus, the mechanical equivalent may be directly determined by observing the quantity of heat developed during the passage of an electric current of known intensity through a conducting wire of known resistance. The result for heat being assumed, it is easy to find the work-equivalent of other forms of energy. Thus, we can determine the equivalent in work of the energy of chemical separation—e.g. by dissolving zinc in sulphuric acid, and observing the heat developed. If the zinc be dissolved in a voltaic cell which is producing a current, heat is evolved in the various parts of the circuit in proportion to their resistance. Thus, by placing in the circuit a wire of great resistance, almost all the heat will be developed in the wire, and so may readily be measured. Again, by making the current produce work through the agency of an electro-magnetic engine, the work may be directly measured, care being had to take account of energy lost in the process by friction or otherwise. Less heat is developed in the circuit in proportion as the work done is greater, the total energy being constant. So, by expending work in driving a magneto-electric machine, we may find the work-equivalent of electric energy. As the electric energy ultimately becomes heat, Joule used this method in one of his determinations of the quantity of heat produced from a known amount of work.

We have seen that we can neither increase nor diminish the total quantity of energy in the universe, while any one form of it may be changed into any other; but we have made no inquiry as to whether or not all forms are equally transformable. The question is obviously of vital importance to us; for, if one form be less transformable than the rest, when we change any other kind into this one, we shall not be able completely to retransform it. Thus there will be a tendency for all forms to be reduced to this more permanent form, and we shall not be able so readily to obtain mechanical work from it. Sir W. Thomson first pointed out that there is in nature a universal tendency to this *Dissipation* (or, as it has since, and perhaps preferably, been called *Degradation*) *of Energy*. The final form which all energy tends to take is that of heat. But heat tends continually to diffuse so as to equalise temperature; and, when there is no difference of temperature between the source and condenser of a heat-engine, no work can be obtained from it, for the amount of work which can be obtained from a given quantity, H, of heat (see HEAT) is $JH\frac{T-T_0}{T}$, T and T_0 being the absolute temperatures of the source and condenser respectively, while J is the mechanical equivalent of heat. Obviously $JH\frac{T_0}{T}$ is the quantity of energy lost for useful purposes so far as this engine is concerned. This shows that all the amount of heat supplied cannot be transformed into work, unless the condenser be at the absolute zero of temperature. If we take as our source of heat in one case a cubic foot of some metal at a given absolute temperature, and in another case two cubic feet of the same metal containing together the same quantity of heat as the one cubic foot formerly contained, and therefore at half the temperature provided the specific heat be constant, it is obvious, from the above expression, that twice as much heat will be lost in the second case as in the first. Hence, we see that heat at low temperature is much less useful than the same quantity of heat at high temperature. And a corresponding statement is true for other forms of energy. Thus, if we have two Leyden jars alike in every respect, and charge one with a certain quantity of electricity, we can get a certain amount of work from the arrangement, which is made evident by the loudness of the sound and the brightness of the flash on discharge. But if we first divide the original charge between the two jars, and then discharge them, we can only get half the amount of energy. The reason is that the potential is only one-half of what it was in the first case; and the higher the potential of a given quantity of electricity is, the greater is the amount of work it can do, just as the usefulness of heat depends upon temperature. In fact, if V be the potential of the charge E in the first case, $\frac{1}{2}$ VE is the energy; but in the second case the charge of each jar is $\frac{1}{2}$ E, and the potential of each is $\frac{1}{2}$ V, so that the energy in each is $\frac{1}{4}$ VE, the total amount being therefore $\frac{1}{2}$ VE, or only half of the original energy. The remaining half is accounted for by the energy spent in dividing the charge—light, sound, and heat being produced. Again, work may be obtained by letting compressed gas expand; and the amount of work depends upon the pressure. The gas may be allowed to expand without doing work, but energy will be dissipated, for the expanded gas, being at less pressure, cannot do so much work as it could do before expansion.

Examples of the degradation of energy are everywhere seen in nature. The fact that the optical image of a body is less distinct than the object itself is due to the fact that some of the so-called radiant energy is absorbed by the reflector, and takes the form of heat. The vibrations of a tuning-fork die down because the energy is communicated to the surrounding air, but they also diminish because of the production of heat from molecular friction in the vibrating body. The stilling of storms is accompanied by dissipation of energy. Possibly starlight is weakened in its passage through the ether. Indeed, no instance of transformation of energy can be pointed out in which there is not also dissipation of energy.

As we have already remarked, since all forms of energy tend to take the form of heat, and since heat is constantly tending by conduction and otherwise to equality of temperature, it follows that, unless the universe be infinite, energy will ultimately become useless for the production of work. The total amount of energy will, in accordance with the principle of conservation, be the same as at first, but any transformation of it will be impossible. There are two ways in which we may regard the energy of a given system; we may regard it from without the system, or from within. When we speak of the total energy of a system, we regard it from the outside. Thus, if we consider a thermal system, the total energy is the work which could be done by the heat in passing from the system to its surroundings, these being supposed to be constantly at the absolute zero of temperature. But the available energy (called in this case the *thermo-dynamic motivity*) is usually regarded as the greatest amount of work which can be obtained by equalising the temperatures of its various parts amongst themselves. [The motivity might, of course, also be regarded from without. In this case it would be the quantity of work obtainable by reducing all the parts of the system to some definite temperature.] The available energy of the universe, supposed finite, will therefore ultimately be zero. The energy of relative motion of its parts tends, in virtue of friction, to take the form of heat. Though we have no direct confirmation of the statement, yet we may conclude from analogy that the relative

motion of the planets and of all heavenly bodies tends to cease. Thus, ultimately, potential energy of gravitating matter must become kinetic energy of visible motion, and then heat; so that the universe will at last contain only one huge material body rotating about its centre of inertia, and the rotation too must cease in time. And even the molecular motions must largely cease, being communicated to the ether. All this is, of course, pure speculation. We might even, if we considered it profitable, speculate further with Rankine and others as to the possibility of the restoration of the availability of energy. If the universe be finite we may have reflection of radiant energy from its boundaries. A material body coming into a focus might be instantly vaporised, the radiant energy becoming again high-temperature heat.

The second law of thermo-dynamics (see HEAT) is essentially a statement, for the case of heat and mechanical work, of the principle of the dissipation of energy. Its proof, as given by Sir W. Thomson, depends upon the assumption that we cannot produce work from heat which is entirely derived from the colder of two bodies used as the source and condenser of a heat-engine. On an excessively small scale heat does pass in nature from a cold part of a body to a hot part, so as to increase the difference of temperature. In an excessively small portion of a gas, the quicker moving particles may be found in one part and the slower moving particles in another, even although the motion was uniform at first. Similarly, by moving in portions of the sides of a vessel containing gas when no particles were impinging upon them, we could increase the motivity of the system without doing work. As this is practically impossible, we see that the truth of the second law of thermo-dynamics depends essentially upon the extreme smallness and the great number of the particles of a body; so that, in the case of the gas, the motivity is increased only because work is done in compressing the gas which takes the form of heat, and is then removed from the system. Thus, while there is increase of motivity of the energy of the system, there is degradation of external energy.

If at any instant the motion of every particle of matter in the physical universe were reversed, the dissipation of energy would cease. Available energy would increase, for everything would occur over again exactly as in past time, but in the reverse order. This increase of availability would, however, only last until the configuration which existed at the commencement of the present order of things was reached, when dissipation of energy would again occur. This reversal of motion might occur in a system containing a very few particles, but we must regard it as an impossibility in the physical universe as a whole.

See the articles in the present work on HEAT, LIGHT, ELECTRICITY, &c., as also FUEL, &c., and for Muscular Energy, see DIGESTION. On the subject of the preceding article, Tait's *Recent Advances in Physical Science* (1876) may be consulted, and the same author's *Thermo-dynamics* (1877); Balfour Stewart's *Conservation of Energy* (1880); and the relevant portions of Clerk MAXWELL's *Heat* (1875).

Enfantin, BARTHÉLEMY PROSPER, one of the chief representatives of the Saint-Simon school of Socialism, was the son of a banker in Paris, where he was born 8th February 1796. He went to the École Polytechnique in 1812, but having joined the pupils who left school and fought against the allies on the heights of Montmartre and St Chaumont, he was expelled in 1814. Enfantin saw Saint-Simon only once, and apparently did not join the school till the death of the master in 1826. After the July revolution of 1830 Enfantin associated himself with Bazard for the active propagation of Saint-Simonism. Bazard expounded it in its relations to philosophy and politics; Enfantin mainly in its relations to the social state. Soon, however, a schism broke out between the two on the question of marriage and the relation of the sexes. Enfantin recognised two sorts of marriage, one permanent, to suit steady and constant temperaments, the other changing and temporary, to suit the lively and mobile. A theory so subversive of social order led to the intervention of the government. The 'Supreme Father' (as his disciples were wont profanely to call him) was, in 1832, sentenced to two years' imprisonment and to pay a fine of 100 francs. Being released at the expiration of a few months, Enfantin went to Egypt for a time. He was subsequently appointed a member of the Scientific Commission for Algiers, and on his return from Africa wrote a sensible, interesting book, entitled *Colonisation de l'Algérie* (Paris, 1843). After the revolution of 1848 he edited the journal entitled *Le Crédit Public*. He afterwards held an important situation on the Lyons and Mediterranean Railway. He died August 31, 1864. That Enfantin was endowed with very extraordinary powers of fascinating and managing men is shown by the influence he exercised over a numerous body of clever and enthusiastic disciples. His plans for the construction of the Suez Canal paved the way for the great project since realised by Lesseps. The principal works of Enfantin are his *Doctrine de Saint-Simon*, in conjunction with others (1830); his *Traité d' Économie Politique* (1831); *La Religion Saint-Simonienne* (1831). An edition of the collected works of Saint-Simon and Enfantin, begun in Paris (1865), has now reached a large number of volumes.

Enfeoffment. See FEOFFMENT.

Enfield, a village of Middlesex, 12 miles by rail N. of London, with a population (1891) of 31,532, is the seat of a government small-arms factory, which is capable of turning out 5000 rifles a week; the ordinary weekly output is, however, about 1800.

Engadine, a famous valley in the Swiss canton of the Grisons, and one of the loftiest inhabited regions in Europe, extends north-east for about 65 miles along the banks of the Inn and its lakes, from the foot of Mount Maloja to the village of Martinsbruck. It is divided into two portions—that toward the south-west, called the Upper Engadine, and that toward the north-east, the Lower Engadine. The latter is the more wild and bleak; but the Upper Engadine, although it is more open, and possesses fine meadow-lands, has also an inclement climate throughout, except in the extreme south-west. The Inn has many villages upon its banks, the highest of which, St Moritz, is 6090 feet above sea-level, while the lowest, Martinsbruck, is 3343 feet. Most of these villages have of late years become, as health and pleasure resorts, clusters of inns, and several English churches are among the conveniences prepared for the great numbers of visitors. The influx of so many strangers has altered many of the old habits of the people; but, though no longer the nearly invariable rule, it is still not uncommon for the young men to betake themselves to the large towns of the Continent, whence they return, with the little fortune gained as confectioners or waiters, to end their days in their cold, lovely valley. Pop. about 11,600, almost all of the Reformed or Calvinistic Church. The language most generally spoken is the Ladin (a corruption of Latin), a Romance tongue, but differing from the other Romance dialects of the Rhætian Alps, and bearing a resemblance to the Italian.

Engagement, THE, between Charles and the Presbyterians. See NEWPORT (Isle of Wight).

Engelhardt, JOHANN GEORG VEIT, theologian, was born in 1791 at Neustadt-an-der-Aisch, Bavaria, and in 1822 became professor of Theology at Erlangen. He died 13th September 1855. His writings include a *Handbuch der Kirchengeschichte* (4 vols. 1834), and *Dogmengeschichte* (2 vols. 1839); and he edited, with Winer, a *Kritisches Journal der Theologie* (1824–29).

Enghien, a favourite watering-place and summer-resort of the Parisians, lies 7 miles N. of Paris, on a small lake. It has five sulphur-springs, good for the skin and throat. Pop. 2426. —In the Belgian province of Hainault there is another town of the same name, a busy manufacturing place (beer, salt, lace, linen, and cloth), with 4187 inhabitants.

Enghien, LOUIS ANTOINE HENRI DE BOURBON, DUC D', only son of Prince Henri Louis Joseph, Duc de Bourbon, was born at Chantilly, 2d August 1772. In 1789 he quitted France, and travelled through several countries of Europe. In 1792 he entered the corps of *émigrés* assembled by his grandfather, the Prince of Condé, on the Rhine, and commanded the vanguard from 1796 until 1799. At the peace of Lunéville, in the year 1801, he went to reside at Ettenheim, an old château on the German side of the Rhine, not far from Strasburg, and within the territories of the Duke of Baden. When the Bourbon conspiracy, headed by Cadoudal, Pichegru, &c., against the life and authority of Bonaparte, was discovered at Paris, the latter chose to believe that the Duc d'Enghien was privy to it, and unscrupulously resolved to seize the person of the duke. On the night of the 14–15th March 1804 the neutral territory of Baden was violated, and the duke, with two attendants, was captured, and carried prisoner to Strasburg, and thence to Paris and Vincennes. On the early morning of 20th March he was tried before a military commission, consisting of eight officers, and after a five hours' examination was condemned to death. Half-an-hour later, between four and five, he was shot in the castle moat, and buried in the grave already dug for him. So cruel and audaciously criminal an act has fixed a deep stigma on the character of Bonaparte. M. Dupin published the records of the trial, and showed the illegality of the proceedings of the military commission. This illegality was publicly acknowledged by General Hullin, the president of the court. Thiers as far as possible exculpates Bonaparte, while Lanfrey adopts the most adverse verdict, and Welschinger lays much of the guilt on Talleyrand. Fouché said that it was worse than a crime—it was a blunder. After the Restoration, the bones of the judicially murdered duke were re-interred in the chapel of the castle of Vincennes. See *Le Duc d'Enghien*, by Henri Welschinger (Paris, 1888).

Engine. See AIR-ENGINE, GAS-ENGINE (Vol. V., page 106), STEAM-ENGINE, &c.

Engineering, the business of the engineer, is the art of designing and superintending the execution of works of a constructive character, such as roads, railways, bridges, canals, harbours, docks, works for supplying water to towns, drainage and sewerage works, as also the working of metals and the making of machinery.

The duties of the military engineer are defined in the next article. The civil engineering profession is subdivided into several sections. The railway engineer projects and superintends the execution of railways and all the works in connection with them, such as the alteration of roads and streams, the construction of viaducts, bridges, cuttings, and embankments. The hydraulic engineer plans and superintends the works connected with the supply of water to towns, irrigation, drainage, the protection of low lands from inundation, and the use of water as a motive-power. The dock and harbour engineer has the management of all works connected with the sea or navigable waters, such as the construction of piers, breakwaters, docks, harbours, and lighthouses.

The mechanical engineer is principally concerned in the manufacture of machinery, the working of metals, the construction of ships, steamers, cannon, and all the various structures in which the metals bear a prominent part. The marine engineer makes parts of ships, and the machinery in ships and boats; or he takes charge of an engine on board ship. Then there are mining engineers, who discover minerals and manage mines; sanitary engineers, who are specially engaged in the drainage of towns; and electric engineers and many other less prominent divisions of the profession. Any one who tends an engine is also called an engineer. In many engineering works the *contractor* takes a very important part; he executes the works from the designs, and under the direction and superintendence of the civil engineer, and on his ability and good management the success of undertakings very materially depends.

Among the most notable of the engineering works belonging to very remote antiquity are the pyramids of Egypt. The rude stone monuments of the north, as at Stonehenge and Carnac, also testify to some engineering skill. The harbours and temples of ancient Greece are very memorable. The buildings of ancient Rome—its theatres, temples, baths, and aqueducts, its roads, bridges, and drainage-works, vie in extent and magnificence with the most celebrated works of modern times. From that period down to the commencement of the 18th century the most extensive works executed were the canals, embankments, and other hydraulic constructions used by the Dutch for the purposes of inland navigation, and to protect their low lands from the sea; the canals of North Italy; and the cathedrals and fortifications of medieval Europe.

Civil engineering, as a distinct *profession*, may be said to have originated, in England, about the middle of the 18th century; since that time the improvements in the steam-engine by James Watt, its subsequent application to the railway-system by George Stephenson, and its use in navigation have given a great impulse to commerce and civilisation. Among celebrated engineers are the Stephensons, Rennies, the Brunels, Telford, Smeaton, Ericsson, Eads, Krupp, Fairbairn, Armstrong, Siemens, Bessemer, Fowler, and Baker.

The education of engineers should embrace a fair knowledge of pure mathematics, and of the mixed sciences of natural philosophy, such as mechanics, hydrostatics, hydraulics, and optics, as also of drawing and arithmetic. The principal society of engineers in Britain is the Institution of Civil Engineers, established in 1818, 'for facilitating the acquirement of professional knowledge, and for promoting mechanical philosophy.' There are now everywhere colleges and schools in which engineering is a special study.

The more important operations in engineering, and the most famous triumphs of the art, are treated of under such heads as AQUEDUCT, BREAKWATER, BRIDGE, CANAL, DOCK, HARBOUR, LIGHTHOUSE, MECHANICS, MINING, RAILWAYS, RESERVOIR, ROADS, STEAM-ENGINE, STRENGTH OF MATERIALS, and WATER-POWER (under Water). For machinery, see also the articles on Printing, Weaving, Spinning, Metallurgy, and the other arts and trades discussed in this work. And see such works as Cresy, *Encyclopædia of Engineering* (new ed. 1880); Spon's *Dictionary of Engineering* (1874); Smiles's *Lives of the Engineers* (1874); Macquorn Rankine, *Manual of Civil Engineering* (new ed. 1884); Wheeler, *Civil Engineering* (New York, 1877).

Engineers, THE CORPS OF ROYAL, formed in 1763, is an important branch of the British army. A similar organisation exists in all regular armies. The duties devolving upon military engineers include the design, construction, and maintenance of fortifications and submarine mining defences at all times, and, during war, the conduct of engineering operations at sieges, mining, bridging, surveying, ballooning, together with the making of roads, railways, and lines of field telegraph. The men, who are called sappers and miners, are therefore selected with a view to these various duties, and with a small percentage of exceptions must have learned some handicraft before enlistment. The service is for seven years with the active army and five in the reserve, or these periods may be three and nine respectively. In addition to ordinary pay they receive 'engineer' pay, varying from ½d. to 3d. per hour, or allotted on the piecework system. There are in round numbers 5000 non-commissioned officers and men in the corps, forming 51 companies; 1 field telegraph battalion, carrying 120 miles of wire and materials; 1 bridging battalion, in 2 troops, each carrying 120 yards of pontoon bridging material; and a field depôt quartered at Aldershot.

In India the Bengal sappers and miners consist of 1000 natives, forming 10 companies; those in Madras, 1050, or 10 companies; and those in Bombay, 400, or 5 companies. The officers and higher non-commissioned officers are British.

There are some 900 officers of all ranks in the Royal Engineers, those not doing duty with the men being employed on detached duty in all parts of the empire. Except those of the coast battalion of Submarine Miners and the quartermasters, who are promoted from the ranks, all pass through the Royal Military Academy at Woolwich or Royal Canadian Military College, and on joining the corps undergo a course of special training at the School of Military Engineering at Chatham, which is the headquarters of the corps. They, like the privates, receive 'engineer' pay besides their ordinary pay as officers, commencing with 2s. a day, and are often able, especially in India, to obtain appointments entitling them to large salaries, irrespective of their army rank. Promotion is by length of service, and not, as in other regiments, dependent upon the occurrence of a vacancy in the higher rank.

At the War Office a deputy adjutant-general manages the discipline, &c. of the corps, and the inspector-general of fortifications superintends all works, &c. The Ordnance Survey is carried out by the Royal Engineers, the office being at Southampton. The militia and volunteer engineers are affiliated to the corps of Royal Engineers. The militia engineers in 1888 consisted of 2 regiments of fortress engineers and 5 divisions of submarine miners; the volunteer engineers of 22 regiments of fortress and railway engineers, 1 of railway transport, and 9 divisions of submarine miners. See Major-general Whitworth Porter's *History of the Corps of Royal Engineers* (2 vols. 1889).

Engineers, in the Royal Navy, are the class of officers who attend and manage the machinery on board vessels of war. On the first introduction of steam into the service engineers were obtained from private engineering establishments, or from merchant-steamers, and their exact status was undefined and ambiguous. In 1847 and 1848 their position became more recognised, and the higher grades were raised from the rank of *warrant* officers to that of *commissioned* officers of a civil branch. This introduced a higher class of men into the navy. At the present day the use of steam for every purpose has so enormously increased in warships that the engineers' position has become one of the first importance, and high emoluments, with enhanced rank, have induced some of the ablest men to serve afloat. There are now the grades of chief-inspector of machinery, inspector of machinery, fleet-engineer, staff-engineer, chief-engineer, engineer, and assistant-engineer, ranking with colonel, lieutenant-colonel, major, captain, and lieutenant in the army respectively, and with salaries varying from £638, 15s. to £109, 10s. Some ten officers are borne on the Navy List for temporary service. All these are commissioned officers, and are strictly examined before admission; their rank and promotion being by selection, and dependent on skill, character, and length of service. A chief-engineer is expected to be able to make notes in the log of every particular concerning the engines and boilers; to draw rough sketches of the machinery, with figured dimensions fit to work from; to understand and manage everything relating to engines, boilers, and furnaces; to understand practical mechanism generally, and the principles of theoretical mechanism. The engineer and assistant-engineer are expected to possess, in a smaller degree, the same kinds of knowledge and skill. By an Order in Council of June 29, 1888, the rank of engineer student was established, vacancies to which are principally filled by open competition. Candidates must not be less than fourteen, nor more than sixteen years of age on the 1st day of May in the year in which they are examined. Applications for forms to be filled up by persons who wish to compete must be sent to the Secretary, Civil Service Commission, London, S.W., on or after the 1st of January in each year, and care must be taken that such filled-up forms are returned before the 15th March following. The Educational Examination is held annually, in April, at London, Liverpool, Portsmouth, Devonport, Bristol, Leeds, Newcastle-on-Tyne, Edinburgh, Glasgow, Aberdeen, Dublin, Belfast, and Cork, the subjects being arithmetic, handwriting, accuracy and intelligence in writing from dictation, composition, grammar, French, German or Italian, geography, algebra, including quadratic equations, Euclid, and mechanical drawing. A fee of one shilling is required from every candidate, and successful candidates will be entered as engineer students at H.M.'s dockyard at Devonport. The parent or guardian of each engineer student is required to make six annual payments during the six years of the student's training—viz. £30 each year for the first two years, £20 for the third year, £15 for the fourth year, and £5 each year for the fifth and sixth years; also to provide uniform, clothing, &c. Board and lodging and medical attendance will be provided by the Admiralty. The weekly pay of students ranges from one to ten shillings, and they are examined as to proficiency once a year.

The Navy Estimates for 1888–89 provided for 631 engineer officers of all grades, at a cost of £144,000. The changes in this branch of the service are more frequent than in any other, and are all for the better, proving the estimation in which the engineers are held and the importance of the position they occupy.

England is the southern, the larger, and by far the more populous portion of Great Britain, the largest and most important of European islands. Separated from Belgium, Holland, Germany, and Denmark by the North Sea, from France by another 'streak of silver sea,' the Channel, and from Ireland by St George's Channel and the Irish Sea, the kingdom of England and Wales has only one short land frontier, that towards Scotland. In shape it forms an irregular triangle, of which the eastern side measures in a straight line 350 miles, the

southern 325 miles, the western 425; but its shores are so deeply indented by bays and estuaries as to make the coast-line longer in proportion to the size of the land than in any other country but Scotland and Greece.

England has for hundreds of years been one of the leading powers of Europe, one of the great moving forces of the world, and, through her colonies, a veritable mother of nations; but her area is relatively very small. The area of the British Islands (121,700 sq. m.) is but $\frac{1}{1000}$th of the surface of the world. The colonies and dependencies of the empire of which England is the centre cover a seventh of the land-area of the globe. England without Wales (51,000 sq. m.) is about the size of Roumania, less than a fourth of France or of Germany, and is but little larger than the single state of New York (49,170 sq. m.); and England with Wales (58,000) is not equal in area to the state of Georgia (59,475), and is not a fourth of the size of Texas. Twenty-nine of the states in the Union are each larger than England, several much larger than the whole United Kingdom.

Her name 'this noble realm of England' owes to the *Engle* or Angles, who with the kindred Jutes (*Geátas*) and Saxons (*Seaxe*) descended on the greater part of what used to be known as Albion or Britain (see BRITANNIA), conquered and occupied it in the 5th and following centuries (see ANGLES, ANGLO-SAXONS). These kindred peoples all learned to call themselves *Englisc* or English, and by *Englaland* they understood the whole area now occupied by them—an area which in the 7th century extended over more than the half of the island from the Forth to the English Channel. South-eastern Scotland, as occupied by Angles, and not by Saxons or Jutes, was in the stricter sense English; and the people of the non-Celtic parts of Scotland, though now markedly differing from the southern English, are in blood and in mental and physical type at least as English in the wider sense as the people of Oxford or Kent. Political circumstances led the English and Anglicised Celts of North Britain beyond Solway and Tweed to become the subjects of the alien Scottish king, but their language they still called *Inglis*, as distinguished from the Erse of their Scottish or Gaelic fellow-countrymen.

The people of the southern kingdom constitute nearly three-fourths of the inhabitants of the three kingdoms; the English language in some form is that of all but a small minority in any of the three; the English literature is the common inheritance of the whole; the constitution and polity of England, slightly modified, is the British constitution under which the three kingdoms have unitedly become glorious, and has been the original model for the free constitutions of all free peoples the whole world over. Hence it is not strange that not merely by Englishmen, but by all foreigners, the name of England is used for what, after the union of Scotland and England in 1603, became officially Great Britain, and even for the whole empire, which, since the Irish Union of 1801, is strictly the United Kingdom of Great Britain and Ireland.

The physical features, as also the geology, of the British Islands are obviously so closely connected that it is convenient to treat of them collectively under the head of GREAT BRITAIN AND IRELAND. There also the general facts and figures fall to be given which concern the three kingdoms jointly—exports, imports, trade, shipping, &c., except in so far as they are separately discussed under such heads as AGRICULTURE, ARMY, COLONY, COUNTY, EDUCATION, EMIGRATION, NAVY, PARLIAMENT, RAILWAYS, &c. Here, on the other hand, some of the facts distinctive of England, which admit of being succinctly stated, may well be noted.

The area of England without Wales is 50,823 sq. m.; that of Wales, 7363; together, 58,186. So that, as the area of the United Kingdom, with Scotland, Ireland, Man and the Channel Islands, is 120,382, England alone covers 42 per cent. of the whole, Wales 6, and England and Wales 48 per cent. The population of England and Wales in 1650 is estimated to have been 5,450,000, the increase up to that date having been slow. In 1750 it was probably 6,400,000. From that date the increase was rapid; and the census of 1801 showed a population of 8,892,536. In 1841 the population of England alone was 15,002,443; in 1851 it was 16,921,888; in 1861, 18,954,444; in 1871, 21,495,331. That of Wales was at the corresponding dates 911,705; 1,005,721; 1,111,780; 1,217,135. At the census of 1881, England had 24,613,926, and Wales 1,360,513, or together 25,974,439. So that in that year the population of England alone was 69·8 per cent. of the total population of the United Kingdom (35,241,482); of Wales, 3·8; and of the two, 73·6. In 1891 the total population was returned at 29,001,018, and the percentage of England and Wales may be set down in round numbers as making up more than 76 per cent., or three-fourths of the total population of the United Kingdom. The density of the population in England is greater than in any other European country except Belgium. In 1891 it was for England alone 540 per sq. m.; for England and Wales, 497; whereas for Scotland it was only 135. In England and Wales there were, in 1881, 20 towns with more than 100,000 inhabitants (in 1891, 24 such towns), in Scotland only 0, in Ireland 3. In England there were 45 above 50,000, in Scotland 6, in Ireland 3.

The following table shows the area in acres and population of the forty counties of England, at the census of 1891:

Counties.	Area in statute acres.	Population.
Bedford	294,963	160,729
Berks	462,210	238,446
Buckingham	477,151	185,190
Cambridge	524,935	188,362
Chester	657,122	730,052
Cornwall	868,665	322,580
Cumberland	970,161	266,550
Derby	658,624	527,886
Devon	1,655,208	631,767
Dorset	627,265	194,487
Durham	647,592	1,016,449
Essex	987,032	785,599
Gloucester	783,699	599,074
Hampshire	1,037,764	690,086
Hereford	532,918	115,986
Hertford	405,141	220,125
Huntingdon	229,515	57,772
Kent	996,892	1,142,281
Lancashire	1,208,154	3,926,796
Leicester	511,907	373,993
Lincoln	1,767,879	472,778
Middlesex	181,317	3,251,708
Monmouth	370,350	252,260
Norfolk	1,356,173	456,474
Northampton	629,912	302,184
Northumberland	1,290,312	506,096
Nottingham	527,752	445,599
Oxford	483,621	185,988
Rutland	94,889	20,659
Shropshire	844,565	236,324
Somerset	1,049,812	484,326
Stafford	748,432	1,083,278
Suffolk	944,060	369,351
Surrey	485,129	1,730,871
Sussex	933,269	550,442
Warwick	566,271	805,070
Westmorland	500,906	66,098
Wiltshire	866,677	264,969
Worcester	472,453	413,755
York	3,882,851	3,208,813
Total of England	32,527,070	27,482,104
Total of the twelve Welsh Counties	4,712,281	1,518,914
Total of England and Wales	37,239,351	29,001,018

For the Welsh counties, see WALES. The areas of the English counties are given in square miles in the articles on the counties.

The climate of Britain is insular and comparatively equable, milder on the whole than that of any region on the same northern parallel (see CLIMATE), with smaller extremes of heat and cold, with colder summers and warmer winters. England is milder than Scotland, and though moist compared with continental countries, less moist than Ireland. In spite of its dull skies and frequent rains, it was wisely said by Charles II. that the English climate 'invited men abroad more days in the year and more hours in the day than any other country.'

The situation of Britain has been shown to be in the very centre of the land-masses of the globe, a very great advantage for commerce and navigation; England, being nearer the European shores, enjoys the advantage in higher measure than its sister-kingdoms. Its seas are less stormy, and it has a greatly more developed system of navigable rivers.

The north-west of England is mountainous and hilly, the east and south mainly a plain crossed by lines of low hills. The fertility of England is much greater than that of Scotland or Ireland, especially that of the wheat-bearing area of eastern England. The agriculturally productive area of England is estimated at 80 per cent. of its total, and of Wales 60 per cent., whereas that of Scotland is only 28·8 per cent., and of Ireland 74. England, whose surface has been said for variety to be an epitome of Europe, is very rich in minerals, of which coal and iron are incomparably the most important, making nine-tenths in value of the whole. The output of coal and iron in England is vastly greater than in Scotland, and Ireland is exceptionally poor in both.

Of the population of England it is impossible to say what proportions belong to the various racial elements that have gone to form it. A non-Aryan race, perhaps Euskarian, must have preceded the Celts, who conquered and assimilated them: the Celts (q.v.) are still the predominant race in Wales. The Roman armies introduced into the towns a considerable element, comprising doubtless Gauls, Germans, Iberians, Italians, Dacians, Phrygians, and the other various races who went to constitute the legions of the empire. Danes and Norman-French were the latest people who came in large numbers. But the great problem is: Did the Teutonic Angles, Saxons, and Jutes exterminate their predecessors the Celtic Britons, or did they over great part of the country mainly assimilate them? (See the history below.)

What is certain is that out of these various stocks a well-marked race has been formed, strenuous, self-reliant, resolute in defence of its rights, daring, laborious, industrious, and ambitious. Its essential character, with marked modifications, it has transmitted to the great daughter-nation of the United States, and to the colonies of Britain. And this race it is which has given its language and in part its institutions to over 100 millions of the world's inhabitants, and with the help of its Scottish and Irish kinsfolk, has created for its and their offspring a glorious heritage in the English literature. England became the classic land of liberty, where the power of the state, based on ancient precedent, has been developed so as least to infringe on the freedom of the individual—a development sketched in the succeeding history, and continued on similar lines in the United States.

England became also the special home and headquarters of agricultural enterprise, mineral production, machine-making of all kinds and steam-power, of commerce, navigation, and shipping. England did not start in the race of commerce as early as many of those who are still her rivals. Long after France, Flanders, and parts of Germany were great manufacturing centres, England was an agricultural and pastoral country, wool its chief production and staple export. The woollen goods for its own use were mostly manufactured abroad. Edward I. did much to encourage such trade as there was in opening English ports to foreign merchants, and Edward III. induced many weavers, dyers, and fullers from Flanders to settle in England. In the 14th century woollen cloth was manufactured at Bristol, London, and Norwich, and began to be exported. Linen and silk weaving became of some importance. Coal was exported from Newcastle to France in 1325; but it was later ere English cutlery was known abroad. Great progress took place in Elizabeth's reign; under James I. Scotland began to have a share in the commerce of the world; and the reign of William III. marked a new era, for the immigration of French refugees after the revocation of the Edict of Nantes in 1685 soon told on the quality and amount of English manufactures. But the great and rapid advance which made the commerce and manufactures of England the wonder of the world dates from the latter half of the 18th century, and is largely owing to the unparalleled development of machinery, the use of steam as a motive power, improved communication, and later, steam-navigation and railways.

It is very observable that the local distribution of the great industries of England has changed very greatly since the 17th century. At the Revolution period, most of the greater towns of England were in the south and east; but these have now been long outstripped by northern rivals, and what were then important manufacturing towns have in many cases sunk into mere villages. After London, the chief towns were Bristol and Norwich, each with some 29,000 inhabitants. Exeter with 10,000 was probably equalled by York. Worcester and Nottingham may be set down at 8000; while Leeds had but 7000, Manchester hardly 6000, Birmingham, Sheffield, and Liverpool perhaps less than 4000. Now English manufacturing industries have most of their special seats in the north. If we draw a line from the mouth of the Severn to the Wash, we find that to the south-east there are hardly ten towns, not seaports or suburbs of London, which have a population exceeding 25,000; to the north-west of the line there are above fifty inland towns of that size. It is very significant that all the coal of England is found north of the line named, about or near the populous money-making towns.

The general figures that measure the vast commerce of the United Kingdom will be found for comparison with those of other countries at the article GREAT BRITAIN. In many cases it is not possible to separate the shares proper to England, Scotland, and Ireland; but the greater wealth of England may be shown by a few miscellaneous figures as to textile industry, the collecting of customs, and the assessments for income-tax.

There were in the United Kingdom at the time of the Report of the Inspectors of Factories in 1885 in all 2635 cotton-factories; of these England and Wales had 2481, Scotland 147, Ireland 7. Of woollen-factories there were in all 1918; of these 1503 were in England and Wales, 274 in Scotland, 141 in Ireland. In worsted-factories the disproportion was still greater. There were 7465 textile factories in all, of which 6359 were in England, 776 in Scotland, and 330 in Ireland. The customs collected at London in 1888 were £9,976,405; at Liverpool, £2,582,170; at other English ports, £2,046,026; whereas the total collected in Scotland in that year was £1,426,284, and in Ireland £1,824,679. Though this indicates with approximate accuracy the move-

ment of shipping, it is true that a share of the vessels in English ports belongs to Scottish owners, and Scotland builds in some years almost as large a tonnage as England does. The total amount of the annual value of property and profits assessed to income-tax in 1887 in the United Kingdom was £629,397,962; the share of England being £535,040,455; of Scotland, £57,910,114; and of Ireland, £36,447,393. Other figures of a similar kind will be seen under SAVINGS-BANKS.

In no way can a better conception be formed of the state of England at different periods than from the works of topographers, foreign visitors, &c., such as Leland and Camden for the 16th century; Drayton and Fuller for the 17th; Defoe, Pennant, Pococke, Moritz, and Young for the 18th; Cobbett, Emerson, Hawthorne, Esquiros, Taine, Kohl, and Burroughs for the 19th. See also Escott, *England: her People, Policy, and Pursuits* (1879; 2d ed. 1886); R. Grant White, *England Without and Within* (1881); Thorold Rogers, *History of Agriculture and Prices in England* (6 vols. 1866–68); T. H. Ward, *The Reign of Queen Victoria: a Survey of Fifty Years of Progress* (2 vols. 1887); A. Innes Shand, *Half a Century of Changes* (1887); W. Besant, *Fifty Years Ago* (1888); besides the government bluebooks and other statistical annuals.

HISTORY OF ENGLAND.

Though the history of England cannot properly be said to begin till the 5th century, when the Teutonic tribes who have given the country its name established themselves in the island, it is of some importance to understand the condition of the people whom they supplanted. There can be little doubt that, speaking generally, the inhabitants of the island when conquered by the Romans were of Celtic origin. They were not indeed entirely homogeneous; two distinct branches of the Celtic language were spoken, the Gauls of France are mentioned by Cæsar as having exercised authority over the island, the Belgæ had certainly established themselves there, and certain tribe-names lead to the belief that men of Teutonic origin had already formed settlements. The island lying at the extremity of Europe had probably formed a natural refuge for tribes driven from their own lands, and a natural prey of those in search of new homes. But on the whole there can be little question that the population was Celtic. It had passed beyond the age of barbarism, and when Claudius determined to complete the conquest which Cæsar's temporary raid in 55 B.C. had foreshadowed, some sort of general confederacy was in existence, a king of the name of Cunobelin reigned at Camulodunum, near Colchester, and the existence of not less than forty varieties of his coins bear witness to the greatness of his influence and the comparative civilisation of his rule. His son, Caractacus, and, eleven years later, Boadicea, queen of the Iceni, opposed a long and terrible resistance to the Roman arms; but the arrival of Agricola in 78, and his eight years of wise government, brought the country at length into the condition of a Roman province. The conquest of the whole island was, however, never completed. It seemed good to the Romans to limit their successes, and to attempt by great defensive works to exclude from their dominions the still unconquered Celts of the north. Lines were erected between the Firths of Forth and Clyde, and between Bowness and the mouth of the Tyne. The intermediate district was a scene of constant warfare, both lines were from time to time strengthened, and the more southern of the two changed during the 4th century into the great Roman Wall (see article SEVERUS). Within this limit the occupation of the country was complete. For two centuries it was probably merely a military occupation, and at no time does it appear that there were more than 20,000 Roman soldiers in the province; but as time passed on it appears certain that the influence of the conquerors became largely felt. Towns, the remains of which still exist, were built, bringing with them of necessity the close intercourse of trade, and numerous traces of villas in many parts of the country show the spread of peaceful Roman life. It was the policy of Rome in its provinces to debar the middle classes from the use of arms, and though possibly, as in India at present, the native nobles and princes were allowed to keep in some degree their rank, it was under the shelter of the Roman legionaries that civilisation advanced, and upon their prowess that safety from the threatened encroachments of unconquered Celts or marauding Teutons was secured. It is impossible to say how far civilisation had extended, or how far the language had been influenced by the Roman occupation. The close resemblance of many common agricultural terms, of the names of plants, and so on, to Latin words would lead to the belief that the language was Latinised. On the other hand, local names, the names of woods, mountains, and rivers, are largely Celtic. It seems not improbable that both high civilisation and Roman speech were chiefly concentrated along the great roads, and round the cities and stations with which these were lined.

The disturbances of the empire, and the danger which threatened it from the pressure of the outlying barbarians, compelled in 411 the withdrawal of the legions; and the half-Romanised inhabitants who had learned to rest on the support and valour of their conquerors were left to their own resources to withstand the unconquered Celts of the north, now known as Picts, and their piratical allies the Irish Scots. The movement of the barbarians had affected the people on the borders of the North Sea; the Jutes from Jutland, the Angles from Sleswick, the Saxons from Holstein and the neighbouring coasts were covering the sea with their expeditions. Summoned to the assistance of the civilised Britons, a party of Jutes found means to establish themselves in Kent. It was an example readily followed. Before the year 600 Saxons and Angles had formed settlements extending as far northward as the Forth. About that year the various princedoms may be regarded as merged in two considerable and rival powers, Northumbria and Kent; while a third, Wessex, fated ultimately to devour the other two, lay along the south, at present interested in extending its power westward. It still remains a question whether the invaders destroyed the conquered inhabitants or not. On the strength of certain expressions in the chronicler Gildas it has been held that no quarter was shown; but it is more probable that, as in other cases of conquest, the invaders settled down in the midst of the conquered population, content to rule as manorial lords over their own free followers and the slaves and dependents of their predecessors.

It was long before the various settlements of the Saxons were fused into one. Long before political union was reached, the unity of the people found expression in a single Christian church. While the powers of Northumbria and Kent were still balanced, the marriage of the king of Kent with a Frankish princess offered an opportunity for the evangelisation of the country. Augustine and his fellow-missionaries landed in Thanet in 596, and, well received by the king, found a home in Canterbury. A similar circumstance brought Christianity to the north; a Kentish princess married to Edwin of Northumbria took with her Paulinus, and established Christianity in York. The change of religion went near to destroying the Northumbrian power. Heathenism found a champion, and Penda, uniting the central tribes into the kingdom of

Mercia, for a while established his supremacy over Northumbria, and drove the Roman priesthood to flight. The gap thus left was supplied by the devoted missionaries of the Celtic Church settled in Lindisfarne. But the restoration of the Northumbrian power was fatal alike to heathenism and to the Celtic Church. After the Council of Whitby in 664, the Roman Church regained predominance, and was organised in a single archiepiscopal see by Theodore of Tarsus, holding his appointment from Rome. After the fall of Penda, the supremacy of the northern kingdom was unquestioned, till some sixty years later it gave way to Mercia. About the year 800, however, both Mercia and Northumbria had to yield to the third power. Egbert, king of Wessex, who had seen something of centralisation in the court of Charlemagne, during the thirty-six years of his reign gradually brought under his power all the English kingdoms, whether Anglian or Saxon, and continuing the hereditary struggle of his people with the British populations, established a permanent superiority over all England, with the exception of the Britons north of the Dee.

But already an enemy had made its appearance to which the newly centralised kingdom was to yield. The Danes, issuing from the Scandinavian coasts, had before the death of Egbert begun to harry the country. At first as robbers, then as settlers, and finally as conquerors, for two centuries they occupy English history. During the reign of Ethelred their incessant but isolated incursions assumed the form of an invasion, East Anglia passed into their hands, and their leader, Guthrum, took to himself the title of king. For seven years Alfred on the throne of Wessex carried on a deadly struggle with this rival power, and at length concluded a treaty of partition at the Peace of Wedmore (878), surrendering to the Danes the north and east of England to be held by them as vassals of the Saxon king. The supremacy of Wessex was thus secured, and ripened in the following reigns into something little short of an imperial authority. Edward the Elder was not only recognised as the overlord of Mercia and Northumbria, but the Welsh kings swore alliance, and the kings of Scotland and Strathclyde acknowledged him as their father and lord; he treated on equal terms and contracted marriage alliances with the greatest princes of Europe. His position was fully vindicated by his son Athelstan, under whom, perhaps, the West Saxon monarchy reached its highest point of greatness. The decisive battle of Brunanburh, in 937, won over a complicated confederation, dealt a death-blow to all opponents. The reign of Edgar the Peaceful, and the government of his great minister Dunstan, closed the period of Saxon greatness. From this time onwards weak kings, factious nobles, and a broken organisation were unable to resist the renewed incursions of the Scandinavian tribes. The jealousies between the various sections of the people, restrained by the strong central authority of the late kings, broke out afresh. The northern kingdoms where Danish law prevailed afforded a natural support for the invaders. The alliance of King Ethelred with the Normans, and his marriage with Emma, a Norman princess, only added a fresh element of weakness by the presence of her foreign followers. Recourse was had in vain to large payments to the Danes, and to the cruel and treacherous murder, on St Brice's Day, 1002, of the Danes settled in Wessex. Ten years later all opposition had been overcome, and Sweyn, the leader of the invaders, was practically king of England. He was succeeded by his son Canute, and though a brief outburst of vigour under Edmund Ironside enabled the English to secure a division of the country, the death of their leader compelled them to submit to Canute. Under its Danish king England was ably ruled, and was in some respects the head of a Scandinavian empire. But Canute's two sons failed to continue their father's work. Opportunity was allowed for the rise of Godwine, Earl of Wessex, and on the death of Hardicanute in 1042, Edward the Confessor, the son of Ethelred, resting on the support of the great earl, re-established the house of Cerdic on the throne. Educated in Normandy, he surrounded himself with foreign friends, and filled the high places of the kingdom with Frenchmen. As leader and representative of the national feeling, Godwine succeeded after a while in driving the foreigners from the country, and establishing himself in a predominant position over the south of England. In the north the influence of the earls of Mercia prevented his absolute supremacy. He handed on both his power and his rivalry with the northern earls to his son Harold. Successful against his rivals, Harold placed most of the earldoms in the hands of his brothers. So completely was he recognised as the first of Englishmen, that upon the death of the king the Witan had no hesitation in electing him to the throne.

In thus choosing a king from beyond the limits of the royal family the Witan had transgressed a well-established English custom. A formidable rival claimant at once appeared. William, Duke of Normandy, a cousin of the late king, demanded the throne as next of kin, and pleaded the promise of the Confessor. A second enemy threatened Harold: his brother Tostig had proved a traitor and had been banished; he now returned in company with the Norwegian fleet. The northern earls opposed him, and Harold, hastening to their assistance, won the battle of Stamford Bridge over the invaders. But the decentralised character of the English constitution and the strength of family rivalry made lengthened union impossible. When, three days after, on the 28th of September 1066, the Norman duke landed at Pevensey, it was single-handed and with hastily collected forces that Harold met him. The great battle of Senlac, near Hastings, was decisive, Harold and his brothers were slain, and England was left without a king. Again the jealousy between Wessex and Mercia prevented either a combined national opposition or the election to the throne of a native prince. William had little difficulty in slipping into the vacant post and securing his election by the Witan. The series of local efforts at opposition which followed his election proved unsuccessful, and by 1070 his authority was recognised throughout the country.

The change of dynasty thus effected connected England with the great movements of the Continent. Up to this time it had been somewhat isolated. Though its church was in communion with Rome, and had frequent intercourse with it, it was distinctly a national church; though feudalism was rapidly advancing, it had pursued an independent and national course of development. It was in some degree as the champion of the great system of Western Christianity that William had put forward his claims, and he brought with him followers imbued with all the principles and forms of continental feudalism. All the varieties of class and of land tenure which had arisen spontaneously in England were now assimilated to those existing where complete feudalism was in force; the connection with Rome was ratified by an entire change in the episcopacy. But William had no idea of assuming the position of a chief among equals, or of subordinating his authority to that of the church. He found in the organisation of the conquered kingdom principles which enabled him, while using feudal language, to be in fact an

absolute king, and to set such limits to the power of Rome as to keep the church virtually in subordination. The Norman kings, when not engrossed in foreign enterprises, were occupied in establishing, in opposition to the nobility and the church, that powerful monarchy which the Conqueror had established. They found in the old institution of the national militia an instrument with which to oppose the feudal levies of the barons. An administrative system centred in the crown, and working chiefly through the machinery of the exchequer, went far to centralise the government. Triumphant suppression of insurrections enabled them to get rid of the feudal baronage of the Conquest, while a new nobility of administrative origin and attached to the national system gradually took its place. But the death of Henry I. leaving only a daughter, Matilda, gave room for a disputed succession. All the discordant elements which the royal power had held in repression burst into life. The reign of Stephen was a time of constant civil war, during which the nation learned from the intolerable tyranny under which it groaned the value of the repressing hand of royalty. The miserable time was brought to a close chiefly by the mediation of the church. Matilda's son Henry, already a powerful prince in France, was accepted as the heir to the throne, and practically intrusted with the restoration of order. It was with the general concurrence of the nation that he was able to re-establish upon a broader and better basis the powerful monarchy of his predecessors. A series of great administrative reforms brought justice and finance into the hands of the king and his intimate council or Curia Regis, and went far to break through the quasi-independence of the land-owners. The suppression of a great insurrection affecting all his possessions, and supported by the kings of France and Scotland, left him unquestioned master of his kingdom so far as the baronage was concerned. His attempts to reduce the church to subordination were less successful; the opposition of Becket to the enactments of the Council of Clarendon produced a disastrous struggle with Rome. But though technically worsted, Henry's power suffered no serious diminution from his defeat. He handed on to his son a powerful and well-organised monarchy, in which the feeling of national unity had made great advances. His system proved strong enough to support the continued absence of Richard in the Crusades and in his French dominions; national life even acquired increased strength by the self-government which was thus forced on the administration.

In the hands of Richard's successor the evil effects of the enormous power concentrated in the crown became obvious. Boastful, tyrannical, and weak, John excited the anger of all classes. The disgrace he brought upon England, the shock thus given to the rising feeling of national pride, afforded an opportunity for the exhibition of the discontent he had roused. He allowed himself to be stripped of all his French possessions; he plunged into a struggle with the Papal See, was excommunicated and deposed, and formally surrendered his crown into the hands of the pope. The nobility, freed from connection with the Continent and supported by all parties smarting alike from the evils of misgovernment and the shame of disaster, appeared as the true leaders of the nation, and wrung from the humbled king that great charter which secured, in the form of a solemn treaty, the foundations of the future liberties of England. To make the charter a reality, and to secure the orderly development of these liberties, was the work of the great king Edward I. John's compact with the people proved insufficient to restrain the personal and capricious exercise of the royal power in the hands of his son, Henry III. The surrender of the crown proved more of a reality than was expected; the Papal See, unable to establish a temporal suzerainty, mercilessly fleeced the people and the church, and the country was filled as of old with foreigners, on whom wealth and high places were lavished. The finances fell into utter decay. At length a demand for money to support, in the interest of Rome, the claims of the king's son to the throne of Sicily brought matters to a crisis, and in 1258 the barons passed the Provisions of Oxford, drove Henry's foreign friends from the kingdom, and virtually superseded the crown by a committee of government. Henry's attempts to break from the restrictions laid on him produced an armed insurrection, and Simon de Montfort, at the head of the barons and the commonalty of the towns, defeating the royal forces at Lewes, established a revolutionary government of which he was practically the master. But the jealousy with which the nobility regarded the rise of Montfort allowed Edward the Prince of Wales to come forward as the leader of a party at once conservative and reforming. His accession to the throne gave him an opportunity of carrying out his views. In the parliament of 1295, a complete assembly of all estates, he gathered into a national centre all the scattered elements of representation and self-government which had long existed in the county courts. The principle that where all were concerned all should have a voice was acknowledged, and the national liberties were placed in the charge of an assembly in which all orders were included. At the same time the position of the crown was maintained and rendered effective by the large powers still left in the hands of the king's council. For many years the struggle between parliament and prerogative remained undecided; but armed with the power of taxation, and taking advantage of the wants or weaknesses of the sovereign, the parliament continued to make good its position as the national council. At the close of Edward III.'s reign it was able to attack and impeach the ministry. The success of Richard II. in ridding himself of the influence of his uncles by which his youth had been surrounded, and his vehement assertion of the powers of the crown, produced a revolution which closed the struggle, and Henry IV. came to the throne with a parliamentary title, while the council nominated in parliament became in fact a body of national ministers.

The rise of parliament had gone hand in hand with the assertion of national life. Edward I. had not only marked out the lines the constitution was to follow, he had rid England of foreign influences. Busying himself but little with the Continent, he had devoted his attention to the conquest of Wales and Scotland. His death before the completion of his conquest of the northern kingdom allowed the Scots to inflict a final defeat upon his weaker son at Bannockburn. But the national feeling of the English, in abeyance during the political disturbances of Edward II.'s reign, reasserted itself in the ambitious efforts of Edward III. to place himself upon the throne of France, and was strengthened by the brilliant victories which attended them. Though the victories were useless, and the war a series of raids rather than a well-considered conquest, the effects at home were of great importance. The continual want of money forced the crown to frequent concessions to the parliament; the spirit of the people was raised by success; and the life of the soldier played an important part in liberating the lower orders from serfdom. The villeinage of earlier times had been gradually declining, and rent and

wages were taking the place of villein tenure and forced service. The terrible ravages of the Black Death upset for a while the economic arrangements of the country, and the attempt to drive back the liberated serf to his old position caused the great rising of Wat Tyler in 1381. The insurrection was suppressed, but a death-blow was practically dealt to serfdom. In close connection with this upheaval of the working-classes was the movement in opposition to the church. The doctrines of Wyclif and the Lollards, so much in harmony with the democratic movement, could not fail largely to influence it, and for a while hostility to the church played a considerable part in parliamentary history.

The completion of the constitutional system marked by the accession of Henry IV. did not prevent the recurrence of disorder, but during the reign of his son full harmony existed between the king and people. The disturbances which had broken out in France afforded an opportunity for renewing the war, and Henry V. found no difficulty in carrying the people with him in his victorious attacks upon that country. A statesman as well as a conqueror, his progress was very different from that of Edward III. The Treaty of Troyes seemed to promise the ultimate union of the two kingdoms, but the work of consolidation was scarcely begun when the great king died, intimating to those who should carry on the work that the occupation of Normandy should be the limit of their aims. The foreign success and domestic harmony was of short duration. Though the power of the nobles as feudalists had disappeared, they were still too strong to accept easily the co-operation of the other orders in a national system except from the hands of a powerful ruler. Their strength had been increased by the great position given to the royal princes. The parliamentary establishment of the younger branch upon the throne had opened the door to the rival claims of hereditary succession. A strong government was scarcely possible during the infancy of Henry VI., especially as the council of regency found in the Duke of Gloucester, a man of ill-regulated ambition, an opponent with whom it was difficult to deal. His greater brother, the Duke of Bedford, devoted himself chiefly to the affairs of France, and though he had succeeded in maintaining some degree of order in England, his early death was the signal for an outbreak with which the council and subsequently the young king proved unable to cope. Continual disaster in France still further discredited the government. Taking advantage of the claim of hereditary right, the Duke of York came forward as the champion of order. The nobility ranged themselves on one side or the other of the contending parties, and the country became the seat of a cruel dynastic war. The Yorkists were victorious in the struggle. The death of their old and moderate leader placed at their head his son Edward, a man of great ability imbued with the morality and principles of an Italian despot, and as the long regency had inevitably replaced in the hands of the council much of its independent power, Edward IV. found little difficulty in employing it for his own purposes. Parliament ceased to have much importance except to register the sovereign's will or to grant submissively the taxes he required. In the earlier struggles for national liberty the king had found his chief opponent in the baronage, and subsequently as leaders of the nation the nobles had exercised a great restraining influence. But in the internecine struggle of the Wars of the Roses they had committed political suicide, and Edward IV., surrounded by a nobility of his own creation, and armed with the powers of prerogative, which had never been formally abrogated, found himself able to establish a practical absolutism. The family dispute had not, however, reached its last act; Edward's successor, Richard III., rendered himself odious to all classes of the people, and the battle of Bosworth placed upon the throne a prince who claimed to be a representative of the Lancastrian House, and whose position was so far less absolute than his predecessors that he acknowledged that he was king by the will of the people.

The accession of Henry VII. and the Tudor House opens the second act of the drama of English history. The great principles of the middle ages had passed away; it was the age of the rebirth of learning; printing had been invented; firearms were superseding the lance and bow; the discovery of the western world was soon to excite the spirit of nautical enterprise; capital was taking the place of the restricted guild system; the inclosure of commons was changing the face of the country, depopulating the fields and filling the cities; the church had begun to be shaken from its foundations. In the midst of this changed society the new dynasty had ascended the throne, claiming to rest upon the popular will, but invested with all the absolute authority with which the late reigns had surrounded the crown. It is not perhaps going too far to say that the king was endowed with a temporary dictatorship. The typical representative of this phase of government is Henry VIII., a man in whom gross passion and unscrupulous determination to gratify his own will were curiously blended with a certain amount of culture and a real desire for the well-being of his people. Charged as it were with the duty of re-establishing an orderly national life upon a strong monarchical basis, he plunged into war as a ready means of asserting national power. France and Spain were already on the threshold of their great struggle for the supremacy of Europe, and it was in strict accordance with the tradition of English policy that Henry allied himself with the Spanish house. But a change was speedily to pass over the foreign relations of England. Instigated by his passion for Anne Boleyn, Henry demanded a divorce from his Spanish wife; the opposition of the papacy precipitated the Reformation in England, and transferred the national hostility from France to Spain. The difficulties he encountered in his pursuit of the divorce brought him face to face with the one weak point in his position as absolute monarch. The possibility of the assertion of paramount authority by a foreign prince had been studiously hidden from him by his ecclesiastical minister Cardinal Wolsey, who, himself master of the church, had thought to avoid all contest of authorities by devoting his power to the service of the crown. Such a possibility was now suddenly revealed to him. The fall of Wolsey and the substitution in his place of Thomas Cromwell supplied the king with a very able instrument for a high-handed assertion of the independence of the English Church. The movement found support in the excited animosity to the doctrines and practice of Rome which was filling Europe. Led by the energy of Cromwell, Henry proceeded beyond mere separation to the destruction of much of the apparatus of the old church. Reformed liturgies, an English Bible, the dissolution of the monasteries, seemed to secure a triumph for the advanced reformers. But the minister had overshot the desire of his master, and the reign closed amid Henry's efforts by even-handed severity to establish the supremacy of the crown without allowing the predominance of either party. So delicate an equilibrium could not be maintained. A burst of reforming zeal, supported by ministers of questionable character and still more questionable prudence, went far to destroy the position of England; and it was not without a very general consensus in her favour that Mary, the champion of the old faith, ascended

the throne. Unfortunately, her birth and natural prejudices led her to ally herself closely with Spain. A great reaction in favour of Roman Catholicism throughout Europe had begun; Spain was at the head of the movement, and there seemed every probability that England would lose its national independence and be bound not only to the ecclesiastical supremacy of Rome, but to the temporal supremacy of Spain. Religious persecutions of a severity unknown in England added strength to the angry feelings then excited. Protestantism and national independence were forced into connection, and it became the inevitable duty of Elizabeth on her accession to play her part as the supporter of this twofold cause. With the aid of her great minister Lord Burghley, she acted with consummate ability. Far too weak to oppose at once the powerful forces of united Catholicism, she contrived by a temporising policy to avoid the dangers which would have attended an open defiance. She took advantage abroad of every opening for indirect support of the Protestant cause; at home, skilfully mingling politics and religion, without direct religious persecution she treated her opponents as traitors. She encouraged with all her woman's wit the feeling for nautical enterprise which was rife in the country; and at length, with the obstacles which had met her early course removed, firmly seated on her throne, and regarded both at home and abroad as the champion of Protestantism, she was able to bid defiance to the power of Spain and establish the supremacy of the English navy in the repulse of the Spanish Armada.

In carrying out the sweeping changes of his reign, Henry VIII. had found the support of his people necessary. Even the settlement of the succession, though intrusted to Henry and carried out according to his wish, was arranged with parliamentary sanction. The co-operation of the people was still more necessary for Elizabeth. Throughout her reign the influence of parliament had been rising. Social changes had still further tended in this direction; if the old nobility had chiefly disappeared, a new nobility had taken its place, and the gentlemen of England, with property often increased from the monastic spoils, had become an important class. Though Elizabeth constantly assumed a masterful position with regard to her parliaments, she none the less listened to them and at times yielded to their remonstrances. It remained for the House of Stuart to force by unwise opposition this rising power into a position of supremacy. The death of the Virgin Queen seemed likely to open the question of the succession, but the crown passed without difficulty to the Scottish king, and the long-delayed union of the two kingdoms under one ruler was accomplished. The parliamentary settlement of Henry VIII. had set aside the Scottish line; it was therefore by strict law of inheritance only that James found himself called to the throne. Trained in a different school of politics, and apparently succeeding by what it was the fashion of the time to speak of as 'divine right,' he failed entirely to understand the position of his predecessors. This miscomprehension of his historical position handed on to his descendants was the cause of the disasters which attended their dynasty. Conceiving themselves possessed of the powers inherent in the old English crown, and determined to make them good, they forced the nation to fight over again the battle which had already been decided in the time of the Lancastrians. The contest between personal monarchy and constitutional government was terminated only by the removal of the Stuarts from the throne. A battlefield was found in nearly every department of government. James I. himself ran counter to many of the national prejudices. Thoroughly Protestant at heart, he favoured the new High Church party, who looked for support in a powerful crown; easily influenced by favourites, he fell in with the fashion of the monarchies abroad, and ruled through the hands of a great minister; in disregard of the wishes of the nation, he contracted a friendship for Spain, which was now regarded as the hereditary foe. But his weaknesses were not untempered by sagacity, and he succeeded in avoiding any overt breach with his people. His more obstinate son was less fortunate. From the beginning of his reign he found his parliament arrayed against him; it succeeded even in wringing from him the great Petition of Right. Weary of the struggle in which he seemed to be worsted, he believed himself strong enough to stand alone, and for some years ruled without a parliament and in disregard of the most important liberties of his subjects. Financial difficulties, caused in part by his ill-advised efforts to establish the Episcopalian form of worship in his northern kingdom, compelled him at length to seek parliamentary aid. The long-repressed discontent of the nation thus found a means of expression, and the edifice of personal government fell before it. A grudging consent to hotly pressed reforms, an unfortunate laxity in observing his promises, and unwise efforts at resuming his power drove Charles into open hostility with the people, and the country was plunged into the horrors of civil war. Revolution ran its inevitable course; the constitutional leaders of the early movement gave place to men who dreamed of much more radical changes, and whose politics were deeply tinged with religious fervour. The war brought to the surface successful generals, and in one of them was found a man who united vast practical ability with the subversive views and religious enthusiasm of the advanced party.

The parliamentary enemies of Charles, having completed their work by the execution of the king, found themselves mastered by the overwhelming ability of Oliver Cromwell. Raised to what was practically the throne, he set himself to reconstitute upon a new basis the constitutional structure which had been swept away. His large and tolerant views, and his determination to produce order, excited the hostility of the narrow sectarians who had formed the majority of the Long Parliament. By all men of conservative mind, or who shared in the loyal sentiment so prevalent among Englishmen, he was regarded with aversion. His efforts to bring well-ordered liberty out of the jarring elements with which he was surrounded failed; he was forced throughout his tenure of power to rely upon his own iron will. He succeeded in raising England to a high place among nations; it again assumed the position of leader of the Protestant interest, and again sought its allies among the enemies of Spain. But on the death of the great Protector, and at the prospect of a succession of military tyrannies, a wave of reaction swept over the country. Enthusiasm had died out, and that majority which at all times loves the old ways and prefers the easy paths of habit to the strenuous effort necessary to complete reforms insisted on the restoration of the banished house. With general acclamation, though not without some attempts to restrain his power within legitimate limits, Charles II. was brought back to Whitehall. Less arbitrary than his father, and far more capable of bending to the storm, he proved no less determined to maintain in his own way the fullness of the power he had inherited. He had to contend with much more formidable opponents. Though the full restoration of the church and crown had followed upon his accession, the Rebellion had not been without permanent results. It was impossible that the parliament which had for years been regarded as the source of government

should sink back into the position it had occupied in the reign of Charles I.; the king could no longer hope to rule without it or to raise the revenue from illegitimate sources. The reign was one long dispute. The character of Charles, licentious, extravagant, and ready to waste the national resources upon his own pleasures, afforded ample ground of complaint. Surrounded by advisers as unscrupulous as himself, he sold himself to the French king to supply his financial wants. At the instigation of his paymaster, he plunged the country into a disastrous war with its Protestant neighbour Holland, and by his mismanagement allowed the enemy's fleet to ride undisturbed at the very threshold of the capital. He tampered with the national credit, and attempted by an exercise of high prerogative to set aside the laws against the Catholics. The enthusiastic parliament elected upon his return became before the close of its long life his bitter opponent.

The assaults of the opposition, Whigs as they were now called, were directed against the Duke of York, the king's Roman Catholic brother. Nothing would satisfy them but his absolute exclusion from the throne. To bring discredit upon the Catholics they were not ashamed to lend themselves to the infamous perjuries of Titus Oates. They thought of placing the king's illegitimate son, the Duke of Monmouth, upon the throne; but their insolence defeated itself. Charles, never deficient in political insight, understood the national love for the rights of legitimacy, the dread of a disputed succession, and the sympathy with which his efforts to support his brother were regarded. He dissolved his refractory parliament, and even thought of vengeance. He drove Shaftesbury, the leader of the opposition, from the country, and assaulted the strongholds of his enemies by finding excuses to confiscate the charters of London and other great cities. The Whigs, who saw that such a step by changing the constituencies might easily change the character of future parliaments, were driven to despair. The more statesmanlike among them began to think of seeking for the assistance of the king's nephew, the Prince of Orange. Some of the wilder spirits sought for a speedier remedy in assassination. The discovery and punishment of the Rye-house Plot, and the skilful mingling of the aspirations of patriots with the atrocious schemes of vulgar murderers, for a while discredited the Whigs, and Charles died to all appearance triumphant. It remained for his brother to bring into action the deep-seated discontent which underlay the seeming success of the crown. With a want of judgment little short of judicial blindness, he proceeded in a few years to alienate every class in England. The open insurrections of Monmouth and Argyll were punished with reckless and bloody severity. The Test Acts were set at defiance, and Catholics filled the army. He maintained the shameful attitude his brother had adopted towards France. He laid his hand upon the freehold offices of the universities and the church, asserted the power of the crown to dispense with statutes, re-established the court of High Commission, called upon the clergy to read publicly his illegal declaration of religious indulgence, and established a standing army to overawe the capital. Such a series of tyrannical actions brought about the crisis. The Whig leaders betook themselves to William of Orange. This great statesman, who had devoted his life to restrain within due limits the power of Louis XIV., at once accepted with joy the opportunity of adding the strength of England to his great combinations. Protestant in religion, tolerant both by nature and by political necessity, the powerful chief of a republican government, he was well fitted to rule a kingdom torn by religious and political faction. The heads of all the English parties had sought his aid; his mere appearance was sufficient to close the Stuart dynasty and drive James a fugitive from the country.

The nation had again entered upon the full exercise of its powers. Taught by experience, before it deposited them in the hands of the king, it formulated the liberties of the country in a great and binding charter which should at once and for ever put an end to those efforts at personal rule which had rendered its previous history so stormy. The victory of parliament was thus completed. The reign of the first parliamentary king was indeed disturbed throughout by conspiracies, and rendered unrestful by the efforts of the exiled house, and at the close of the reign of Queen Anne for one critical moment there was a possibility that the Tories under Bolingbroke would succeed in re-establishing the Stuarts; but the rapid action of the great Whig nobles thwarted the attempt, and the failure of the Jacobite insurrection in 1715 secured in accordance with the settlement of parliament the Hanoverian House upon the throne. From that time onward, through the reigns of the four Georges, of William IV., and of Victoria, what we now regard as constitutional government has constantly prevailed. The contests of parties, however severe, have been over differences of opinion of a less vital character than those involved in a change of dynasty. It has been possible, without revolution, without impeachment, to allow of the quiet and orderly change of ministers as a regular part of the working of the parliamentary machine. Such a process implies little short of the complete disappearance of the personal wishes or opinions of the monarch as a factor in the political life of the nation. It was not without resistance that the crown consented to assume this attitude. Neither William III. nor the statesmen who had secured his accession understood the full results of what had been done. Nor was William himself, bent upon using the wealth of his new dominions to aid him in his great continental schemes, inclined to resign any of the powers of the crown or to throw himself into the arms of a single party; he attempted, like his predecessors, to employ as his ministers the ablest men of all parties. It was almost by accident that what is known as 'party government,' by which the king chooses his ministers from the majority in the House of Commons, and thus puts himself in harmony with his parliament, was discovered. The lesson which the success attending the great Whig government of 1696 taught was strengthened by experience. It was not till the Duke of Marlborough, the heir of the views and objects of William, found himself supported by the homogeneous ministry of 1708, that he met with unqualified success. From that time the ministry, virtually a committee of the majority of the house, and known as the Cabinet, has formed a recognised part of the machinery of government.

But it was not only in the establishment of constitutional government that the Revolution of 1688 produced a change in the attitude of England. It introduced the country as a first-rate power into the politics of Europe; no important complications have since arisen in which it has not played its part. Throughout William's reign, as a matter of course, its strength was employed against France. The war of the Spanish Succession opened to its armies under the leading of Marlborough a glorious career of victory. The Whig leaders, who had not shrunk from impeaching the authors of the Peace of Utrecht which closed it, yet appropriated the advantages then acquired, and forced England in support of the treaty to the very head of the European powers. In the war of the Austrian Succession, the national energies, directed chiefly against

France, secured British supremacy upon the ocean, which ripened under the great Pitt in his alliance with Frederick of Prussia into the unquestioned command of the colonial world both in the east and west. Though paralysed for a moment by the disasters of the American rebellion, the military enterprise of the country revived under the younger Pitt. Forced into opposition to the French Revolution, he was the soul of the great coalitions by which the proselytising vehemence of the Jacobins was held in check. The appearance of Napoleon upon the scene, and the extraordinary successes which attended his arms, changed the character of the war; it became a struggle for existence. It was again English subsidies, English troops, and English successes in Spain which tended more than anything else to bring the great powers into action, and to rouse that feeling of national life which produced the overthrow of the Napoleonic empire. Once again England stood at the very head of European powers.

One cause of these vast successes, unexpected in a country under popular rule, is to be found in the character of the government which sprang from the Revolution. That event was in its essence an aristocratic rather than a popular movement. The restriction of the constituencies and the influence of the possession of land threw power into the hands of a comparatively limited class. It was more as an oligarchy than as a democracy that England was able to prove itself so powerful abroad. But great social changes were gradually working themselves out, a revolution was taking place in the industrial world. The enlarged application of steam, the invention of machinery, improved methods of agriculture, the extended use of coal, the removal of the iron trade from the south to the north, and its great increase, were all tending to bring into greater prominence the trading, manufacturing, and artisan classes. The strange anomalies of the representation became still more glaring; change of occupation was not effected without much individual hardship, and the discontent arising from suffering was joined with that engendered by a sense of political exclusion. The ideas fostered by the French Revolution played their part in the general ferment. The determined and successful effort of the Irish Catholics to obtain religious emancipation laid bare the increasing weakness of the governing classes. And at length the leaders of the Whig party made common cause with the classes hitherto excluded from government, and, backed at once by the traders and the artisans, forced upon an unwilling parliament the great Reform Bill of 1832. From this time there has been a marked change both in the position of England and in the character of the questions which have excited public interest. Still mistress of the sea, and possessed through its colonies of an empire distributed in every corner of the globe, England has found enough to do in the preservation and improvement of this gigantic dominion, and has as far as possible abstained from interference in continental quarrels. Once and again it has shown its influence. In 1848, the year of revolutions, and in the subsequent consolidation of Italy, its sympathies were not hidden, but there was no thought of active interference. It allowed the great American republic to settle its disputes uninterrupted. It adopted the same attitude of non-intervention in the Prussian wars against Denmark, against Austria, and against France. It has only been in questions which seemed to touch the safety of its Eastern empire that it has drawn the sword. The Crimean war was avowedly for the maintenance of Turkey as a check upon Russia, which was threatening the road to India. Of the same class have been the wars in Egypt and Afghanistan. Still more directly when India itself burst into insurrection was England called upon to interfere and engage in the victorious but terrible campaigns which marked the suppression of the Mutiny. The other wars, and they are not few, have all been connected with mercantile and colonial interests. The questions which have chiefly moved men's minds have been of a social or mercantile character. The extension of the electoral franchise, the reform of municipalities, the repeal of the corn laws, the establishment of free trade, the improvement of the condition of the working-classes, the regulation of strikes and trades-unions, a national system of education, and of late years the question of the management of Ireland, have been the points round which political interest has centred. They are the fitting questions to occupy a democracy. To that phase of political life in one way or other England is fast hastening. It has still to be seen whether under such conditions means will be found to keep together those colonies which are already to all intents and purposes independent, and to preserve to the empire the magnificent position which the gradual development of physical and political forces has secured.

SOVEREIGNS OF ENGLAND.

	Began to reign.
Anglo-Saxon Line—	
Egbert	800
Ethelwulf	836
Ethelbald	857
Ethelbert	860
Ethelred	866
Alfred	871
Edward the Elder	901
Athelstan	925
Edmund	940
Edred	946
Edwy	955
Edgar	957
Edward the Martyr	975
Ethelred the Unready	978
Edmund Ironside	1016
Danish Line—	
Canute	1017
Harold I.	1036
Hardicanute	1039
Saxon Line—	
Edward the Confessor	1041
Harold II.	1066
Norman Line—	
William I.	1066
William II.	1087
Henry I.	1100
House of Blois—	
Stephen	1135
Plantagenet Line—	
Henry II.	1154
Richard I.	1189
John	1199
Henry III.	1216
Edward I.	1272
Edward II.	1307
Edward III.	1327
Richard II.	1377
House of Lancaster—	
Henry IV.	1399
Henry V.	1413
Henry VI.	1422
House of York—	
Edward IV.	1461
Edward V.	1483
Richard III.	1483
House of Tudor—	
Henry VII.	1485
Henry VIII.	1509
Edward VI.	1547
Mary	1553
Elizabeth	1558
Stuart Line—	
James I.	1603
Charles I.	1625
Commonwealth	1649
Stuart Line—	
Charles II.	1660
James II.	1685
House of Orange—	
William and Mary	1688
Stuart Line—	
Anne	1702
Brunswick Line—	
George I.	1714
George II.	1727
George III.	1760
George IV.	1820
William IV.	1830
Victoria	1837

This sketch excludes from its view the history both of Scotland and of Ireland; separate articles will be found under these headings. For a more detailed account of the events of each reign, and of the character and deeds of each important person, the reader is referred to special articles, at the end of which a list of authorities will be given. See the *Introduction to the Study of English History* (1881), by S. R. Gardiner and J. B. Mullinger, the second part containing a list of authorities. For special periods the following books will be found useful.

Before the Conquest.—Guest's *Origines Celticæ* (1883); Pearson's *Early and Middle Ages*, vol. i. (1867); Kemble's *Saxons in England* (1849; new ed. 1876); Sharon Turner's *History of the Anglo-Saxons from the earliest period to the Conquest* (1852); Lappenberg's *History of England under the Anglo-Saxon Kings* (1845; new ed. 1880); Green's *Making of England, 449–829* (1881); Green's *Conquest of England, 758–1071* (1883); Stubbs' *Constitutional History*, vol. i. (1874); Hook's *Lives of the Archbishops of Canterbury*, vol. i. (1860); Elton's *Origins of English History* (1882).

1066–1485.—Stubbs' *Constitutional History*, vols. ii. iii. (1875–78); Lingard's *History of England*, vols. i.–v. (1819); Freeman's *Norman Conquest* (1867–70; new ed. 1877–79); Freeman's *William Rufus* (1882); Bright's *Medieval Monarchy* (1875); Sharon Turner's *Early and Middle Ages to 1307* (1853); Gairdner's *Richard III.* (1878); Hook's *Lives of the Archbishops* (1860).

1485–1688.—Froude's *History of England, 1527–88* (1856–69; new ed. 1881–82); Lingard's *History of England*, vols. vi.–xiv. (1819–31; new ed. 1883); Mackintosh's *History of England* (1834; new ed. 1846); Bright's *Personal Monarchy* (1876); Ranke's *History of England in the 17th Century* (1875–76); Gardiner's *History of England, 1603–42* (1869–82; new ed. 1883–84), and *History of the Great Civil War* (1886 *et seq.*); Carlyle's *Letters and Speeches of Cromwell* (1845; new ed. 1872); Macaulay's *History of England, 1660–1702* (1849–55); Hallam's *Constitutional History, 1485–1760* (1827).

1688–1837.—Lecky's *History of England in the 18th Century* (1878–87); Stanhope's *Queen Anne* (1870; new ed. 1880), and *History of England, 1713–83* (1836–54); Massey's *History of England, 1745–1802* (1855–63; new ed. 1865–66); Martineau's *History of the Peace, 1800–48* (1849–50; new ed. 1877–78); Bright's *Constitutional Monarchy* (1877); Erskine May's *Constitutional History, 1760–1860* (1861–63; new ed. 1871); Walpole's *History of England from 1815*, vols. i.–iii. (1878–80).

1837–80.—Justin M'Carthy's *History of our own Times* (1879–80; new ed. 1882); Walpole's *History*, vols. iv. v. (1886); Bright's *Growth of Democracy* (1888); Molesworth's *History of England, 1830–74* (1866–73; new ed. 1874).

England, CHURCH OF. The history of the Church of England, strictly speaking, does not begin till the close of the 6th century, but for completeness of survey some account of Christianity in Britain before the Saxon Conquest needs to be prefixed. There is no trustworthy information extant as to the original preaching of the gospel in the British Isles; all that is forthcoming is either conjecture or legend. To the former category belongs the theory that St Paul was the first missionary thither—an opinion which rests only upon the apostle's own mention of his intended journey into Spain (Rom. xv. 24, 28) and the statement made by his convert and friend, Clement of Rome, that in his missionary travels he proceeded as far as 'the limit of the west' (*Epist. ad Corinth.* i. 5), words which have been construed as signifying Britain, because the farthest western boundary of the Roman empire. But that they do not in fact denote anything except the Spanish peninsula (much of which lies farther west than Britain) is made all but certain by the latter alone finding mention in the reference to St Paul in the Muratorian Canon, a document of the 2d century. To the class of mere legend belong no fewer than nine distinct accounts, specifying other apostles and saints as having evangelised Britain, one only of which—that which brings St Joseph of Arimathea to Glastonbury, and makes him shrine the Sangreal there—found popular acceptance. The most tenable theory which a consideration of all the factors of the problem suggests is that Britain was evangelised from Gaul, and that rather by sporadic and intermittent action than by means of an organised mission from Lyons or any other of the Gallic churches. Gildas, the earliest extant British historian (*circa* 516–570), acknowledges that he has no information to give upon the subject, since all the documents which might have cleared the matter up had either been destroyed by the Saxon invaders, or carried out of the country by the exiles who fled before them. And this testimony serves as specific disproof of one of the legends—that which ascribes the conversion of Britain to missionaries sent by Pope Eleutherius (177–193), at the request of Lucius, king of Britain; for this story is based solely on an interpolation made in 530 into the record of the pontificate of Eleutherius in the *Catalogus Pontificum Romanorum*, a date too near that of Gildas's history for him to have been ignorant of the fact if then credibly attested. The story of the martyrdom of St Alban, said to be the protomartyr of Britain in the persecution under Diocletian, though incrusted with mythical details, may probably contain a germ of fact, as the scene of his death was a place of pilgrimage at the beginning of the 5th century: but the first tangible historical item in the annals of British Christianity is the record of the presence of three British bishops (Eborius of York, Restitutus of London, and Adelfius of Caerleon) at the Council of Arles in 314. Others attended the Council of Sardica in 347, and that of Ariminum in 360. And from this time forward we find definite allusions to a settled church in Britain made by writers such as St Chrysostom, St Jerome, and Sozomen.

At the beginning of the 5th century, Pelagius (Morgan?), a native of Britain, originated the heresy which bears his name, and it spread so rapidly in his own country that his opponents were obliged to invoke the assistance of the Gallican Church against it. Accordingly, Germanus, Bishop of Auxerre, and Lupus, Bishop of Troyes, were sent in 429 to combat the new heresy, and Germanus paid a second visit with the same object in 447.

This controversy exactly synchronises with the earliest Saxon invasions, which, though carried on unsystematically by detached bands of adventurers, met with no effective resistance, and gradually overthrew the Romano-British civilisation, forcing the native population steadily, if slowly, back into the western parts of the island, apparently extirpating the church and Christianity itself in the process of conquest. Thus England forms the sole exception to the rule visible in all other parts of the Roman empire, that the Teuton invaders submitted to the creed of the conquered, and adopted as much of their civilisation and polity as they were capable of assimilating.

But what the British Church failed to effect, perhaps even to attempt, was achieved by external agencies. Kent, the oldest kingdom of the Heptarchy or Octarchy, was also the earliest to receive the gospel; and Bede's picturesque narrative tells how Gregory, Archdeacon of Rome, was attracted by the appearance of some fair-haired Saxon slave-children exposed for sale in the forum, and on inquiry into their race and country was seized with a desire to become a missionary thither. He could not obtain the necessary sanction, because his services at home were too valuable to be dispensed with; but when he was elected pope he determined to take effectual steps for carrying out his original plan with other instruments. He chose Augustine, prior of St Andrew's monastery on the Cœlian Hill, a foundation of his own, as head of the mission he projected, and sent him, accompanied by forty monks of the community, with supplies and with letters of recommendation to the bishops and sovereigns of Gaul. This policy directed the course which the mission was to take, for Charibert, king of Paris, had given his daughter Bertha in marriage to Ethelbert, king of Kent, though a heathen, on condition that she should be permitted the free exercise of her religion, and be attended by a body of domestic chaplains. Ethelbert accepted the conditions, and repaired a ruined Christian church just outside Canterbury for their use, and was thus likely to receive Christian missionaries more readily than any other of the Anglo-Saxon kings. Moreover, he held the honorary precedence amongst them denoted by the title of Bretwalda, so that his example, if he could be induced to encourage the strangers,

would be exceptionally influential throughout the country.

Augustine and his companions landed in Thanet on August 7, 596, and were granted an audience by the king in a few days under a great oak, to which they advanced in procession, preceded by a silver cross, bearing a picture of Christ, and singing the Litany. They were favourably received, and given permission to preach and make converts of such as chose to listen to them, while Ethelbert himself, about a year after the arrival of the mission, accepted their teaching, informed the Witan of his proposed change of religion, and obtained its sanction, besides inducing several of its members to follow his example, as did also great numbers of the commons. Hereupon Augustine, in compliance with directions given him by Pope Gregory before his departure from Rome, went to Gaul to obtain episcopal consecration as Archbishop of the English, which he obtained at the hands of Virgilius, Archbishop of Arles (November 16, 597). He sent news of his success to Rome, asking for additional men and supplies, which were promptly sent, together with the distinction of the archiepiscopal pall for Augustine himself, and a commission empowering him not only to erect twelve suffragan sees in southern England, but to do the same in the north, and appoint any one he pleased as metropolitan over them at York. But in fact little solid advance was made outside Kent for a considerable time, since a conference between Augustine and representatives of the British Church broke down through prejudice and misapprehension on both sides; and the apparent success which attended the missions in the kingdoms of Essex, Mercia, East Anglia, and Northumbria proved unsubstantial, for even those of them which had been most unanimous in accepting the gospel relapsed into heathenism after the death of the convert kings.

The recovery of these regions is due to the Celtic missionaries from their headquarters at Iona, an Irish colony, and notably to Aidan and his successor Finan. All northern and central England was evangelised by their agency, and also Essex, so that about two-thirds of the whole area of the country owes its Christianity to this source. The remainder is thus accounted for: East Anglia was converted by Felix, a priest from Burgundy, whom Augustine then raised to the episcopate; Wessex, by Birinus, an Italian, who obtained a mission from Pope Honorius, independently of St Augustine's, in 634; and Sussex, the last part of England to receive the gospel, by Wilfrid, Bishop of York, then exiled from his own diocese (681–685), the Isle of Wight being actually the latest scene of conversion. No difficulty was raised by the Scoto-Celtic missionaries in accepting the primacy of Canterbury, and in fact the several missions were welded into a single church during the life of Theodore, seventh Archbishop of Canterbury, who sat from 668 to 693. He it was who at the Synod of Hertford in 673 broke up the existing dioceses, each of which was conterminous with one of the Saxon kingdoms, into sixteen more manageable areas, all of them suffragan to Canterbury. In 735 York was made an archbishopric and metropole of the northern part of the island, though with precedence after Canterbury; but this distinction was not given formal expression until 1093, when the title 'Primate of All England' was attached to the holder of the latter see. The Welsh Church remained separate for a much longer time than that of Northumbria. It is not till 875 that there is proof of the intervention of Canterbury within its limits, for which the lack of any Welsh metropolitanate gave the occasion, and not till 1188 was the union with the Church of England fully effected.

Save for the sufferings inflicted during about a century by the piratical invasions of the pagan Danes, who treated the Saxon Christians much as the British Christians had been treated by the forefathers of those Saxons, the Anglo-Saxon Church remained peaceful and undisturbed till the Norman Conquest, living a life of its own, having scarcely any intercourse or relations with the continental churches, and ministered to by an episcopate and clergy with slender claims to learning, culture, or activity.

The Conquest, albeit attended with much hardship and oppression of the subjugated nation, and with some extrusion of Saxon prelates the moment William felt himself firm on his new throne, proved almost an unmixed benefit to the church of the country. The Norman clergy, while no less devout than the most pious Saxons, were far their superiors in learning and intellectual gifts, and the men whom William intruded into the places of the deprived Saxons, whether as bishops or abbots, were for the most part of high mark, in proof of which it will suffice to name Lanfranc, Archbishop of Canterbury, Osmund, Bishop of Sarum, and Anselm, Lanfranc's successor, though his accession to the primacy was under William II. in 1093. The great Norman nobles as a rule exercised their patronage with similar discernment; they founded abbeys and churches, cathedral and parochial, larger and statelier than had been known in England; they invited over monks from the most celebrated foreign monasteries to occupy the new foundations, and they brought the English Church, after several centuries of virtual isolation, again into touch with the rest of Latin Christendom. One factor in this last change, however, had results which no one could then forecast, for it was the Conqueror himself who availed himself of the opportunity given by the abortive Saxon revolt of 1069 to depose the Saxon primate Stigand. For this purpose he invoked the assistance of the pope, who sent two cardinals as legates. Under their presidency a synod was held at Winchester in 1070, wherein the deprivation of Stigand was effected, and the first precedent established for the internal jurisdiction of the papal authority in England. When William's own strong personality was removed, difficulties at once arose from this cause, as in the disputes concerning the investiture of bishops between William II. and Henry I. on the temporal side, and St Anselm upon the ecclesiastical part, which ended in a compromise whereby the king abandoned the claim to invest bishops by the delivery of the pastoral staff and the episcopal ring, and the church agreed not to treat the act of homage on the part of a bishop-elect as disqualifying him for consecration. This was a practical victory for the civil power, and the beginning of that mode of its nominating English bishops by uniting a letter-missive in favour of a specified person to the *congé d'élire*, or license for election, which still prevails.

Graver troubles arose when Henry II. endeavoured to abolish the privilege of clergy, which exempted all members of the clerical body from the jurisdiction of the civil courts, even for the most serious offences against the laws. He availed himself of a vacancy in the see of Canterbury to nominate his chancellor, Thomas Becket, to the primacy, in the expectation that he would assist in bringing about this desired change. At first the new archbishop gave some support to the plan, but at the Council of Clarendon, where the new laws were synodically voted, he refused to validate the acts of the council by affixing his official seal to them, to the great anger of Henry, who was present, and who imme-

diately took action which drove Becket into exile for six years. On his return to England, he excommunicated the Archbishop of York, the Bishop of London, and the Bishop of Salisbury for usurping his functions during his absence, and they at once proceeded to Normandy to complain of him to the king. The hasty words which the news drew from him were caught up by four knights of the court, who hurried over to England, and murdered the archbishop in his own cathedral. The crime proved fatal to the proposed measures, which Henry was compelled to abandon; and though some limitation of the privilege of clergy took place in the reign of Edward III., and again in that of Henry VII., it was not till the Reformation statutes of 1536 and 1541 that it was finally abolished.

The Papacy was even more successful in the reign of John than in that of his father. The pope then was Innocent III., one of the ablest and most ambitious of the Roman pontiffs, who set aside a disputed election to the see of Canterbury, and appointed Cardinal Stephen Langton instead of either claimant. The king refused to accept the nomination of Langton, and the pope at once put the kingdom under an interdict, which involved the cessation of the offices of religion throughout the country. But as John proceeded to retaliate by acts of violence against the clergy, a sentence of excommunication was fulminated against himself, quickly followed by one of deposition, whereby his subjects were released from their allegiance, and the kingdom was granted to Philip, king of France, who was enjoined to invade England with an army. Although John called out a military force to resist the threatened invasion, he was afraid to trust himself to his alienated subjects, and made secret terms with Pandulf, the papal legate at the French court, in accordance with which John signed a deed of resignation of his insular dominions into the hands of the pope, to be held from him as his feudal vassal on payment of a thousand marks yearly, and actually executed this undertaking in the church of the Templars at Ewell, near Dover, in 1213, kneeling before the seated legate, laying the crown at his feet, and taking the oath of homage to the pope as his lord paramount. The exiled prelates hereupon returned, and Cardinal Langton gave absolution to the king. But although Langton was thus forced upon the country by external influence, he at once identified himself with the popular party, headed the confederacy of the barons formed to extort reforms from John, disregarded the pope's attempt to protect his vassal, and compelled the signature of the Great Charter at Runnymede in 1215, refusing to publish the bull with which Innocent III. attempted to quash it. Nevertheless, the vassalage of the kingdom was not suffered to remain a mere dead letter of titular dependence on the Papacy; it continued as a very potent fact during the long reign of Henry III., when the church patronage was almost monopolised by the popes, in virtue of 'mandates' and 'provisions,' and exercised chiefly in favour of Italians; while the revenues drawn to Rome from England, as vouched by a complaint lodged at the Council of Lyons in 1274, largely exceeded those of the crown. This policy, which at once affected the people generally in their religious relations throughout the parishes all over England, and the state in its corporate character, did much to beget a temper of revolt against the Roman claims, as those of an alien and even hostile power, and had much to do with the spread of Lollardism at a somewhat later period, and even with the permanent success of the Reformation.

There was, however, an event of a very different kind which also marked the 13th century: the introduction of the new institute of friars, then but lately founded by Francis of Assisi and Dominic Guzman on a basis differing in several important particulars from the older monasticism which had played so great a part in church history. The Dominicans, or Friars-preachers, reached England about 1219, the Franciscans about 1224, being soon followed by the Carmelites and Augustinians. For a time they worked as marked a revival as they had already brought about in religion on the Continent, and the Franciscans became in addition famous for their learning, not only furnishing the ablest teachers to the universities, but producing men of such exceptional eminence as Roger Bacon, Duns Scotus, and William of Ockham. For a time the influence of the friars was wholly healthful and stimulating, but the very popularity which they enjoyed crowded their ranks with unworthy members, and the greed which they soon evinced, as well as the anti-national attitude they assumed in consequence of their exemption from local jurisdiction, as holding directly from the pope, so that they viewed themselves as his liege-men and acted as papal garrisons in England, marred the fair promise of their advent, and made them additional factors in the growing alienation from Rome. This change of attitude towards the friars appears as early as the episcopate of Robert Grosseteste, Bishop of Lincoln (1235–53), who had been one of the first to welcome their arrival, but became their steady opponent towards the close of his life, as he also was of the papal usurpation of English church patronage.

Edward I. renounced that fealty to the Papacy which his father and grandfather had accepted, besides checking the transfer of land by the Statute of Mortmain in 1279; and his own grandson, Edward III., carried resistance much further—in 1350, by the Statute of Provisors, which put an end to the pope's encroachments on the rights of patrons; in 1353, by forbidding appeals to Rome under pain of outlawry; in 1367, by refusing to continue payment of the tribute with which John had saddled the kingdom; and in 1374–75, by an inquiry into the number and value of the benefices occupied by aliens, succeeded by an embassy to the pope to complain of the abuses. One member of that embassy, John Wyclif, Master of Balliol, Oxford, had a powerful, if temporary, influence in fostering opinions adverse to the current system, and the popularity of his translation of the Bible contributed much to the same end. His teaching, though officially condemned both by the university and the church, found many supporters both amongst the educated and the masses, and probably helped the enactment of the Statute of Premunire in 1393, as it certainly did the spread of Lollardism after his death in 1384. Active measures were taken for its repression under Richard II. and Henry IV., and the first execution by burning for heresy in England was that of William Sawtré, a London rector, in 1401. He was the earliest of many victims (including Sir John Oldcastle, Lord Cobham) during a persecution which lasted with little intermission till the outbreak of the Wars of the Roses; but meantime the reaction against Rome was holding its course both in church and state, and was much increased by the high-handed action of Pope Martin V., who endeavoured to revive the abuses which successive kings and parliaments had abated or removed.

Some recovery of Roman influence, however, took place in the weak reign of Henry VI., and Cardinal Kemp, Archbishop of Canterbury, was not only nominated by the pope to the primacy, but avowedly governed the church as papal legate; a policy

wherein he was followed by his successors Cardinals Bouchier and Morton, under the last of whom (1487–1501) the long struggle of the nation against papal encroachments seemed to end in final defeat, and in the reduction of England to a mere appanage of Rome. With the accession of William Warham, a patron of learning, to the primacy in 1502, some abatement of this subjection becomes visible; but the time for a far wider and deeper revolt was near at hand, seeing that the Lutheran movement, destined to influence the whole Western Church, took place during Warham's primacy, and rapidly affected even those who were most opposed to its principles. In particular, the widespread anger it aroused against practical abuses strengthened the hands of Cardinal Wolsey in undertaking the reform of the monastic houses in England, by purging the greater monasteries of their scandals, and suppressing small and useless foundations, drafting their inmates into the larger societies, and applying their revenues to educational purposes. But rougher hands were to carry on the work in a very different fashion from his temperate measures. The failure of Henry VIII. in obtaining a divorce at the pope's hands from his queen, Catharine of Aragon, since her nephew, the Emperor Charles V., was too powerful to be thus braved, led to his determination to break with Rome; and though Wolsey declined to assist his plans, and was disgraced in consequence, yet in Thomas Cranmer, whom, on Warham's death in 1532, he raised to the primacy, he found a ready instrument for his purpose. Cranmer declared the marriage with Catharine void, and the king's private marriage to Anne Boleyn valid; while Henry retorted upon the pope's verdict of 1534 against this union by hastening on the proceedings of the famous 'Reformation Parliament,' which continued from 1529 to 1536. Herein papal licenses and bulls were prohibited, the king's ecclesiastical supremacy declared the law of the land, and its impugnment punishable with death; the submission of the clergy, compelling them to accept a revision of the canons by a royal commission and to assemble in their convocations only when summoned by the king's writ, was extorted; the payment of annates to Rome was forbidden; and the statute in 'Restraint of Appeals,' terminating all ecclesiastical suits within the kingdom by prohibiting the carriage of any suit before the pope, was enacted.

These changes seem to have been received, not only without resistance, but with real approval, even by the clergy as a whole; and, except for the breach with Rome, little alteration was made in the ordinary routine of church teaching and discipline, though some slight advance was made in the reforming direction by the issue of the Ten Articles in 1536 and the *Institution of a Christian Man*, or *The Bishops' Book*, in 1537, recast and re-issued in 1542 as the *Necessary Erudition of a Christian Man*, or *The King's Book*. A greater practical change was carried out by the wholesale spoliation and suppression of the monasteries, mainly by the agency of Thomas Cromwell between 1536 and 1539, and the devolution of their great revenues, including the impropriated tithes of parish churches, into the hands of the king and the secular landlords. The Act of the Six Articles in 1539 was aimed at the more advanced Reformers, and made several of their favourite tenets heresy at statute law, so that it was no longer possible for the accused to save his life by abjuration, as it had been under the previous system. Some modification of its severity was made in 1543 and in 1544, and the beginnings of vernacular services appear in the publication of the Litany in English, in addition to an earlier permission for the private use of the Psalter, Creed, Lord's Prayer, and Hail Mary. Such was the posture of affairs at the death of Henry VIII. in 1547.

Under the child-king Edward VI., the reforming movement was pushed on much more rapidly, and is sharply divisible into two distinct periods: an earlier one, whose landmarks are the Order of Communion of 1548, and the First Book of Common Prayer in 1549, both of them the work of the native clergy, and drafted on mainly conservative lines; and a later one, when the influence of the foreign Reformers domiciled in England, and notably Bucer and Peter Martyr, became dominant with the king's advisers, and resulted in the destruction of the altars of the churches in 1550, the issue of the Second Prayer-book in 1552, by royal and parliamentary authority only, and without the assent of the church, and the compilation of the Forty-two Articles, the first draft of the present Thirty-nine, in 1553. So much wanton havoc had been wrought under colour of reformation in the closing years of Edward's short reign that Mary's accession was received without alarm, and even with welcome, and that by the clergy no less than by the laity, with the exception of those who felt themselves imperilled. But though she immediately set herself to undo all the work of the preceding quarter of a century, aided by her husband Philip II. and her kinsman Cardinal Pole, so that she was enabled with the assent of parliament to bring the church and nation back into the relations with the see of Rome which had prevailed up to 1529, yet her impolitic cruelties and the fierce persecution of which Cranmer, Ridley, Latimer, and Hooper were the most conspicuous victims, alienated the national sympathies from her, and led to a fresh reaction, which at once took shape under her successor Elizabeth. In 1559 the Act of Uniformity re-establishing the Common Prayer-book, and also a statute reviving the royal supremacy, were enacted; the Thirty-nine Articles were published in 1563, and the Church of England placed in a position midway between the attitudes in the two periods of Edward VI.'s reign already referred to. The Marian bishops, who refused to accept the changes, were deprived, but not otherwise harshly treated, and only 189 of the whole clerical body, inclusive of these fourteen prelates and six abbots, out of a total of 9400, declined to conform; while there was no separatist Roman Catholic body in England till after Pius V. issued his Bull of Excommunication against Elizabeth in 1570, nor were they organised in anywise till 1598. See ARCHPRIEST.

The Puritan section in the country, however, was far from content with the amount of reform achieved, and quickly came into collision with the authorities in church and state, mainly upon minor details of ceremonial. The first secession on these grounds took place in 1563, and was generally condemned by the leading foreign Reformers; but nevertheless Puritan principles spread very fast, and became powerful in parliament, though not sufficiently so to prevent the enactment of a severely repressive statute in 1593, when the Puritans' own violence and intractability had provoked a reaction against them, and they remained quiescent during the remainder of Elizabeth's reign. They revived in activity under James I., and had high hopes of success; but the Hampton Court Conference, wherein an attempt was made to arrive at an amicable understanding between them and the church, proved abortive; and while their disciplinary proposals were checkmated by the Canons of 1604, their doctrinal aspirations were even more effectually and permanently defeated by the rise of the Anglo-Catholic school of theology, which exchanged the destructive and innovating temper which had inevitably prevailed during the crisis of the Reformation, when the removal of abuses was the main

object, for a constructive and conservative one, making constant appeal to the standards of the ancient undivided church, and being especially opposed to the tenets of Calvinism and Zwinglianism. But the king's feebleness of nature made him ill able to guide the country at such a time, and his political blunders brought about an alliance between the Puritans and the patriot party, who were aggrieved by many acts of misgovernment. The authorities of the Church of England, contrariwise, both under James and his successor Charles I., lent themselves to the support of absolutist views, and thus incurred much odium, which was considerably increased by the dissatisfaction aroused by the action of Archbishop Laud, whose good intentions were not accompanied with practical discretion, but were marked with much high-handed intolerance. The reaction was swift and violent: the Westminster Assembly of Divines met in 1643, and adopted from Scotland the Solemn League and Covenant, one detail of which is the total abolition of prelacy, and which parliament made binding on all persons in England over the age of eighteen; in 1645 the Book of Common Prayer was forbidden under severe penalties, and the Directory of Public Worship substituted for it; in the same year Archbishop Laud was brought to the block, and the Church of England, as a body holding a recognised national position and free to exercise its functions, disappeared from view for the fifteen following years. The restoration of Charles II. in 1660 was attended by the return of the exiled clergy and the reinstatement of the church, while the Savoy Conference in 1661 decided the issue as to the general aspect of the revived communion in favour of the High Church or Anglo-Catholic view, by revising the Prayer-book in its present form, which was enforced by an Act of Uniformity in 1662, a measure followed by the resignation of a number of the ministers admitted to benefices under the Commonwealth, estimated variously at from 800 to 2000. This was virtually the last settlement of ecclesiastical affairs in England by the joint action of church and state, and the many events which have since occurred to condition them have not materially altered its broad features. The illegal exercise by James II. of a dispensing power in issuing the 'Declaration of Indulgence,' which, though ostensibly meant for the relief of all Nonconformists, was designed to cover the legalisation of Roman Catholicism, and the trial of the seven bishops who refused to give it circulation in their dioceses, directly caused James's deposition, and resulted hurtfully in some respects for the church.

For the Nonjuring schism under William III. deprived the church of many pious and some able men whom it could ill spare, and contributed something to the gradual cooling of zeal and the laxity of doctrine which marked the Hanoverian period and were furthered by the influence of such prelates as Hoadly and White Kennett. But socially the Church of England touched its highest point of influence just before the season of decay. At the close of Queen Anne's reign it appeared to be strong and successful everywhere, and there was practically no competitor in the field, as both Roman Catholics and Nonconformists were few and powerless. But with the silencing of Convocation under George I. in 1717 (made feasible by its impolitic surrender in 1664 of the right of the clergy to vote all taxes payable by them), and the steady encouragement given to the ultra-Broad Church section of the clergy, a blight came upon the church, and it rather vegetated than actively lived thenceforward till nearly the close of the 18th century; for the Methodist movement, begun by John and Charles Wesley in 1727 on the footing of a guild within the church, and given formal shape in 1740, began to assume the status of an external sect in 1760, and soon afterwards became the active rival of the church. The Evangelical revival towards the close of the century owed much of its success to the alarm caused by the French Revolution, since the adoption of freethinking opinions in England was thought likely to lead to results similar to those of the Terror; but though it did much for individual piety, the notion of working in and for the church at large, or as a national institution, does not seem to have so much as crossed the minds of its leaders, and it did thus nothing whatever to promote any corporate reforms, though achieving much in raising the standard of clerical devoutness.

It was reserved for the factor variously known as the Oxford or Tractarian movement, or by its advocates as the 'Catholic Revival,' to make this omission good, and to stimulate the energies of the whole Anglican communion. The movement itself was immediately occasioned by a statute enacted in 1833 suppressing ten bishoprics in the Church of Ireland, which at once prompted the question, 'If the like policy should at any time prevail in England also, and lead to the overthrow of the church as an establishment, what would it have to fall back upon for its very existence as a corporate body?' The answer to this question was given in the 'Tracts for the Times,' issued from Oxford at intervals during 1833–41, and chiefly written by Newman, Keble, Pusey, Isaac Williams, and Richard Hurrell Froude. They at once excited active controversy, seeing that they not only traversed the Low and Broad Church positions, but also that of the contemporary High Church school itself, which was content to acquiesce in a theology bearing clear marks of 18th-century influence, and differing materially from that of the great Stuart divines, which the Tract-writers aimed at reviving. Although at first the line adopted by the school as a whole may be roughly described as a *via media* between Roman Catholicism and Reformation doctrines, although at first the former system was freely criticised, yet two great waves of secession to the Roman Church, in 1845 and 1850, the earlier occasioned by the condemnation of Tract XC., written by Dr Newman, and the latter by the Gorham Judgment, drew considerable numbers of its more distinguished members with them, and not only weakened it seriously at the time, but seemed to justify all the adverse criticism it had met, and to discredit it altogether. Nevertheless, it stood the shock firmly, and proceeded on the lines originally sketched out, and that with such energy and success as to entirely change the face of the Anglican Church during the succeeding half-century. The great development of church building and restoration, the revivals of convocation and of sisterhood life, the creation of a copious and learned ecclesiastical literature, the impetus given to the foundation of colonial and missionary dioceses and to the increase of the home sees, at first merely suffragan, but later as separate dioceses, the introduction of a higher standard of clerical life and work, and the embellishment of public worship, are the chief results of its labours; and what might have been less anticipated from its origin, it has shown itself not less ready in adapting agencies of nonconformist birth and usage to the purposes of the church. That it has in fact been the determining factor in these respects, and has rather drawn the remaining schools into the current than been anticipated or aided by them, is vouched by the date, not less than by the character, of the reforms, since they do not begin to be manifest, even in germ, till the Oxford movement became powerful, and was translated from theory into

practice. As regards the alleged tendency towards Roman Catholicism, that must be judged not by the degree in which the school is in sympathy with Roman Catholics rather than with Protestants on certain issues, nor yet by counting up individual secessions in that direction, but by the broader inquiry into the growth of the Roman Church in England since the Oxford movement has affected the condition of religion in the country. And the fact is, as attested alike by the marriage returns (especially trustworthy in the case of Roman Catholics, because of their strict discipline in this matter) and by the calculations made by the Roman Catholic authorities themselves, they do not increase at the same rate as the nation at large, and constitute, despite their threefold sources of increase—births, immigrants, and conversions—a slowly but steadily diminishing factor in its ratio to the population, and chiefly dependent, even so, upon the Irish element to maintain its numbers.

In marked contrast with the torpor of the last century and the earlier years of the present one, the history of the Church of England for fifty years past has been as crowded with events profoundly affecting it as any corresponding period of time during the Reformation era; with this notable difference, the absence of the Erastian character which the direct intervention of the crown and the civil power in general gave then to the aspect of ecclesiastical affairs. In the modern revival of the Church of England the court has had neither share nor sympathy, there has been rather more opposition than aid from parliament, owing to the temper of the large nonconformist element in the House of Commons, and the legal tribunals have been actively hostile; but no serious check or delay has been interposed to the movement by any or all of these adverse influences. It is possible to name only the most salient events of the half-century in the briefest fashion to complete this historical outline. The beginning of Queen Victoria's reign was marked by the enactment of the Pluralities and Non-residence Act in 1838, and of the Church Discipline Act in 1840. The development of the colonial episcopate (which, though initiated in 1787, had increased to no more than five sees down to 1836) began in 1841, and was steadily rapid in operation. The Gorham case, decided against the ruling of the Court of Arches by the Judicial Committee of Privy-council, synchronised with the establishment of a Roman Catholic hierarchy in England by Pius IX. in 1850, professedly as a restoration of the pre-Reformation episcopate. Convocation was revived in 1853, through the action of Lord Aberdeen, then premier, and has met regularly ever since. In 1860 *Essays and Reviews* was published, and was soon followed by kindred but bolder writings of Dr Colenso, Bishop of Natal; and though both the *Essays* and the bishop were condemned by the ecclesiastical authorities, these sentences were reversed, the former in 1864, the latter in 1865, by the Judicial Committee; against which findings strong protests were made (in the case of *Essays and Reviews* by 11,000 clergymen), and the Convocation of Canterbury affirmed synodically the contrary condemnations. The Church Congresses, which have done so much to make the outer public familiar with the working of the English Church, began in 1861; the Pan-Anglican Conferences, equally powerful in welding together the separated parts of the vast Anglican communion, in 1867. Contrasting with the license allowed to the Low and Broad Church schools by the Privy-council decisions, the judgment in the suit of Liddell *v.* Westerton (1857) was largely, and those in the suits of Martin *v.* Mackonochie (1869), Hebbert *v.* Purchas (1871), and Clifton *v.* Ridsdale (1877), were entirely, hostile to the High Church litigants, condemning various ceremonial adjuncts of public worship which they held to be permitted or enjoined by the formularies. But these findings have been so riddled with destructive criticism by eminent jurists and other experts as miscarriages of justice that they have never commanded respect or obedience, nor has the imprisonment of some of the clergymen affected been found to deter others from pursuing the same course. Indeed, the failure of the suit of Sheppard *v.* Bennett (1872), instituted for the purpose of excluding the tenets supposed to underlie the condemned ceremonial usages from toleration within the Church of England, deprived them of the only plausible defence which could be set up for them, that of the ultimate inconsistency of those usages with the dogmatic standards of the church. The restoration of the long dormant class of suffragan bishops took place in 1870, and they now form a considerable factor in the home episcopate; while the increase in the number of English dioceses, originating with the foundation of the sees of Manchester and Ripon in 1836, was promoted by the passage of a bill for that purpose in 1878, which has been acted on by the erection of the sees of Liverpool, Newcastle, St Albans, Southwell, Truro, and Wakefield.

The polity of the Church of England is episcopal, and the area is territorially distributed into two provinces, Canterbury and York, each presided over by an archbishop, having severally twenty-three and nine dioceses subject to their jurisdiction, in several of which there are suffragan bishops acting, making the number of employed bishops about forty. There are about 13,500 benefices, and the whole body of the clergy, inclusive of those unemployed, is estimated at 23,000 members. The gross income of the church from all sources is roughly estimated at about £7,250,000, and the church accommodation at 6,250,000 sittings. The colonial dioceses and missionary jurisdictions in connection with the English Church are 65 in number, with about 80 bishops and 3400 clergymen; and of the allied sister or daughter churches, that in Scotland has 7 bishops and 266 clergymen; that of Ireland, 2 archbishops, 11 bishops, and 1773 clergymen; that in the United States, 71 bishops, and about 3300 clergymen; making, exclusive of retired bishops, a gross total of 211 bishops and 33,000 clergymen. The Church of England claims that its bishops are the legitimate and canonical successors of the pre-Reformation hierarchy, and has carefully fenced the episcopal office with safeguards to insure its regular continuance. But Roman Catholic controversialists allege that there was a complete solution of continuity at the accession of Elizabeth, when Matthew Parker was appointed Archbishop of Canterbury in the room of the recently deceased Cardinal Pole. Yet not only has the regularity of the English succession been acknowledged by such eminent authorities as Bossuet in the past and Döllinger in the present day, but there is decisive proof that the objections now alleged are merely factitious afterthoughts. The question of the necessity of papal confirmation to validate the status of bishops was debated in the Council of Trent, November 30, 1562, and objections were adduced against its obligation. But it was argued on the other side that to rule against it would be dangerous, because the only argument adducible against the orders of the English bishops was that they had not papal confirmation, since they proved that they had due call, election, mission, and consecration; and the whole council accepted this view of the situation (Le Plat, *Monum. Conc. Trident.* dcclxxi.).

The doctrinal standards of the Church of England are primarily the Book of Common Prayer, including the three Creeds occurring therein; and

secondly, the Thirty-nine Articles. The first four general councils are also part of her legal system, and there is a general appeal to Holy Scripture as interpreted by 'the Catholic Fathers and ancient bishops.' She differs from the Roman Catholic Church by the rejection of the distinctively Roman tenets embodied in the modern articles of the Creed of Pope Pius IV., and from the Eastern Church in a less degree, and chiefly in respect of the invocation of saints and the cultus of images, as not warranted either by Scripture or by the church of the first five centuries. On the other hand, she differs from the societies which have sprung up since the Reformation by requiring episcopal ordination for all her clerical members; by the structure and tone of her Liturgy, which is simply a translated and abridged revision of the pre-Reformation Missal, Breviary, and other office-books; and by her refusal to admit into her formularies any tenets which have not the warrant of antiquity, whatever plausible arguments may be adduced for them from the letter of Scripture. She has always exercised strong attraction upon the educated classes, and has probably a larger proportion of cultured laymen actively interested in and working for her than any other communion of the day, and in England she has also retained the agricultural class. But the lower middle class and the town artisans have been less influenced by her, and, in fact, constitute the strength of English Nonconformity. The revival of the last fifty years has, however, begun to tell upon this class also, and nearly every large town can show congregations formed of such materials; while the advance of the daughter-church in the United States is notably rapid and permanent.

The most convenient books for the student to consult upon the history and position of the Church of England are Perry, *Student's English Church History* (1878); Dixon, *History of the Church of England from the Abolition of the Roman Jurisdiction* (1877-83); Abbey and Overton, *The English Church in the Eighteenth Century* (1878); Sadler, *Church Doctrine, Bible Truth* (1872); Bishop Christopher Wordsworth, *Theophilus Anglicanus* (1865); Curteis, *Bampton Lectures on Dissent in its Relation to the Church of England* (1872); Howard, *The Church of England and other Religious Communions* (1885); Moore, *Englishman's Brief on Behalf of his National Church* (S.P.C.K.); Bishop Forbes, *Explanation of the Thirty-nine Articles* (1878).

England, New. See New England.

English Channel. See Channel (English).

English Harbour, a port of Antigua (q.v.).

English Language. *Periods.*—Great as are the changes that separate the oldest English from the English of the present day, these changes are so gradual and so continuous that no definite lines can be drawn. But it is easy to discern three main stages of development: *Old English* (O.E.), *Middle English* (M.E.), and *Modern English* (Mn.E.), each subdivided into an *early* and a *late* period. There are besides two marked periods of *transition* between the main periods. The chronology of these periods is approximately as follows:

Early Old English (Alfred period)	700-900
Late Old English (Ælfric period)	900-1050
First Transition (Layamon period)	1050-1150
Early Middle English (*Ancren Riwle* period)	1150-1300
Late Middle English (Chaucer period)	1300-1400
Second Transition (Caxton period)	1400-1500
Early Modern English (Shakespeare period)	1500-1650
Late Modern English	1650-1900

Old English.—*Dialects.*—There were four dialects of O.E.: (1) *Northumbrian* (North.), extending from the Humber to the Forth; (2) *Mercian* (Merc.), between Thames and Humber; (3) *Kentish* (Kent.); (4) *West Saxon* (W.S.). North. and Merc. together constitute the *Anglian*, W.S. and Kent. the *Southern* group.

Literature was first cultivated in the North, and the Angles were for a long time the dominant tribe. Hence *Englisc* ('Anglish') came to be the collective name for the whole group of dialects, and remained so after the supremacy had passed to the West Saxons, and W.S. became the official language of the whole English people.

Vocabulary.—O.E. was, in the main, a homogeneous language, forming new words at will by derivation and composition. Thus 'scribes and Pharisees' were Englished as 'bookers and sundersaints' (*bōceras and sundorhālgan*). But it adopted many Latin words at different periods, some of which, such as *strēt*, 'street' (*via strāta*), it brought with it from its continental home on the other side of the German Ocean. Celtic loan-words, such as *drȳ*, 'sorcerer,' are very rare, because those Celts with whom the English came most in contact were almost completely Romanised.

Spelling and Pronunciation.—On their conversion to Christianity the English adopted the Latin alphabet in its Celtic form—whence ȝ = *g*, &c.—with the traditional Latin values of the letters as preserved by the Celts. They added to it from their national Runic alphabet the letters þ = *th* and ƿ = *w*.

The O.E. spelling was as phonetic as its defects would allow. There were no 'silent' letters. Double consonants, as in *sunne*, 'sun,' were pronounced double, as in Italian; *e* and *o* had a close and an open sound—when open we write them *ę*, *ǫ*; *æ* had the sound of our *a* in *man*; *y* had its original sound of French *u*. In the diphthongs *ea*, *eo*, the stress was on the first elements; *ie* (originally a diphthong) had the open sound of our *i* in *bit*; *c* had a 'back' sound = *k*, and a 'front' one, which we write *ċ*, nearly that of our *ch*, as in *cīld*, 'child'; *c* was always front in the combination *sc*. There was a corresponding distinction between *g* and *ġ*, as in *ġeard*, 'court;' *ġeong*, Angl. *ġung*, 'young' (where it is a modification of original *j*; compare German *jung*). Double *ġ* is written *cg*, as in *ecg*, 'edge.' In *ng* the *g* was pronounced distinctly, as in *lang*, 'long.' After a vowel, *r*, or *l*, *g* had the open sound of the *g* in German *sagen*, *ġ* that of our *y* in *young*: *dagas*, 'days;' *sorg*, 'sorrow;' *dæġ*, 'day.' Non-initial ('strong') *h* had the sound of Scotch *ch* in *loch*, as in *dohtor*, 'daughter;' *f*, *s*, *þ* had the voiced sounds *v*, *z*, *dh* between vowels and elsewhere, as in *ofer*, 'over.'

Phonology.—Original (Germanic) *a* appears in O.E. only before an original back vowel, as in *dagas*, and before nasals, as in *nama*, 'name;' *lang*. This latter *a* becomes *ǫ* in Angl., as in *nǫma*. Before *r* and *l* consonant, *a* becomes *ea*, as in *heard*, 'hard;' *eald*, 'old.' Angl. restores *a* before *l*, and lengthens it: *āld*. In other cases *a* becomes *æ*, as in *dæġ*; *e* before *r* and consonant becomes *eo*, as in *eorþe*, 'earth.' There is an *ā* which is common to all the dialects, as in *sā*, 'sea,' and one which is peculiar to W.S., becoming *ē* in the other dialects, as in *dād*, 'deed,' Angl. and Kent. *dēd*. In W.S. *æ* and *ā* are diphthongised into *ea*, *ēa*, as in *ċeaster*, 'city;' *ġēar*, 'year' = non-W.S. *cæster*, *ġēr*. W.S. *ie* corresponds to *i*, *e*, *ę* in the other dialects, as in *bierhtu*, 'brightness;' *ġiefan*, 'give;' *ieldra*, 'elder' = Angl. *birhtu*, *ġefan*, *ęldra*. W.S. *īe* appears as *ē* in the other dialects, as in *hīeran*, 'hear' = Angl. *hēran*. In Late W.S. *ie*, *īe* become *y*, *ȳ*, as in *yldra*, *hȳran*. In Angl. *ēa*, *ēo* become *ē* before *c*, *g*, *h*, as in *ēc*, 'also;' *flēgan*, 'fly;' *hēh*, 'high' = W.S. *ēac*, *flēogan*, *hēah*. In Late Kent. *ȳ*, *ȳ* become *e*, *ē*, as in *senn*, 'sin' = Early Kent. and common O.E. *synn*.

Inflections.—O.E. has all the characteristics of an inflectional language. It has a threefold grammatical gender. Nouns have four cases—nominative, accusative, dative, and genitive. The acc. is the same as the nom. in all neuters and all plurals, and

in all 'strong' masculines, whose inflections are as follows: nom. *dæġ*, dat. *dæġe*, gen. *dæġes;* pl. nom. *dagas*, dat. *dagum*, gen. *daga*. Strong neuters differ from masculines only in taking *u* in the pl. nom., which is dropped after a long root-syllable, *scip-u*, 'ships;' *hūs*, 'houses.' The nom. sing. of strong feminines is the same as the neut. pl., *caru*, 'care;' *synn;* the oblique cases taking *-e* (*synne* = acc., dat., gen., sing.), and the pl. nom. *-a* (*synna*). 'Weak' substantives inflect with *n;* *nama*, obl. *naman;* pl. nom. *naman*, dat. *namum*, gen. *namena*. There are isolated irregularities, such as *mann*, 'man;' dat. sing. and pl. nom. *męnn*.

Adjectives have a twofold declension, 'strong' and 'weak.' The weak forms appear after the definite article and similar demonstratives, *gōd mann*, 'a good man;' *se gōda mann*, 'the good man.' The definite article, which is also used as a demonstrative = 'that,' 'that one,' has nom. masc. *se*, neut. *þæt*, fem. *sēo*. The oblique cases and the plural begin with *þ*, nom.pl. *þā*. The corresponding forms of 'this' are *þes, þis, þēos, þās*.

The verbal forms are much simpler. The endings of a 'strong' verb, such as *bindan*, 'bind,' are as follows: indic. pres. *binde, bindest, bindeþ;* pl. *bindaþ;* pret. *band, bunde, band;* pl. *bundon;* subj. pres. sing. *binde*, pl. *binden;* pret. *bunde*, pl. *bunden;* inf. *bindan;* gerund *tō bindenne;* partic. pres. *bindende*, pret. *ġebunden*. 'Weak' verbs, such as *lufian*, 'love;' pret. *lufode;* part. pret. *ġelufod; hīeran, hīerde, ġehīered; þęncan, þohte, ġeþoht*, 'think,' have nearly the same endings as the strong.

Syntax.—In its syntax O.E. has all the characteristics of an inflectional language. In the use of cases, government of prepositions, use of the subjunctive, concord, &c., O.E. grammar is very similar to that of Latin. But the distinctions of tense in the verb are very imperfect. The present does duty for the future, and the preterite for perfect and pluperfect. But we see the beginnings of periphrastic forms, such as *wile cuman, is cumen, hæfde ġebunden*, although with very vague meanings. The O.E. word-order closely resembles that of Modern German, the verb being put at the end in dependent sentences: *hīe ġehīerdon þæt se cyning ofslægen wæs*, 'they heard that the king was killed.'

MIDDLE ENGLISH.—In the M.E. period the effects of the earlier Scandinavian conquests became visible in the form of numerous loan-words, some confined to the northern dialects, others, such as *bǭþe*, 'both' (Old Icelandic *bāþir*), extending through all of them.

Soon after the Norman Conquest in 1066, English ceased for some centuries to be the language of literature and the higher purposes of life, and on its revival—English was introduced into the courts of law in 1362—retained only the homelier element of its original vocabulary, which was otherwise made up of French and Latin, the Latin words being generally Frenchified in pronunciation and often in spelling, even when taken directly from literary Latin. The French element itself was of various periods and dialects. Early Norman influence soon gave way to that of other dialects, especially Parisian French.

Dialects.—The M.E. dialects are (1) *Northern* (= the older Northumbrian), including Lowland Scotch, which still called itself 'English;' (2) *Midland* (= Mercian), subdivided into *East* and *West* Midland; (3) *Kentish;* (4) *Southern*. Although Southern answers to W.S. geographically, it is by no means its direct descendant, but shows strong marks of Mercian influence in the substitution of *ē* from W.S. *ā*, as in *dēd*, &c., which is universal, and of *hēran* from *hȳran*, which is very general in Southern. After the seat of government had been removed from Winchester to London, the position of the latter on the borders of the two dialects led to a further mixture of Southern and Midland forms. Midland, being intermediate between the now mutually unintelligible Southern and Northern dialects, came to be the means of communication between them; and the history of the London dialect—which is now the history of standard English—becomes henceforth a record of increasing Midland influence. It must be noted that Northern, and, to a less extent, Midland, are ahead of Southern in their development; so much so, indeed, that 14th-century Northern is grammatically on a level with Early Mn.E.

Spelling and Pronunciation.—The most immediate result of the Conquest was the introduction of a French orthographic basis. O.E. *y, ȳ*, whose sound was preserved in Southern, was expressed by the French *u*, as in *sunne*, 'sin;' *fur*, 'fire' = O.E. *synn, fȳr; u* itself was then expressed by the French *o*, as in *comen*, 'come' = O.E. *cuman*. In Late M.E. *ū* was expressed by the Parisian *ou*, as in *hous* = O.E. *hūs; y* thus came to be the unmeaning variant of *i* that it now is; *æ* was discarded in Late M.E., and so *ee, e* expressed the open as well as the closed vowel, as in *see* = O.E. *sǣ; þ* and *ƿ* were successively discarded in favour of *w, th*. Voiced *f* was written *v*, as in *luvien; c* was written *k* before *e* and *i*, as in *king; ċ* was expressed by the French *ch* = *tsh*, into whose sound it passed in Late M.E., as in *chīld*. Strong *h* was in Late M.E. written *gh*, as in *doghter*. The difference of form between the English *ȝ* and the French *g* was utilised by assigning *g* to the stopped sound, as in *gōd*, 'good,' *gg* to the old *cg*, as in *egge*, 'edge,' which had nearly the sound of French 'soft' *g* = *dzh*, and restricting *ȝ* to the open sounds of *gh*, as in *dazes* (later *dawes*) = O.E. *dagas*, and of our consonant *y* in *ȝung*, in Late M.E. expressed by *y*, as in Mn.E.

Phonology. — The O.E. diphthongs became monophthongs in M.E.: *ea* was levelled under *æ*, which in Late M.E. became *a*, so that O.E. *þæt, heard* became *þat, hard; dēad*, 'dead,' became *dēd*, written *deed, ded* in Late M.E.; *eorþe, dēop*, 'deep,' became *erþe, dēp*. In Northern and East Midland *y, ȳ* became *i, ī*, as in *sinne, fīr*, Kent. keeping *senne*, &c. In Late M.E. *a, e, o* were generally lengthened before single consonants followed by a vowel, as in *nāme*, being kept short in monosyllables, such as *þat; i* and *u* were never lengthened, as in *writen*, 'written;' *sune*, 'son' = O.E. *ġewriten, sunu; e* and *o* had already been broadened to *ɛ* and *ɔ*; so 'new-long' *e* and *ɛ* were levelled under *ē*, as in *even, mete*, 'even, meat' = O.E. *efen, męte*. O.E. *ā* was 'rounded' into *ǭ* in Southern and Kent. and in some Midland dialects, as in *ston* (Northern *stan*) = O.E. *stān*, 'stone;' and new-long *o* was levelled under it in such words as *over* = O.E. *ofer*. O.E. *ī, ē, ǣ, ū, ō* were kept unchanged, as in *wīn, kene, lǽden* (*leden*), *hus* (*hous*), *mone* = O.E. *wīn*, 'wine;' *cēne*, 'bold;' *lǣdan*, 'lead;' *hūs; mōna*, 'moon.' Diphthongs, whose second elements were written *y, w* in Late M.E., developed out of the weakening of O.E. *ᵹ* and *g*. Examples are: *dai* from O.E. *dæġ; wei*, 'way,' from *weġ; ēie, īe*, 'eye,' from Angl. *ēge; dawes* through *dazes* from *dagas; nēwe*, 'new,' from Angl. *nēowe* (W.S. *nīwe*); *dęu*, 'dew,' from *dēaw; bowe*, 'bow,' sb. from *boga; flōwen*, 'flow,' from *flōwan; sǭle*, 'soul,' from *sāwol*. Other consonant changes are that of *sċ* into *sh*, generally written *sch*, as in *fisch* = O.E. *fisċ*; Scandinavian *sk* remaining unchanged, as in *skin*. Initial *ġ* became consonant *y*, as in *ȝard, ȝung*. O.E. *hr, hl, hn* became *r, l, n*, as in *ring* = O.E. *hring;* O.E. *hw* being generally written *wh*, as in *what* = O.E. *hwæt*.

Inflections.—The simplification of the O.E. inflec-

tional system in M.E. is mainly the result of phonetic changes, the most important of which are the levelling of all unaccented vowels under *e*, and of inflectional *m* under *n*, by which, for instance, the O.E. *-an*, *-en*, *-on*, *-um* were all levelled under *-en*; *n* itself was then often dropped in the Southern dialects. The striving after clearness and symmetry led to further changes. Already in Early M.E. the masc. pl. ending *-es* was extended to neuters, as in *wordes* by the side of *word*. The *-en* of weak nouns (*namen*) was restricted to the pl., the nom. sing. *name* being extended to the oblique cases of the sing. In the strong feminines the *e* of *care* was extended to O.E. *synn*, &c., making it into *sinne*, which was now invariable in the sing. like *name*, by whose analogy it then took *-en* in the pl. (*sinnen*). This paved the way for the loss of all inflections except the gen. sing. *-es* and the pl. endings *-es* and *-en*, which last unfortunately has only survived in isolated forms, such as *oxen*.

The adjective inflections were simplified in the same way, till at last there remained nothing but the distinction between *gōd man* and the pl. *gōde men*, definite *þe gōde man*, *þe gōde men*. The definite article extended its *þ* to the nom. sing. masc. and fem., which finally ran together into the indeclinable *þe*; *þat* was restricted to its demonstrative meaning, and extended to the masc. and fem. The neuter *þis* was extended in the same way. Its pl. *þās* was identified with the old pl. *þā* in its demonstrative sense, and so came to be the pl. of *þat*, a new pl., *þise*, *þese*, being formed from *þis*.

The M.E. verb retained the O.E. structure on the whole, but a large number of strong verbs assumed weak inflections. The chief changes are in the pl. pres. Southern keeps the old *-aþ* (*we bindeþ*), but Midland levels it under the *-en*, *-on* of the subj. and pret. (*we binden*), and Northern changes *-eþ* into *-es*, which it often drops (*bindes*, *we bind*). This last form passed first into Midland, then into Modern English.

Syntax.—The inevitable result of the loss of inflections was the loss of grammatical gender and concord, and the introduction of a strict and logical word-order. Prepositions had to do the work of cases, and the only remaining case, the genitive, was more and more restricted in its use. Altogether M.E. is grammatically on a level with modern Danish, which shows that there is no need to attribute its syntax to French influence.

MODERN ENGLISH.—In the modern period, the predominance of the London dialect is confirmed, having been further strengthened by the introduction of printing in 1477, which by degrees led to the adoption of a fixed orthography.

The main distinction between M.E. and Early Mn.E. is the loss of final *e*, which made the adjective indeclinable, and broke down the grammatical and metrical system of Chaucer's language, and made a new departure necessary. The Mn.E. vocabulary becomes even more composite than before; not only new French words, but Dutch, Italian, and Spanish, are adopted; Greek as well as Latin words are gradually popularised in vernacular prose, which, in the Early Mn.E. period, is clumsy and unidiomatic.

Spelling.—The dropping of final *e*, together with the shortening of double consonants—by which the M.E. distinction between *sunne*, 'sun,' and *sune*, 'son,' was done away with—led, after much confusion, to the practice of adding a final *e* to denote a long vowel, as in *wine* = M.E. *wīn*, and doubling a consonant to indicate a preceding short vowel, as in *penny* = M.E. *peni*. Through the influence of the spelling reformers, *i* and *u* were assigned to the vowel-sounds, *j* and *v* to the consonant-sounds, instead of being used at random; and *ee* and *oo* were restricted to the close M.E. sounds, as in *see*, *moon*, the open sounds being expressed by *ea*, *oa*, *e*, *o*, as in *sea*, *stone*.

Phonology.—In Early Mn.E. the M.E. short vowels were kept unchanged, except that in the court pronunciation *a*, as in *man*, was fronted to its present sound; *ā* in *name* underwent the same change, the resulting *ǣ* being afterwards narrowed to the sound of the *e* in *there*; *ī* and *ū*, as in *wine* and *house*, were diphthongised by degrees into something like the present sounds—*wəin*, *həus*. Close *ē* and *ō*, as in *see* and *moon*, were moved up into the vacant places, becoming *ī* and *ū*, the open sounds in *sea* and *stone* remaining unchanged. Of the diphthongs, *ai*, as in *day*—under which *ei*, as in *they*, was often levelled—became *æi*, and then *ǣ*; *au*, as in *saw*, was kept, and then became a very broad long *o*, nearly as in the present pronunciation; *ōu* and *ǭu* seem to have run together into *ou* or *ǭu*, as in *flow*, *soul*; *ęu*, as in *dew*, was kept; *ēu*, as in *new*, became *ǧu* with French *u*, and *ǧ* in words of French origin, as in *tune*, underwent the same change: *nǧu*, *tǧun* = M.E. *newe*, *tun*.

Front *gh*, as in *night*, was kept in the earliest Mn.E., but was generally dropped with lengthening of the preceding vowel, so that *night* passed through *nit* into *nəit*. Back *gh*, as in *laugh*, was rounded into nearly the sound of *wh*, which towards the end of the Early Mn.E. period passed into *f* in many words; *l* developed an *u* before it in such words as *fall* (written also *faull*), *folk*, and was then dropped before another consonant, as in *folk*; *k* and *w* were still pronounced in such words as *know* and *write*; *r* was kept before consonants, as in *hard*.

In Late Mn.E. *æ* was lengthened before certain consonants, as in *father*, *glass*. Towards the end of the 18th century, this *ǣ* was broadened into its present sound *aa*; *u*, as in *come*, was unrounded into nearly its present sound, being afterwards re-rounded into *u* after lip-consonants, as in *pull*. The vowels in *sea*, *stone*, were narrowed into close *ē*, *ō*, the former passing into *ī* in the 18th century; *ǧu* in *new* became *iu*, whence 18th-century *jū*; *kn* passed through *nh* (voiceless *n*) into *n*; *w* was dropped before *r*, as in *write*.

The present English sound-system is characterised by its great obscuration of the vowels of unaccented syllables, most of which are reduced to *ə*, as in *national* (pronounced *næshənəl*, in Early Mn.E. *næsjonæl*), or an obscure *i*, as in *carriage* (pronounced *kæridzh*); by its diphthongisation of nearly all long vowels, as in *neim*, *stoun* = *name*, *stone*; by its broadening of long vowels before *r*, as in *care*, *their*, compared with *came*, *they*, *r* itself being weakened to *ə* when not followed by a vowel (*keə*, *keəring*), or dropped entirely, as in *farther*.

The English dialects of Scotland and Ireland are no longer spoken in their purity by the educated. Scotch still preserves the pure close monophthongic vowels in *name*, *stone*. Irish keeps up the distinction between *sea* and *see*. Both, as also most of the dialects in England, preserve consonantal *r* in *hard*, &c. But on the whole, standard English pronunciation is quite as conservative as that of the dialects: compare *fall* with Scotch *fa'*. Most of the dialects in England—as also the vulgar London dialect—drop the *h*, and its preservation is mainly due to the conservative tendencies of the educated London dialect. American English often sides with the dialects against the present standard English, and is developing many peculiarities of its own. It never drops the *h*. Australian English has, of course, diverged less, and its vulgar dialect is quite 'Cockney' in character. See DIALECT, and AMERICANISMS.

Structure of Living English.—The characteristics of a language should always be sought in its spoken form, for the literary language is nothing but a

mixture of living and dead colloquialisms; even the most archaic literary forms, such as *thou hast*, were once colloquialisms.

Living English is essentially an *uninflectional* language, having nothing in common with such a language as Latin. It has no conception of an accusative case, of the subjunctive mood, of grammatical gender, or concord. It thus stands in a certain opposition to most of its European contemporaries.

The history of the loss of the older distinctions has been already traced. We now have to consider the processes of *re-construction* which have made English what it is—an isolating language with incipient agglutination.

The main reconstructive agent in English—besides the extended use of prepositions and auxiliaries, and a rigid word-order which we see in other modern languages—is *stress* or accent. One result of it is *gradation*, by which many words in common use appear in two forms, one emphatic, the other (with obscured vowel, or curtailed in some way) unemphatic, often with strong divergencies in meaning and use. Such a word as *have* has, indeed, three gradations: (1) *hæv* with strong stress (*you will have to do it*); (2) *hæv* with weak stress (*to have it done*); (3) *həv, əv*, as an auxiliary (*where have you been?*). The unemphatic forms are often run together with the next word, as in *ail not, ai shaunt = I will not, I shall not.* Stress is also used to form *attribute-groups*, as in *a good-natured man* with stress on *good*, compared with he is *good-natured* with equal stress. So also in *employer's liability for injury bill*, the strong stress on *injury* binds it with all the preceding words into one attribute-group. This enables the language to dispense with inflection and concord.

The most archaic part of English grammar is the pronouns. Here we find the last remnants of adjective-inflection and concord in the distinction between *that, this* and *those, these.* The distinction between nom. *I* and acc. *me* still survives in form, but not in spirit, for *me* appears as a nom. in *it is me*, and *I* is really not much more than a prefix to the verb.

The most elaborate reconstructions are those which have built up the verb with a few auxiliaries—*be, have, shall, will, do, go*, &c.—aided by gradation and agglutination. The future is fully expressed, with subtle distinctions in the use of *will, shall, go*, &c. There is a peculiar distinction between 'definite' and 'indefinite' tenses. Thus the definite *he is writing a letter* implies 'at the present moment,' while *he writes a letter* excludes this, implying 'every day,' 'now and then,' &c. Every tense makes a distinction between an 'unemphatic' and an 'emphatic' form (*I saw, I did see; aiv sijn, ai hæv sijn*), and has special forms to express *negation* (*ai sij, ai dount sij*), and *interrogation* (*ai sij, duw ai sij*). These distinctions cross one another in various ways (thus there is a *negative interrogative emphatic* form), giving in all eight 'modes' of the English verb.

The extensive use of the gerund in *-ing*—which arose from a blending of the old partic. pres. in *-ende* with the substantive ending *-ung, -ing*, as in *leornung*, 'act of learning'—combining, as it does, the syntactical peculiarities of substantive and verb, gives great flexibility and conciseness to the English sentence, as in 'I remember seeing him,' 'he insisted on my staying the night.'

The comparative symmetry and simplicity of English grammar is strongly contrasted by the imperfections of its vocabulary: (1) Allied ideas are expressed by unconnected words, *sour milk, lactic acid;* (2) distinct ideas are expressed by the same sounds, *bear* (vb.), *bear* (animal), *bare* (adj.); (3) even where there is connection between the words, it is disguised by stress-shifting and sound-change: *photograph, photography* (foutəgræf, fətogrəfi); (4) the want of the power of creating new words on an English basis. These defects—aggravated by our unphonetic spelling—make the English vocabulary difficult of mastery both to uneducated natives and to foreigners.

SPECIMENS.

1. *Old English, from the Chronicle* (*Early W.S.*).

878. Hēr hiene bestæl se hęre on midne winter ofer twęlftan niht tō ċippan-hamme; ǫnd ġeridon West-seaxna lǫnd ǫnd ġesǣton; ǫnd miċel þæs folces ofer sǣ ādrǣfdon, ǫnd þæs ōþres þone mæstan dæl hīe ġeridon ǫnd him tō-ġeċierdon, būton þǣm cyninge Ælfrede: ǫnd hē lytle werede unīeþeliċe æfter wudum fōr ǫnd on mōr-fæstennum.

Mercian Forms: hine . ġesǣton . ġeċerdon . unēþeliċe. *Late W.S. Forms:* hyne . and . land . ōþeres . hȳ, hī . ġecyrdon . þām . unȳþeliċe . mōr-fæstenum.

Translation.—Here (at this date) him-self stole the (Danish) army at mid winter after twelfth night to Chippenham; and rode-over West-saxons' land and settled (on it); and much of-the people over (the) sea drove, and of-the rest the greatest part they rode-over and to-themselves to-turned (subjected), except the king Alfred: and he with-little troop uneasily (with hardship) throughout woods went and in moor-fastnesses.

2. *Early and Late Middle English* (*London Dialect*).

From the Proclamation of Henry III., 1258.—Wē hoaten alle ūre trēowe in þe trēowþe þæt hēo us ǭȝen þæt hēo stedefæstlīche healden and swerien tō healden and tō werien þǭ isetnesses þæt bēon imakede and bēon tō makien þurȝ þan tōforen-iseide rædes-men.

Early W.S.: hāta þ . ealle ūre trēowan . þǣre trēowþe þe . hīe . āgon . tō healdenne . þā geseċttnessa þe bēoþ . þǣm tōforan-gesegdum rædes-mǫnnum.

Translation.—We bid all our faithful (ones) in the fidelity that they to-us owe that they stedfastly keep and swear to keep and preserve the decrees that are made and are to make (be made) through the before-said councillors.

From a Petition of 1386 [ȳ = u].—Tō the mǫost nǭble and wōrthiest lǭrdes, mǫost ryghtful and wȳsest cōnseille, tō owre lige lǭrde the kyng cōmpleynen, if it lȳke tō you, the folk of the mercerȳe of Lōndon as a membre of the sāme citee of many wronges ydō tō hem.

3. *Early Modern English.*

(To show the pronunciation; the vowels generally as in Italian: *y* = French *u*, *ə* as in *err.*)

Mutsh gan dhei praiz dhe trīz so strai(h)t and hei, dhe sailing pein, dhe sędar prəud and taul, dhe vein-prop elm, dhe poplar nevər drei, dhe bildər ǭk, sǭl king ov forests aul, dhe aspin gūd for stāvz, dhe seipres fynəral.

4. *Living English* (*London Dialect*).

ei wənz həəd ən əmjuwzing stǭri əv tuw ingglishmən, huw keim tu ən in in səm eut ə dhe wei pleis, ən stopt dhēər ə fǭtnəit widhəut spijking tə wənənədhə. ət dhi end əv dhæt təim ə frenshmən keim, ənd in wən dei hij meid frendz widh dhe tuw ingglishmən seprətli, ənd intrədjuwst dhəm tə wənənədhə.

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English Literature is, in its largest sense, the mind of the English-speaking races, expressed in successive generations by the fittest representatives of each succeeding form of thought. All conflicts of opinion through which decisive action has been reached lie, with their opposing arguments and with the passions they excited, in the books that form the literature of a people; these show for each nation, in strength and weakness, all the workings of the mind that shaped its history. Such a literature must express also the slow forward movement towards higher civilisation, coloured variously by the influences of race and climate, and brought home to us by fellow-feeling with the individualities of earnest men.

Before the English came with power into Britain there was a Celtic population of the Gael and of the Cymry, each with a literature diffused chiefly by rhythmic recitation. Many traditions of later invention, with perhaps a few snatches of the oldest song, that passed with no great change from lip to lip of generations living in some secluded home among the hills, carry the mind back to a Gaelic literature that gathered much about Fionn, Oisin, and a battle of Gabhra, said to have been fought in the year 284. In like manner we have traces of a Cymric literature, strongest in the time of battle for home and country against English invasion. Tribes of the Celts in Britain gathered their forces for a last firm stand, and were overthrown at Cattraeth; Aneurin's poem, the *Gododin*, which celebrates the chiefs who fell, tells us of this battle. To the battle of Cattraeth there has been a date assigned, the year 570. If King Arthur ever lived, he lived in that 6th century, and shared its struggle.

By the year 570 the settlements of English on our eastern and southern coasts had made sure their predominance. Various Low-German tribes from the other side of the North Sea (see ENGLAND) had been finding their way over to our eastern and southern coast for many years before the time of the six settlements which Bede described (449–547). Their original differences are still marked in our dialects, in differences of frame and feature, and even of character. In our literature the traces of such difference are at first very distinct, and they have at no time been altogether lost.

At first the strength of English literature was in the north. Little wealth had been drawn from the meadow-land among the mountains of Scandinavia. Its seas could be fished only by men strong to brave the waves of the Atlantic. Outward nature was alive with wonders that quickened imagination, and with necessities that called upon the energies of men. Wealth was only to be had by plunder, and a young Norseman counted for little among his neighbours until he had brought home his first shipload from a viking expedition. Such energy of Northmen from the shores of Sweden, Norway, Jutland, who were not particular as to the nationality of any strong man who sailed with them, first gave its stamp of vigour to the north of England. They came, not Christians, and were here first brought under the influence of Celtic monks and priests, who were devoted to their missionary work, and among whom women were fellow-workers. The Celtic people of the north, yielding to the new-comers the fertile land, kept their flocks and herds upon the hills. The two peoples were neighbours who had reason to respect each other. From time to time there would be intermarriages, and then began that gradual admixture of Celtic with Teutonic blood which has added a new vigour to the English race.

The fervour of the Celt brought to the conversion of the northern English a noble zeal and self-devotion. The abbess Hilda, who drew Cædmon into the fellowship of her monastery at Whitby, in which men and women worked together for the spreading of the gospel, was taught in the Columban school. The work of Cædmon was to spread among the people knowledge of the chief truths of religion, in what is now called a 'paraphrase,' that took the form of poems shaped for recitation by the people to each other upon festival occasions, and by the men who made it their vocation to chant tales of battle and adventure. It is a time of strength in any literature when men's minds are occupied by some great interest that touches the essentials of life. The strength of the old Greek literature was brought out when patriots fought for their homes against the power of Persia. In the beginning of our English literature, strength came from the spiritual war to extend the kingdom of Christ. Cædmon died about the year 680;

and Bede, who tells us of him, was in the year 680 a child of seven. Aldhelm, whose English songs, familiar in King Alfred's time throughout the country, are now lost, was then a young abbot of twenty-four, who had devoted his life and fortune to a work at Malmesbury like that of the abbess Hilda at Whitby. With these monasteries were associated many forms of labour for advance of civilisation, including, of course, the formation of schools. Bede in the monastery at Jarrow became the first great teacher. He shaped, in Latin, manuals for use in education, and thus his works serve as an encyclopædia of the best knowledge of his time. He gathered also, by wide inquiry, materials that were digested into the first History of England; that was his *Ecclesiastical History*, finished in 731. The history of the church in those first days was inseparable from that of the people among whom it had laboured in its missionary work.

The 8th century, to which Bede's work belongs, was the golden time of our First-English or Anglo-Saxon literature. In some monastery, perhaps not far from Whitby, a monk who found delight in the old tales of the Norseman and the Dane had shaped into the language of his country what probably had come with its Teutonic settlers as a saga of the Danes. With a few short interpolations of Christian thought, this old poem, named from its hero *Beowulf*—its writer is unknown, and it is assigned usually to more than one—reproduces all the features of life in the north before it had been touched by Christianity. Thus our English literature begins with two great poems, one heathen, the other Christian in essence. Each of these works, the greatest that remain to us in First-English, survives only in a single MS. With few exceptions the other pieces of First-English literature have as narrowly escaped total destruction. We owe our knowledge of them to the preservation of two MS. collections; one known as the Exeter Book was presented by Bishop Leofric, near the time of the Norman Conquest, to Exeter Cathedral; the other is the Vercelli Book, which was discovered in 1822 in the cathedral at Vercelli. One poet's name is preserved—Cynewulf—interwoven by himself in runes with pieces of his verse. He wrote *Elene* and other church legends in verse of considerable merit, but his date is doubtful. Probably he lived in the 8th century. In that century of greatest energy of thought among the Anglo-Saxons, the empire of Charlemagne drew light from a Yorkshireman, Alcuin, who was appointed to do for its monasteries and their schools what might be called the work of a great minister of public instruction. He had been born in 735, the year in which Bede died, and it was in 782 that he took up his residence at Aix-la-Chapelle.

But when Alcuin died in the year 804, the simpler question of the establishment of Christianity had passed into the more complex forms of battle against heresies, of struggle to maintain full uniformity of theological opinion. At the same time advance of thought was being checked in England. There were continued attacks of the Northmen, some of whom were trying the mettle of King Alfred, at the same time that others were following Rollo up the Seine to lay the first foundation of the Norman power. Those who followed Rollo in 876 learned in Normandy the language of the women of the country from which their descendants afterwards crossed over to England to make conquest of a kindred people. In the 9th century John Scotus Erigena, born possibly in Ireland, possibly in Ayrshire, was an acute thinker established at the court of Charles the Bald. He wrote a Latin book *On the Division of Nature*, which, by its endeavour to bring the teaching of theology into philosophical harmony with other teaching in the schools, yet without opposition to a single dogma, laid the foundation of what is called the Scholastic Philosophy.

King Alfred was then living, and working strenuously for the revival of lost learning. Ruin of a monastery meant in those days the annihilation of a school; and the ravages of the Danes had caused such decay of learning that in re-establishing the ruined schools Alfred translated the most important books of the schools into the language of the people. For Latin could no longer be the language through which studies were pursued. Orosius, whose *Universal History* had been a school-book, was thus translated, with omission of whatever was not practical, and with addition of new geographical detail. Bede's History was translated. A favourite school-book for ethical training had been Boëthius *On the Consolation of Philosophy*. That also was translated by King Alfred. For the higher training of the clergy the king, justly named Great, turned into English Pope Gregory's book on the *Pastoral Care;* and to him also is ascribed the foundation of the continuous record of the annals of the country, known as the *Saxon Chronicle*, which now and then had afterwards an entry in verse, especially, under the year 937, a poem on the battle of Brunanburh (q.v.). The noble work of Alfred, who died in October 901, filled his kingdom of Wessex with new life, and the centre of intellectual energy was thus removed from north to south. The work of Alfred's son and grandson spread this new influence, until, in 954, the grandson, Eadred, free of the last of the under-kings, ruled over all England from the Channel to the Firth of Forth. The centre of intellectual energy was then the midland region, which included the five burghs that had been strongholds of the Danes in Mercia. But after the death of Alfred, First-English literature passed into work associated with honest endeavour to restore religion by restoring strictness of monasticism. The chief interest of this period for us is in the *Homilies* of Ælfric, who wrote books also to aid his work of teacher in the school at Winchester. Ælfric's *Homilies* were upon the series of days kept holy by the church, and thus we have in them an exposition of the doctrines of the Church of England at the end of the 10th century. The first of the two sets in which they were arranged was written in the year 990. A poem on the battle of Maldon in the year 994 tells a victory of the Danes over Byrhtnoth, who was killed in the battle. It has much of the old spirit of the poems written, as this also was, for recitation to the people. It differs, however, from the older work in being a plain record of facts, not wanting in animation, but without the play of fancy that transforms the real into the mythical by painting some strong enemy as giant or fire-breathing dragon.

The Norman Conquest brought a royal court in which French was familiar, while Latin was the common language of the learned throughout Europe. Friends of the Conqueror held all the places of high trust, and of those who had money to spend few would pay it for written records of the English pieces still recited to the country-people. From 1066 till about the year 1200, except in a few religious writings of no great importance, English literature speaks the thoughts of Englishmen through French or Latin. The literature in the language of the people had not ceased to be; but there was nobody who cared to put it upon record. Even where it was already written, it might be rubbed from the parchment to make a palimpsest in which English was replaced by French or Latin.

Of the English literature written in Latin after

the Norman Conquest, a very large part was monastic chronicle. Every great religious house set up its chronicle, which might begin with Adam or with Hengist and Horsa, but which, wherever it began, was a compilation of no value till its record came near to the date of writing. Then it included facts yet within living memory, and became more and more valuable as a record of the past, until it became, for the occurrences of each successive year, the testimony of a living writer. From these chronicles we have our surest knowledge of the past. They were written usually by men whose sympathies were with the church and with the people, who cared little for pomp and show, but had clear notions about duty. There was strength of England and in their practical simplicity. The most important of the monastic chroniclers were Ordericus Vitalis, who wrote an *Ecclesiastical History of England and Normandy*, and William of Malmesbury, who wrote a *History of English Kings*. Each closed his chronicle and probably his life about the same time, 1141–42. In William of Malmesbury the arrangement of the narrative showed a chronicler who had the genius of a historian. Milton placed him next to Bede. About the year 1147 a stream of romance broke from among the hills in the *History of British Kings* —British as distinguished from English—by an imaginative Welsh ecclesiastic, Geoffrey of Monmouth. This Latin chronicle, enriched by its author's fancy, began with the mythical origin of Britain in Brut, a great-grandson of Æneas, and went on through tales of kings, as Gorboduc and Lear, from which our poets afterwards drew subjects for their verse. These led to stories of King Arthur, who in this book came to life again, and became the hero of that cycle of romance in English literature which answers to the cycle of the Charlemagne romance in France and Italy. Geoffrey of Monmouth's Chronicle was abridged by Alfred of Beverley; it was turned into French verse by Geoffrey Gaimar and also by Wace, whose version supplanted Gaimar's and abides in literature as Wace's *Brut*. Romances of Arthur, Merlin, Lancelot, Tristan, were supplied abundantly as the demand for them increased. Walter Map was a man of genius, who was chaplain to Henry II. He attacked abuses of the church with witty Latin poems, that set forth a Bishop Golias as type of the fleshliness in which the spiritual life of the church was being lost. Walter Map arranged the chief Arthurian tales into a sequence, and put soul into them by uniting them inseparably with the spiritual allegory of the Holy Grail. Thus, within forty years after they had first come into our literature, the tales of King Arthur were associated, as they still are, with the spiritual life of the English people.

After the year 1200 English regained its place in literature as the language of the country, and we have an increasing number of MSS. containing works by Englishmen written in English, as well as in French and Latin. To a date near 1205 is assigned an English poem of about 56,000 lines, in which the famous story told by Wace in French was told again by Layamon, a priest living near Bewdley by the Severn. Layamon's *Brut* is the first great piece of literature in Transition English, and near to it in date is a large fragment of a work named from its author, a canon of St Austin's order, Brother Orme or Ormin, the *Ormulum*. This was a metrical arrangement of the series of gospels appointed to be read in church throughout the year, set forth in simple narrative, each of them followed by a little homily upon it, written in like manner for pleasant recitation to the people. To this period belongs also the rise of the Robin Hood and other ballads, and the telling in English verse of metrical romances, such as those of *Havelok* and of *King Alexander*, that at first were told in French.

The foundation of the Dominicans as preaching friars for the maintenance of orthodoxy in religion, and of the Franciscans for the spread of the religious life by brotherhood with the poor, was in the beginning of the 13th century. Books being forbidden property to the Franciscans, they escaped from bondage to their records of opinion, looked straight to nature, and advanced the knowledge of the outward world. The first rector of a Franciscan house at Oxford was Robert Grosseteste, who in 1235 became Bishop of Lincoln, and made strenuous war against abuses of the Roman government of the church. He found that three times the revenue of the king of England was being paid for the support of absentee Italians, to whom the pope gave English church livings. Roger Bacon, who settled at Oxford as a Franciscan under Grosseteste, died after the year 1294, and had produced the most advanced body of scientific knowledge, the result of independent thought and experimental research, then to be found in Europe. He set it forth in his *Opus Majus*, *Opus Minus*, and *Opus Tertium*, all poured out in fifteen months to satisfy the pope's request for an account of what he knew. Robert of Gloucester's chronicle from the siege of Troy to the death of Henry III. in 1272 put English history into verse for diffusion among the people, still chiefly by recitation. In the reign of Henry III. appeared in October 1258 the first proclamation in English since the Conquest. There was not another in that reign. At the close of the 13th century the wisdom of the people was gathered also into the metrical *Proverbs of Hendyng*.

At the beginning of the 14th century the religious spirit of the people was expressed by Robert of Brunne's metrical version—as the *Handlynge Synne* —of a *Manuel des Péchés* that had been written in French by a Yorkshireman, William of Wadington. There was in the popular poem of 'The Land of Cockaigne' a homely satire on the sensualism that had spread among the monks, who now had too much to live upon and too little to do. The miracle-plays that first came into use after the Conquest had developed greatly. Early in the 14th century long sequences of Bible story, then first set forth in the language of the people, were so dealt with by trade-guilds as to be a great means of bringing the Bible into the street, and vividly presenting to the people the events on which the forms of their religious faith were founded. Such sequences of miracle-plays have come down to us —the Chester, the Coventry, the Wakefield or Towneley, and the York. There are known to have been more than these, and they did not wholly go out of use until the reign of Elizabeth. Englishmen then had Bibles to read in their own tongue, and had learned to read them, so that there was no more need for the device of an *Ormulum* or of a sequence of miracle-plays to show what they contained.

While English literature was in such ways the voice of the nation, the genius of Dante had raised literature in Italy to its highest artistic form, the higher for close union with all that was felt to be most real in life. The year 1300 is the assumed date of the *Divina Commedia*. Dante, who died in 1321, was followed by Petrarch (born in 1304), and by Boccaccio (born in 1313). Petrarch and Boccaccio were the great living poets of Italy when Chaucer's genius was being shaped in England. They died nearly at the same time—Petrarch in 1374, Boccaccio in 1375, when Chaucer was in ripest manhood, and the better artist for the influence these great Italians had upon his work.

But energies of thought in care about essentials were the main cause of the strength of English

literature in the 14th century. There was continued provision of monastic chronicles, also of religious poems, one of them, the *Cursor Mundi*, of great length. But a new mind found utterance. Decay of spiritual life in the church, as its wealth became its weakness, and caused poets and reformers to lament 'the fatal gift of Constantine,' had given cause for earnest questionings and struggles for reform. At the university of Paris, in 1324, Marsiglio of Padua had controverted the sacerdotal limits of a church, had declared only Christ the judge of heresy, and had broken with the medieval view of papal authority. In this country William of Ockham, called the invincible doctor, argued boldly against the pope's power in temporal affairs. It was he who brought the Scholastic Philosophy to a close by reasoning upon doctrine without faith in the infallibility of dogma. The great movement of the 14th century towards reform was prompted by visible corruption. Wyclif himself as a reformer looked at first mainly to discipline, with which questions of doctrine became gradually more involved. For seventy years, from 1309 to 1378, the popes were at Avignon under French influence, and this quickened English resistance to their claims. For the next forty years or more the influence of the papacy was further weakened by the rivalry of two popes, one in France and one in Italy. Thus, while John Wyclif, who died on the last day of the year 1384, having secured between 1360 and 1382 a complete translation of the Bible into English, represented in our literature of the 14th century a strenuous reform movement within the church, William Langland, in a great poem addressed to the people at large, the *Vision of Piers Plowman*, sought to animate men to the search for Christ, and battled vigorously with church corruptions. Five great pestilences in the 14th century—the greatest the Black Death of 1348–49—were regarded as signs of divine wrath against sin, and added much to the intensity of feeling. Langland, who wrote his Christian poem, which made love 'the triacle of heaven,' between 1362 and the close of the century, seems to have been urged to utterance by the great pestilence of 1361.

The Jack Straw rebellion of 1381 caused John Gower, a wealthy gentleman, religious, liberal, and with distrust of Wyclif's followers, to seek the source of all ills of the land by a review in his Latin poem, *Vox Clamantis*, of all orders of society. In this, although an orthodox churchman warning against heresies, and one who had no sympathy with popular violence, he wrote with emphasis of the corruption of the papacy and the gross appetites of the religious orders. Gower wrote three great books, and wrote them in what still were the three languages of English literature. Of his book written in French only the name remains, *Speculum Meditantis;* that in Latin was the *Vox Clamantis*. In his English poem, the *Confessio Amantis*, Gower, like Chaucer, followed the lead of Boccaccio's *Decameron* in threading together upon a connecting narrative a series of tales. Like Chaucer's, they were told in verse. Gower's tales were moralised to illustrate the seven deadly sins, and one book dealt with a question pressed on the country by the gross misrule of Richard II., the duties of a king. Gower lived until 1408, blind during the last eight years of his life. Geoffrey Chaucer died in 1400. In the *Canterbury Tales*, with their Prologue and the rest of the connecting thread of narrative, as well as in other writings, Chaucer shows a genius akin to Shakespeare's. Not only is there a rare dramatic power manifested clearly, though there was not yet a drama, but he had also the calm sense of highest truth, and that kindly breadth of human sympathy without which a power such as Shakespeare's cannot be. In his other poems Chaucer seems in earlier life to have been influenced by the French poets fashionable at court; but he came more and more under the influence of the great Italian masters. His *Troilus and Cressida* and his *Knight's Tale* are free versions of two of the most famous poems written by Boccaccio, and the influence of Dante was upon his later work. In the north, while Chaucer wrote, the spirit of liberty maintained by the endeavours of the kings of England to extend their sovereignty beyond the Tweed produced from John Barbour, Archdeacon of Aberdeen, his poem of the *Bruce*, which was half-finished in 1375. Barbour wrote also a collection of church legends which were printed in 1881–82.

In the earlier half of the 15th century there were many influences adverse to the maintenance of the high standard of English literature. There were civil wars and there was foreign war of aggression, part of the endeavour of the kings of England to maintain and extend sovereignty in France. None of these wars were inspiring to the men on the south side of the Tweed. Scots and French were driven to alliance against a common danger; and in battle for their independence the Scots bred the better poets. In England at the beginning of the 15th century there were, indeed, two poets of mark, John Lydgate and Thomas Occleve or Hoccleve, each of them about thirty years old when Chaucer died. Hoccleve was a clerk in the office of the Privy Seal, who wrote in English his chief poem *De Regimine Principum*, on the duty of kings, that it might be humbly presented to King Henry V. as a reminder to him that Hoccleve and other clerks in the government service could not get payment of their salaries. Without disloyalty Hoccleve pointed out the evil of aggressive war. John Lydgate, an accomplished monk of Bury St Edmunds, had travelled in France and Italy before he became the most famous teacher in his time of rhetoric and poetry. He drew many to the monastery school of Bury St Edmunds, and himself wrote much good verse that was in high repute. Besides many short pieces and lives of saints, he wrote especially three larger poems—one was his *Troy Book*, on the siege of Troy; another was the *Story of Thebes*, with a pleasant introduction linking it to Chaucer's *Canterbury Tales;* the third, his most important work, was the *Falls of Princes*, a version through the French verse of Laurent de Premierfait, from the Latin prose of Boccaccio's *De Casibus Illustrium Virorum*. James I. of Scotland, captured as a child, instructed in English manners as a prisoner at the English court, married to a cousin of Henry V., and crowned at Scone in 1424, was too manly to be made a puppet in the hands of England. His poem the *King's Quhair*, which celebrates his love for Jane Beaufort whom he married, is one of the best pieces written as in the school of Chaucer; and if he was also the author of a piece so homely and vigorous as *Peebles to the Play*, with its humorous scenes of life among the people, he had a master's breadth of power.

Wyclif's followers were rigorously persecuted in the earlier years of the 15th century. John Huss was burned in 1415 by the Council of Constance, three or four months before the battle of Agincourt. On Christmas-day in 1417 a noble-hearted gentleman, Sir John Oldcastle, Lord Cobham, who had befriended the Lollards, was hung by the middle from a gallows with an iron chain and roasted alive. That was one stage on the way from Wyclif to Luther. In 1449 Reginald Pecock was raised from the bishopric of St Asaph to that of Chichester, and on the part of the bishops undertook an answer to the complaints made by the

Lollards against the higher clergy. The Lollards were forerunners of the men called afterwards Puritans, who wished for a church with all its rites and ordinances founded upon Scripture and freed from the traditions of men. Pecock's answer to them, called the *Repressor of over much Blaming of the Clergy*, a large work in English prose, admitted their right to be reasoned with, and gave to reason the same place that was assigned to it long afterwards by Richard Hooker, when he opposed the Puritan view at the end of Elizabeth's reign. There are, indeed, many points of resemblance between the arguments of Pecock's *Repressor* and those of Hooker's *Ecclesiastical Polity*. But Pecock, because he reasoned with the people in their own tongue, instead of compelling obedience, was condemned by his own order, and imprisoned for the rest of his life in Thorney Abbey; while Hooker for like service in a later time won honour as a champion of the church. Civil as well as religious liberty was represented even in our scanty 15th-century literature by Sir John Fortescue, Chief-justice in the reign of Henry VI. Fortescue, when his king's cause was lost and he was an exile in France with the queen and the young prince who might hereafter be king in England, gave to the prince a lesson on the limits of an English king's authority, comparing it with the absolutism of the king of France. He wrote like a sound constitutional lawyer on the *Difference between Absolute and Limited Monarchy*, and about the year 1463 *De Laudibus Legum Angliæ*. By that time new powers had begun to work in Europe for the shaping of the future. The capture of Constantinople by the Turks in May 1453 drove into exile many learned Greeks, who earned their living in Italy and elsewhere by teaching. They had a ready welcome at Florence, where Cosmo de' Medici was establishing his power. There began in this way a diffusion of Greek studies, through which Plato came to life again, and his doctrines came in strong aid of the movement against fleshly corruptions of the church. A saying that arose then, *Cave a Græcis, ne fias hæreticus*, shows the supposed tendency of these new studies. At the same time a new force, which would quicken greatly the formation of opinion in the world at large, was coming into life through the discovery of the art of printing with movable types. In 1455 the printing of a Bible with such types was finished. The working printers, presently dispersing, carried their profitable skill to other places. There was a press at Rome in 1466, at Paris in 1469, and the new art was brought into England by Caxton about 1477. The 15th century closed with another event fruitful of great consequences—the discovery of the New World (1492).

Luther and Raphael, born in the same year, 1483, were youths of eighteen in the first year of the 16th century; Michael Angelo and Ariosto were young men of twenty-six. The intellectual predominance obtained by Italy through the free life of her republics was not immediately destroyed by the establishment of petty tyrannies as single families won mastery over their fellow-citizens. The new lords, of whom Lorenzo de' Medici (who died in 1492) was a great typical example, spent freely the money of their subjects upon luxuries of art. They led the way in encouragement of every form of intellectual life that could keep active minds busy upon other questions than those which concerned their ancient rights. At the little Italian courts every gentleman was, to the best of his power, a small artist who cultivated ingenuity in clothes, in manners, and in words. When our English youth travelled, in Henry VIII.'s time, into Italy for polish, they brought home fashions of speech and writing that developed in new form an Italian influence upon our literature. This was not, as in Chaucer's time, the influence of one great writer on another, but the diffused social influence of a prevailing fashion.

Struggle for independence had raised poets in Scotland, of whom there is a long list in William Dunbar's *Lament for the Makers*, first printed in 1508, when Andrew Millar and Walter Chepman had just set up the first press in Edinburgh. Robert Henryson, schoolmaster of Dunfermline, shrewd, homely, and religious, author of the first pastoral in our literature, *Robin and Makyn*, of a sequel to Chaucer's *Troilus and Cressida*, the *Testament of Cresseid*, and of translations from Æsop's fables, was then dead. William Dunbar himself, the next great poet after Chaucer, was about forty years old when he received, in the year 1500, a pension of £10 Scots from James IV., whose marriage with Henry VII.'s daughter Margaret, in 1503, he celebrated with his poem of the *Thistle and the Rose*. It was probably in 1501 that Gavin Douglas dedicated to James IV. his poem of the *Palace of Honour*. In July 1513, two months before the disaster at Flodden, Gavin Douglas finished the earliest translation of the *Æneid* in our literature, with verses of his own to introduce each book. Gavin Douglas, become Bishop of Dunkeld, died of the plague in 1522, a pensioner at Henry VIII.'s court. Dunbar was dead in 1530. David Lyndsay, who became Sir David Lyndsay of the Mount, was associated with James V. of Scotland from his infancy, and addressed to him many admonitions on the sorrows of the people and the duty of a king. Lyndsay's *Satire of the Three Estates* was the most important example in our literature of the Morality Play that expressed moral teaching by the dramatic action of personified attributes and forms of life. It shadowed forth the reform wanted in the Church of Scotland; and the passing by the Estates in 1540 of what was called a friendly act of reformation was prepared for by the public acting of this satire in the presence of the king. Lyndsay's last poem, the *Monarchie*, was finished in 1553, and in this 'the Scottish poet of the Reformation,' as he has been called, becomes distinctly Lutheran. The vigour of these poets of the north was not equalled in the south under Henry VII., where Stephen Hawes, a gentleman of the king's chamber, wrote, among other poems, a *Pastime of Pleasure*, with an allegory of the course of life in knightly adventures, that show distinctly, but in form only, the advance of allegorical literature towards its crowning work in Spenser's *Faerie Queene*. John Skelton, who had been chosen for his scholarship to be a tutor to Henry VII.'s children, wrote in the reign of Henry VIII. satires against church corruption, in little torrents of short lines with continuities of rhyme, verse called Skeltonical. It poured out the complaints of *Colin Clout*, who represented the poor Englishman of country and of town, and it boldly attacked Wolsey himself in the height of his power. From Skelton, with whom he had fellow-feeling, Spenser borrowed afterwards for himself the name of Colin Clout.

Greek scholarship was still advancing, and was still associated with the free advance of thought. William Grocyn, having learned Greek in Italy, first taught it at Oxford in 1491. The physician, Thomas Linacre, who had also learned Greek in Italy, taught also at Oxford. In 1497, when Erasmus sought to learn Greek, he came from Paris to Oxford for it. John Colet, the founder of St Paul's School in 1510, and William Lily, its first headmaster, were Oxford scholars, associating their Greek studies with ideals of true life and a wise liberality of thought. Thomas More when at Oxford was inspired by these men, and his *Utopia* (Latin, 1516; Eng. trans. 1556) imagines a commonwealth in the New World lately discovered, and through playful wit brings thought

inspired by Plato and by Plutarch into the Christian ideal of a higher policy than statecraft yet had known. More sought also to bring home the teaching of the Gospels by a Latin paraphrase. Translation of the Scriptures into the language of the people had many learned advocates who were restrained only by fear of mistranslations that would, as they thought, corrupt the Word of God.

Luther's translation of the New Testament into German appeared in 1522. Tyndale's translation into English followed in 1525. Sir Thomas More was its adverse critic, because he found Lutheran bias in the choice of words. In 1530 Tyndale finished printing his translation of the Pentateuch, made with Miles Coverdale's help. In October 1536 Tyndale was strangled and burnt near Brussels. In the same year Coverdale's completed translation of the Bible was admitted into England, and work towards the production of a translation that would satisfy all judgments was continued (see BIBLE).

From Italy there flowed new streams of literature. The *Arcadia* of Sannazaro, finished in 1504, was in a form of pastoral that spread to other lands. The first eclogue of mark in France was Clement Marot's *Complaint on the Death of Louise of Savoy*, mother of Francis I., written in 1531, and paraphrased afterwards by Spenser in the eleventh eclogue of the *Shepherd's Calendar*. George of Montemayor, a Portuguese, produced in 1542 a *Diana Enamorada*, which joined force with the *Arcadia* of Sannazaro as an influence on English literature. Blended with influences from the Spanish romance of chivalry, it led to Sir Philip Sidney's romance of *Arcadia*, first published in 1590, after Sidney's death. Of the same parentage came also a long line of French romances, which continued far into the 17th century.

The modern drama, based upon the form of Latin plays then usually acted, had its rise in Italy. Ariosto first wrote comedies about the year 1498; his earliest, *I Suppositi*, was based on the *Eunuch* of Terence, and the *Captives* of Plautus. Trissino's *Sofonisba*, dedicated to Leo X. in 1515, and first printed in 1529, was the first Italian tragedy of mark. The Italian sonnet was first imitated in Henry VIII.'s reign by Sir Thomas Wyat and the Earl of Surrey. Experiments in unrhymed verse by the Italian poets led to the first use of blank verse in English literature, when the Earl of Surrey used it in translating two books of the *Æneid*, which had been so turned into Italian.

The great question of church reform became more passionate, and divided all Europe into two camps, which came to have their headquarters, one at Madrid, the other in London. Luther had died in 1546, when Calvin's age was thirty-three, and Calvin died at Geneva in 1564. Hugh Latimer preached before King Edward, and was burnt by Mary. John Knox, indignant against three ruling Maries, sounded from Geneva his *First Blast of the Trumpet against the Monstrous Regiment of Women*, just before the accession of Elizabeth. He could not make his peace with her, but, warned from England, he landed at Leith, and stirred Scotland to the heart with religious zeal. It had its aims in accord with the teaching of Geneva, but was associated by Knox with a masterly reshaping of provisions for the education of the people.

In Elizabeth's reign the struggle for all that they most prized, against Spain enriched by the wealth of the New World, lifted the hearts of men as the hearts of the old Greeks were lifted when they fought for freedom against Persia. Fashions and follies there were then as now, chiefly brought in from Italy, with an exuberance of ingenuity that touched alike the clothing of men's bodies and men's thoughts. Thus the Italian influence, which became dominant over outward forms, introduced that straining for conceits and dainty turns of speech, alliteration, and antithesis, which was so common as to need a name. It was called Euphuism from *Euphues*, the hero of a book by John Lyly, published in 1579, and written in the fashionable manner. Lyly wrote in that manner to win hearing. His aim was to advance a view of the need and nature of true education, which had been urged by one of the best scholars of the day, Roger Ascham, in his *Schoolmaster*, first published in 1570, two years after its author's death.

In the twenty-one years of Elizabeth's reign before 1579 English energies were growing. In that year Edmund Spenser, aged about twenty-six, produced his first book, the *Shepherd's Calendar*, following Clement Marot in his way of applying pastoral images to the religious conflicts of the time, and boldly taking his place beside the disgraced Archbishop Grindal, with whose firmness in encouraging free search for Scripture truth the poet was in sympathy. In the same book Spenser paid homage to Tityrus (Chaucer) as his master. He took the style of Chaucer for his model, avoiding the false emphasis laid on tricks of thought and phrase. Spenser was Chaucer's successor, Milton's predecessor. In the great fragment of his *Faerie Queene*, which represents man through all his powers for good striving heavenward, and attaining only by the intervention of the grace of God—of which Prince Arthur is the bearer—all militant forces of his time have their expression. The *Faerie Queene* is throughout an intense utterance of the spiritual life of England under Elizabeth, in all that were then the forms of the long battle towards a higher life for man. England was full of song. Men felt proudly the rising vigour of their country. A tailor (John Stow) was inspired to write its annals. An attorney (William Warner) wrote in verse of *Albion's England*. The defeat of the Spanish Armada in 1588 removed the common danger that had knitted Englishmen together. In 1589 the Marprelate tracts against the bishops, and the replies to them, brought oppositions of opinion in the English Church into that bitter conflict of which Francis Bacon, then twenty-eight years old, pointed out the unseemliness in a paper addressed to the government on *Controversies in the Church of England*. Shakespeare's age was then twenty-five. He had come to London probably when twenty-two, two years before the defeat of the Spanish Armada, and at that time the English drama was but twenty-five years old.

The first English comedy, *Ralph Roister Doister*, a version of the *Miles Gloriosus* of Plautus, had been written between 1534 and 1541 to be acted by Eton boys. It was a schoolmaster's chance substitution of English for Latin in a play written by him for his boys; and it was acted under conditions that would not prompt imitation. Its production, therefore, was an isolated fact. But the first tragedy, *Gorboduc*, by Thomas Sackville and Thomas Norton, acted in the Inner Temple at Christmas, 1560—actually on the first of January 1561—was a substitution of English for Latin in an English play written in the manner of Seneca, that drew to itself the attention of many young men who could write. Its grave dwelling upon the need of union to keep a people strong, a truth of deep significance to England at that time, pleased Elizabeth. The play was acted again before her, by command. It set an example that was followed at court, where English plays came into request. It showed also to young wits how they might furnish themselves with money by writing English plays to be acted by those gentlemen's servants who already had formed little companies for playing *Interludes*. Such interludes, short entertainments in dialogue by a few servants of the house, who used their skill in

mimicry for the amusement of their lord and his guests, produced a form of literature in which John Heywood excelled. But these short pieces had no developed plots. Desire grew towards the new way of showing tales in action. It was an improvement on the most dramatic recitation by a single story-teller. But in the twenty-five years from 1561 to 1586 few plays of high mark were produced. There was little more than a wide spreading of the taste for the new kind of entertainment, and a development of companies of actors. At length a civic opposition drove the actors privileged to play in London out of rooms and inn-yards in the city into buildings of their own, just outside the jurisdiction of the mayor and corporation, which they erected for sole use as theatres. These first theatres were built in 1576. Ten years afterwards Shakespeare came to London when the new conditions of the stage had made the way ready for plays of higher mark. John Lyly had produced court plays chiefly mythological. George Peele had already pleased the queen with his *Arraignment of Paris*. Christopher Marlowe began with *Tamburlaine* upon the public stage in 1586 or 1587, his short and brilliant career ending in 1593. Robert Greene, who died in 1592, Thomas Lodge, Thomas Kyd, and others maintained a poetical drama during the six, or about six, years of what may be called Shakespeare's apprenticeship. During these years he made himself generally useful, acted, and sometimes turned old plays into new. At the end of the six years this group of dramatists, the pure Elizabethan, passed away; and for the next six years, 1592 to 1598, in which Shakespeare was master, writing plays of his own, he seems to have had no strong competitors. But in or about the year 1598 many young dramatists —Ben Jonson, Dekker, Marston, Heywood, Middleton—who were to earn fame in the next reign began to write, while Shakespeare went on with his work, remaining foremost of all. Beaumont and Fletcher, Massinger, and Ford did not write any plays until after the death of Elizabeth. Webster wrote his two finest plays in the reign of James I., and emphasised, like others in his time, that element of terror in the drama which Aristotle had joined to pity. Webster lived into the middle of the 17th century. James Shirley, who was only nine years old when Elizabeth died, and who wrote plays chiefly in the reign of Charles I., lived until 1666, the last of those who are usually called Elizabethan dramatists. The period of highest achievement in our English poetical drama falls, then, within the first ten or twelve years of the reign of James I. But already in this best time of fruitage there are conditions of decay, which make it hard to say where ripening ends and rotting begins. The energies of struggle had developed a dramatic literature in Spain as in England. Influence of the Spanish drama, coinciding with a lower social tone in James's court, caused many of the plays of younger dramatists to find in intrigues of animal love the sole groundwork of invention. On the stage of Elizabeth's time there was no such restriction, but interest was shown in all the trials of the life of man.

The 17th century, from the accession of James I. in 1603 to the Revolution of 1689, was occupied by new forms of struggle about the limit of authority. Becket's struggle with Henry II. had been for sovereignty of the church over the king. From that time onward, Reformation movements chiefly were for war against the pope's claim of dominion. While England was in contest against Spain, Elizabeth was leader of her people. When removal of the danger from abroad gave freedom for domestic difference, the queen became unpopular. There was dread that civil war would come again after her death. The two chief heroic poems at the close of her reign, Drayton's *Barons' Wars* and Daniel's *Civil Wars of York and Lancaster*, were designed—as other poems and plays were then designed—to press on Englishmen a feeling of the ills that follow when this house is raised against this house. When James I. sought less wisely than Elizabeth to maintain and magnify the power of the sovereign, he soon made the question of the limit of authority political as well as religious, and prepared the way for civil war in the next reign.

Revolt against authority of mere tradition in the teaching of the schools had its chief leader in Francis Bacon, whose analytical mind looked in his *Essays* upon the nature of man himself, and in his philosophy upon the nature of the world without him. His two books of the *Advancement of Learning*, with which he began to lay foundations for his *New Organon*, were published in 1605, and his work as teacher of the right way of experimental search into nature, unimpeded by tradition, was suggested by a strong reaction against bondage to common opinion (the Idol of the Forum) or the teaching of great men who have played large parts on the stage of life (the Idols of the Theatre). Men with a bent for science began to inquire as Bacon counselled that they should, and grew in desire towards unbiased inquiry by well-planned experiments. They were searchers into nature so inspired who were incorporated in London as a Royal Society in 1662.

But James I., though Bacon's patron, knew little of the whole advance of free inquiry that Bacon represented only in one form of study. To obtain freedom of worship, English Puritans sailed for New England in the *Mayflower* in 1620, and added strength to the foundations of an England on the other side of the Atlantic, which had its origin in the vigour of Elizabethan navigators. Part of the region that Sir Walter Raleigh named Virginia, after the virgin queen, was granted by James I. in April 1606 to a London company, whose first settlers called their town Jamestown, in honour of the king, and who produced in Captain John Smith the author of a *True Relation of Virginia*, published in London at the close of the year 1608. This may be regarded as the first book in the English literature of America. The settlers in New England who had left Old England for conscience' sake, and who included many graduates, of Oxford and especially of Cambridge, brought a new strength to the New English world that is well represented in the record of the Mather family.

John Milton went to Cambridge in the year (1625) when Charles I. became king. He joined fine scholarship and the poet's temperament to strenuous endeavour towards freedom of thought. His high ideals were expressed with the power of a master poet who had subjected his mind to long and patient training. His earlier verse was pastoral, as he thought suited to a time of preparation for a higher flight; but the period of his prose works intervened between his earlier verse and the later in which he rose to the epic with *Paradise Lost*, published in 1667. His other epic, *Paradise Regained*, was published in 1671 with *Samson Agonistes*, his one drama, modelled on the Greek. In the controversies of the day about religion, Milton was the best representative of the first principle of the Independents. They would unite all men as fellow-Christians who built their faith upon the Bible, and would leave to each the right of joining himself to an independent congregation of the worshippers with whom he best agreed in his interpretation of the Bible. Richard Baxter was the ideal type of the Presbyterian who thought

the Episcopal Church less scriptural than a church managed by presbyters and elders, but was as desirous as the ruling church to bring all Englishmen into accord with one church discipline and one form of belief. Of the church established by Elizabeth as *via media* between Rome and Geneva, the church of which Richard Hooker in his *Ecclesiastical Polity* had, at the end of Elizabeth's reign, best maintained the cause, Jeremy Taylor was in Stuart days the ablest supporter. God made us to differ that by wrestle of opinion we may win the victory for truth. Richard Hooker, Jeremy Taylor, Richard Baxter, and John Milton —who shall say which was the better Christian?

Milton's early poems were written at a time when the English drama seemed to break in its fall into a rainbow-tinted spray of song; Herrick, born lyrist, Wither, Suckling, Cartwright, Habington, Randolph, Cleveland, Lovelace, Cowley, Crashaw, George Herbert, and Henry Vaughan represent the graces and the follies and the grossnesses of life, the strife of parties, and the highest aspirations towards the divine ideal. Milton's *Comus*, the most beautiful example of the masque, which before Milton had been best developed by Ben Jonson, was an indirect plea for the high use of the poet's art, when Prynne had just expressed the Puritan antipathy to plays, masques, dances, in his *Histriomastix*. *Comus*, acted at Ludlow in 1634, was also a setting forth of the beauty of temperance and purity, at a time when the course of fashion, aided by the readiness of the king's friends to show that they were no Puritans, was bringing sensuality into repute. Dr Thomas Browne of Norwich—not Sir Thomas till the time of Charles II.—in his *Religio Medici*, published in 1642, joined faith in doctrines of the church with a free, reverent spirit of inquiry. Every page of that book was rich with subtle utterance of independent thought. Milton's prose pamphlet *Areopagitica* in 1644 enshrined in a piece written carefully after the manner of a Greek oration the cardinal principle that for the advance of truth there is no safeguard to be relied upon but free exchange of thought. 'Let truth and falsehood grapple,' Milton said; 'who ever knew truth put to the worse in a free and open encounter? Her confuting is the best and surest suppressing.'

This is the battle that runs through the history of English literature. All the prose writings of Milton in the Commonwealth time dealt essentially with the question of the limit of authority; they sought the best solution of the problem between king and people that had stirred up civil war. The Commonwealth was an experiment that failed. The Restoration was a going back to a new starting-point, and trying again for an answer to the problem. It was found at last in 1688. The argument for absolute authority had its best expression in the political philosophy of Thomas Hobbes, whose *Leviathan* appeared in 1651 as his contribution to the great controversy of the time. James Harrington's *Oceana* in 1656, and Richard Baxter's *Holy Commonwealth*, show the energies at work which have made English literature at all times a true and full expression of the people's life. They were in George Wither's verse and Andrew Marvell's satire; in Butler's *Hudibras* with a wide reach of wisdom in its wit that struck at everything insincere; in *Paradise Lost*, that shapes an epic to maintain God's love among the discord of disputes about predestination and free-will; in *Paradise Regained*, with its calm burden of Rest in the Lord, enforcing faith and patience in the darkest times —dark even as the times seemed to religious men who looked at the court and country in 1671—and in *Samson Agonistes*, which was added as a scriptural example of such faith. In all work of the best writers there was the best life of the time engaged upon its most essential problems. John Bunyan's *Pilgrim's Progress* in 1678 and 1684 found its answer in the religious feeling to which it appealed, still strong throughout the body of the people. The masterpiece of John Dryden, *Absalom and Achitophel* in 1681, and the poems that next followed, dealt altogether with those vital questions of the day which pointed to the coming revolution.

Strain for ingenious conceits had been an Italian fashion that spread to Spain and to France as well as to England. In all three countries it became laboured, and took the form called by Samuel Johnson 'metaphysical,' in the poetry of which John Donne in the reign of James I. was the favourite writer. At the same time Marino in Italy and Gongora in Spain illustrated the same form of decay. Our days of Euphuism were represented in Spain by the school of the 'Conceptistas,' and those whom we may call our later Euphuists were represented by the school of 'Cultos.' In France reaction against this laboured extravagance had begun in the days when English royalists of the time of Charles I. were in political adversity and lived in Paris. They who afterwards in England were patrons of literature attended the *salons* of the Marquise de Rambouillet, and were in contact with the critics and the poets who prepared the way for the predominance of France. Boileau, the master critic of this school, began his satires about the time of the Restoration, and summed up his views in his *Art Poétique* in 1673. A taste for criticism now spread; even the small wits prided themselves on sense. Boileau lived until 1711. Critics who followed his teaching in the letter rather than the spirit swarmed about him and survived him. The period of Latin-English thus came in, when writers, to avoid the low association of ideas with homely words, sought their vocabulary from the Latin side of the language, and wrote sentences that they would never speak.

Boileau opposed the strain of writers for extravagant conceits—which he called the paste brilliants of Italy—by fixing attention on the simplicity that graced the highest art in Roman literature of the time of Augustus. Works of Virgil and Horace were the models through which he would have nature to be studied. This was right counsel, but many misapplied it. In England they grew blind to the art of their own best writers who were not in obvious relation with the new French school. Deaf to the music of Chaucer and Spenser, they supposed that Waller, whose earliest verse was written in the reign of Charles I., and who died, aged eighty-two, in 1687, had been the first in England who wrote smooth verses and invented the right use of rhyme. Sir John Denham's poem on the view from *Cooper's Hill*, first published in 1643, was exaggerated into epic dignity. Dryden described it as a work that, 'for the majesty of the style, is and ever will be the exact standard of good writing.' Dryden was then advocating the disuse of blank verse in our plays, and he used for a few years the rhymed couplets preferred in France which found their way into the heroic play of the Restoration. These heroic plays, of which the first had been Davenant's *Siege of Rhodes*, were sustained in popularity by Dryden himself with plays like his *Tyrannic Love* in 1669, and *Conquest of Granada* in 1670. They retained much of the extravagance against which, on behalf of good sense, Boileau made elsewhere successful war; and the *Rehearsal*, by the Duke of Buckingham, produced in 1671, was a burlesque meant as a plea for good sense even in the theatre. The heroic plays passed into rhetorical tragedy, of which only two pieces by Otway, *Venice Preserved* and the *Orphan*, avoiding royal heroes, were distinguished by domestic

pathos. But Charles II. left Otway to starve. The rhetorical tragedies became associated with an artificial stage delivery until the time of Garrick, who went straight to nature. In the comedy of the Restoration, Sir George Etheredge's profligate young gentlemen, who call themselves men of sense and have no reason in their lives, reproduce with a light touch, a grace of gracelessness, the fashionable manners of the time. But Molière, greater than Plautus or than Terence, had raised comedy in Paris to an intellectual supremacy that was felt by the best comic dramatists in England. Wycherley, whose four comedies were produced in the reign of Charles II.; Congreve, whose plays were all written under William III.; Sir John Vanbrugh, and Farquhar, who wrote also in the reign of Anne, learned from Molière to put a larger life into their art as dramatists, and produce what has been entitled the Prose Comedy of English Manners.

Until nearly the end of the 18th century this French influence prevailed. It was maintained by the just predominance of French literature, which had reached its Augustan age; but this influence, like that of Italy, had in its strength an element of weakness that increased with years. In due time it was shaken off by one more great reaction, out of which came the forms of literature in the present day.

The 18th century in English literature shows especially the course of thought between the English Revolution of 1688, of which John Locke expressed the true ideal, and the French Revolution of 1789, that sought to establish an ideal of true citizenship. It failed, but showed the way to a success much slower of attainment, towards which the English literature of the 19th century labours in every generation with more conscious resolve. The 18th century was not an age, as Carlyle once called it, 'of shams and windy sentimentalities.' There were plenty of these; but the spirit of the century lies really in the great reaction against them. Corruptions in that section of society which usually calls itself the World, that touched religion to the quick, and put formal conventions in the place of truth, had stirred resentment. Pierre Bayle, in his *Dictionnaire Historique*, implied in all his pictures of the lives of men a world without a God. A scepticism of earnest, honest minds grew up, that denied God because it could see no truth in his priests. The corruption of society, greater even in France than in England, great in both countries through the evil lives of men whose high social position made them leaders of the weak, made vice appear to be the sand upon which civilisation had been built. Mandeville's *Fable of the Bees* began, even in Queen Anne's time, the satirical expression of this doctrine, which had its highest expression afterwards in France, through the writings of Rousseau. First there was this growing conviction of wrong; then followed in France the passionate desire for remedy.

There arose in Queen Anne's reign, from the genius of Daniel Defoe, the real beginnings of the modern newspaper and of the periodical essay. Newsletters, intended to give information to one side or other in the time of civil war, had already been published before the Commonwealth. After the Restoration, Sir Roger L'Estrange, having obtained for himself the 'sole privilege of printing and publishing all narratives, advertisements, mercuries, intelligencers, diurnals, and other books of public intelligence,' produced in August 1663 the first number of his *Public Intelligencer*. When the plague drove the court to Oxford, he produced, in November 1665, the first number of his *Oxford Gazette*, which became, when the court returned to London, the *London Gazette*, on the 5th of February 1666 (see GAZETTE). Other newspapers arose, which expressed opinion indirectly by representing facts in the form most agreeable to their subscribers. Daniel Defoe, having been sent to Newgate in 1703 for an ironical pamphlet against passionate attacks on the Dissenters, began, as a political prisoner, his journal, the *Review*, of which the first number appeared on the 19th of February 1704, and which appeared in and after 1705 three times a week until June 1713. This paper had two features which were new, and upon these the growing power of English journalism has since been based. Defoe aimed at exact truth, palatable or unpalatable, in his record of facts; and he joined to his record independent comment. Thus he became the founder of what is now known as 'the leading article.' He also added to his *Review* a monthly supplement that dealt wholesomely with follies and fashions of society. The notion of this was developed afterwards by Richard Steele when he established the *Tatler* in April 1709. Out of the *Tatler* came Steele and Addison's *Spectator*, which began on the 1st of March 1711, and opened the way to many later efforts of the same kind to better and refine the ways of men.

In the foundation also of the modern novel of real life, which displaced the French romances of Gomberville, Calprenède, and Madeleine de Scudéri, themselves due, as we have seen, to Spanish romances and Italian pastorals, Defoe led the way with his *Robinson Crusoe* in 1719. This did not profess to be a novel, but was, like all following novels of Defoe, written in imitation of some other form of literature that had for its chief features a true record of experience of life. Defoe's picture of a single man battling against circumstance, unflagging in the energetic use of his own resources, with unfailing trust in God, expressed so completely the new interest in the development of man, that Rousseau afterwards, in his *Émile*, made *Robinson Crusoe* the first book to be put into the hands of the ideal pupil. As the movement towards larger assertion of individual and national life advanced in Germany, imitations of *Robinson Crusoe* were so many as to form a group in literature that became known as the *Robinsonaden*.

Pope, under Queen Anne, followed the critical fashion of the time, and made his mark first in 1711, with an *Essay on Criticism*, which was writing about writing about writing. His *Rape of the Lock*, in 1712–14, was, perhaps, the daintiest trifle ever written; but it was half-earnest play upon the idleness of fashion. Under George I. Pope earned money by translating Homer. But under George II. he had grown with the growth of his time, and to the full extent of his powers he dealt in his *Essay on Man*, his *Satires* and *Epistles*, with the deeper questions of life, and felt with the world about him that 'the proper study of mankind is man.' From the beginning of the reign of George II. our best literature expressed the growing interest in questions of the nature and the prospects of society. Swift, under Queen Anne, had followed the critical fashion of the time with his *Battle of the Books*, but joined to it the keen use of his wit in dealing with the dissensions about religion. That was in his *Tale of a Tub*. His other writings in Queen Anne's reign belonged almost without exception to those controversies of the day that shaped the course of history, and to the labour to let light into the lives of men. Under George I. Swift was Dean of St Patrick's, deep in politics of Ireland. At the end of that reign his *Gulliver's Travels*, in 1726, expressed the meanness to which life and its aims had sunk, not more contemptuously than Gay's *Beggar's Opera* in 1728, and its sequel *Polly*, which placed pirates a little above, savages

high above, the pollutions of a civilised society. In 1725 and 1726 Allan Ramsay's *Gentle Shepherd*, Thomson's *Winter*, and Dyer's *Grongar Hill* sent a healthy breath into our literature, the first sign of a renewed sense of the beauty of outward nature. Thomson completed his *Seasons* in 1730, showing, with distinct reference to the scepticism of the time, in the world that surrounds us, God, 'parent of good.' Pope sought in his *Essay on Man*, in 1732–38, to reason against those who believed that man and nature replied 'No' to the question, 'Is there a just God?' Butler's *Analogy* was published in 1736—a triumphant effort of sheer reasoning against the same creed of despair.

The same controlling force was upon all forms of life. It touched alike the pulpit and the stage. Garrick's triumph as an actor was a triumph of natural over conventional expression. 'If this young fellow is right, we are all in the wrong,' said the old actor Quin. Even as late as 1768 and 1772, when Goldsmith's first comedies, the *Good-natured Man* and *She Stoops to Conquer*, were produced, conventional notions of dignity and traditions of false sentiment caused alarm in the breasts of managers. Sheridan's *Rivals* in 1775, and *School for Scandal* in 1777, completed the emancipation of good wit from trammels of an artificial style. Gray's poems, first collected in 1768, three years before his death, foreshadowed, with almost too exquisite art, something of the new in the forms of the old.

Good Samuel Richardson was with his time more fully than he knew when in his first novel, *Pamela*, in 1740, he asked his readers to care for the sorrows of a maid-servant. Henry Fielding in his novels painted life full of the spirit of the coming change. Byron afterwards described him as 'the prose Homer of human nature.' Fielding's *Tom Jones*, published in 1749, is a great landmark on the way from the English Revolution of 1688 to the French Revolution of 1789. Nature reasserts herself in the fresh liveliness of Smollett's novels, the last of them published in the year of his death, 1771. Fanny Burney's *Evelina* and *Cecilia* followed in 1778 and 1782; without breaking from the conventional, long-worded style, they were unconventional in substance. There was quick, fresh observation, with a grace of wit in their invention and character-painting. They were followed at the beginning of the 19th century by the works of Maria Edgeworth and Jane Austen. These two women were foremost in this way of literature, until they were left behind by the superior genius of George Eliot.

Samuel Johnson died in 1784, after forty-seven years of life in London. In 1738, after his first year's struggle with poverty as a Grub Street author, he had published his *London*, a paraphrase of Juvenal's third satire. He won his way as a man of letters, never rich, but always firm to his own sense of right, delighting in the society of men, strong in wit combats, deeply religious, but dependent only upon God. By his character he first gave its right dignity to the position of the professional man of letters. His toast to the next insurrection of the blacks, and his interest in the negro Francis Barber, whom he took as a servant, educated and treated as a friend, in visible protest against the valuing of man by the colour of his skin, may stand among many evidences of Johnson's part in the new sense of the fellowship of man. His *Rambler*, in 1750–52, following the *Spectator* in its aim, reduced to system the critical theory of the time, that sought for dignity on the Latin side of English. But Johnson lived with his time and led his time, and the style of his *Lives of the Poets*, written in 1779–81, is not that of the *Rambler*. When in 1764, Goldsmith in his *Traveller*, which, according to its second title, was a 'Prospect of Society,' expressed the spirit of the time in mournful review of the nations of Europe, it was his friend Johnson who added those last lines that spoke the language of the 19th century, by showing that the solution of the great problems of life lies for each man within himself. Goldsmith's *Deserted Village*, in 1770, expanded a passage in the *Traveller* into a picture of depopulation caused by greed of wealth, and yet more strongly expressed the new sense of social inequalities. It also combined a charm of simplicity with what was really dignified and graceful in the old style that was giving way before impatience of formalism. The *Vicar of Wakefield*, in 1766, in substance and in manner a poet's novel, expressed even more completely the advance of time. The transition from rhetorical forms to a style founded directly upon nature is well marked in Goldsmith and in Cowper. They are on the way to Wordsworth. A strong spirit of freedom was in them. In her old age, the daughter of his friend Lord Clare described Goldsmith, whom she had known in her youth, as 'a strong republican in principle, who would have been a very dangerous writer if he had lived to the times of the French Revolution.'

In other forms of literature there was a corresponding movement. David Hume, whose philosophy raised honest questions which put more clearly and forcibly the doubts that startled a faith based only upon traditional opinion, completed his *History of England* in 1761. Begun as a history of the Stuart times before the English Revolution, it became the first work in which the whole course of English history was told with an intellectual sense of sequence in the affairs of men. The first volume of Edward Gibbon's *Decline and Fall of the Roman Empire* appeared in 1776, the year of the death of David Hume. The last volume was published in 1788, the year before the fall of the Bastille. The book was suggested by the sight of Rome in ruin. Its design was, in days when modern states seemed tottering, to draw from Rome a study of the causes of decay. The scepticism of the 18th century was in Gibbon the more strongly marked by an elaborated pomp of words that contrasts with the philosophic calm and simplicity of David Hume. The year of the first volume of Gibbon's great work was the year also of the publication of Adam Smith's *Wealth of Nations*, crown to an arch formed by a series of studies on the nature of society and on the grounds of its well-being, that had its spring in the days of Charles II. from Sir William Petty, and passed through Locke's second *Essay on Civil Government* to Adam Smith. The first volume of Blackstone's *Commentaries on the Laws of England* appeared in 1764, and Jeremy Bentham began his career as a political economist with *A Fragment on Government, being a critique on Blackstone's Commentaries*, published in the same year as the *Wealth of Nations* (1776), the year in which Malthus was born. Thenceforward the study was continuous, and passed on to John Stuart Mill and to the writers living in our day.

The year of the publication of the *Wealth of Nations* was the year also of the Declaration of Independence on the 4th of July by the English American colonies, which on the following 9th of September were first termed by congress the United States. When the political action of this country made such an issue likely, the eloquence of Burke was spent in the endeavour to avert the revolution. The colonists would not bear taxation for imperial purposes without representation. The English government maintained the right to tax. 'Assert the right,' said Burke, 'but do not use it.' That was, in brief, the policy of the Rockingham administration, inspired by Burke, and in association with which Burke began to devote his mind to the great

questions that touched the destiny of nations. The American Declaration of Independence gave to the world another England in the New World as an independent civilising power. It was one result in the long process of evolution that has quickened the development of the whole race of man. If Burke, who seemed to be a friend to the Americans, was a bitter opponent of the French, it was because his Conservative mind, Liberal in its tendencies, sought to avert in one case the revolution that he dreaded, and sought in the other case to suppress a revolution that had broken out, and might possibly involve a struggle to secure great change by violence in his own country.

The thin volume, published at Kilmarnock in 1786, revealed to the world in Robert Burns a lyrical poet and satirist of the first order, who found time later, amid the troubles of a short and stormy life, to fashion from his heart such love songs as the world has never seen. William Cowper in his *Task* (published in 1784) said of the towers of the Bastille that there was not an English heart that would not leap to hear that they were fallen. When they fell hearts of young poets in England did leap. William Wordsworth —then a youth of nineteen—conceived the high ideal that was sought by many who set loose the passions of the ignorant, and hoped within the lifetime of a generation to lift to its full height the race of man. He found his way to France, even took some part in the work of revolution; grieved over its failure, because his young spirit had seen heaven where Edmund Burke saw hell: the younger and the older man being alike sincere, alike inevitably drawn by bias of their minds to their appointed sides in the great controversy. The failure of the revolution did not fill Wordsworth with despair. While still cherishing his aspiration towards what Tennyson has since called a 'crowning race of man,' he came to feel that the way to such a race was long, since no state could be better than the citizens of which it is composed. But with unbroken hope he set himself to teach through verse the strength that grows out of the simple lives of men.

Thomas Campbell's *Pleasures of Hope*, in the last year of the 18th century, was a testament of hope left by the 18th century to the 19th. Wordsworth's *Excursion* in 1814, the year before Waterloo, was a poetical foreshowing of the work of individual development into which the 19th century should grow. In its own time it was little understood; but now we are abreast of it and understand it well. The tumult of the revolutionary spirit was in Byron; its pure ideal was in Shelley; its practical outcome was in Wordsworth; and a breath of health passed for the renovation of society wherever Walter Scott's novels were read. In the later days familiar to us all, it is enough to point to the continuous advance, through every form of literature, towards the raising of the people by the raising of the citizens whose lives are all in all. Open expression of the reaction against Latin-English and the diction encouraged by the period of French influence was in Wordsworth's defence by preface and appendix of the style of the *Lyrical Ballads*, first published in 1798. He argued, and he acted upon his belief, that there is no separate book language; that the best thoughts are best expressed in a selection of the words in ordinary use. Again and again he laid stress on the word 'selection.' He was misapprehended, and gave some little cause for misapprehension by a defiant use in his poems of words and phrases which his better judgment, when the critical war was over and his cause had triumphed, led him afterwards to alter.

The impulse out of which Scott's poetry and Scott's novels grew it is usual to term Romanticism, as its most essential element was a revolt from the severity of classical form alike in choice and treatment of subjects for poetic expression. It was a revolt from the predominance of substance over form, towards a more emotional and fearless expression of the relations of the human soul to the mystery and romance of the world around it. The vivid directness and imaginative power of Percy's *Ballads* (1765) gave a rude shock to the dull didactics of the 18th century, and the imitative work of the young Chatterton also revealed what influence our earlier poetry could effect upon a capable imagination. Cowper and Burns revealed the capacity for poetic expression of simple, natural language, and the earliest creations of Blake's strange spiritual genius foreshadowed a romantic revival in literature and art, which was to give us in the poetry of Coleridge, Shelley, Keats, and Rossetti almost the greatest poetic triumphs of the next century. Scott's romance was a direct issue of romanticism, and a host of imitators, under the mighty spell of the same impulses that made our greatest novelist, carried reverence for the past to strange ends in literature, art, and even religion. Not the least gain has been that revival of interest in the earlier English language, which has revolutionised the modern study of our tongue and created anew an audience, no longer few, for Chaucer, and even the lesser Elizabethans. Englishmen have awoke to the fact that they possess a native literature infinitely richer in quality and larger in quantity than any people in the world, and the success of such publications as the admirable reprints of Professor Arber and the Universal and National Libraries of Professor Henry Morley prove that this knowledge even already is widespread.

The past has been studied and the future battled for with independent energy. Above all things truth must be found. History stands more and more pledged to an accurate inquiry into the trustworthiness of all its facts. Every statement must be traced to its original authority; that ascertained, let each man reason on it as he would. Greek history has been restudied by Grote and Thirlwall; Roman, by Merivale; the history of the Jews and of Latin Christianity by Milman; the history of England by Macaulay, Freeman, Stubbs, Froude, Brewer, Gardiner, Green. Buckle and Lecky have studied history and theorised upon it. The *Edinburgh Review* (1802) and the *Quarterly* (1809) inaugurated a new era of criticism. Science has made wonderful advance both in knowledge and in its application, as Francis Bacon would have it applied, to enlargement of the dominion of man. It has not only abounded in results of accurate research, but has developed a large power of generalisation founded upon patient experiment, by which especially Charles Darwin has influenced 19th-century thought.

In church questions there has been the same advance of fearlessness in the inquiry after truth, and the same strenuous endeavour to make truth bear fruit within the lives of men. Every tendency of religious thought has had its faithful representative in Whately, Keble, Pusey, Newman, Dr Arnold, Maurice, Dean Stanley, Canon Liddon, Dr Martineau, and many more. The periodical press has opened a free plain for ready encounter of all forms of thought in honest grapple with each other. There is even an increasing number of magazines founded upon the plan first adopted by George Henry Lewes in 1865, when he established the *Fortnightly Review*, for the free conflict of opposite opinions within the lists of a single journal. This good example was followed promptly, in 1866, by the establishment of the *Contemporary*

Review; and the *Nineteenth Century* appeared in 1877. With the increase of reading power, the novel of the 19th century has taken the place occupied in the 16th by the drama. Women among the novelists have come to the front in literature as earnest helpers to a better day, and novels have been used, perhaps too much, for study of the deepest problems of the time. Mrs Somerville in science, Mrs Browning in poetry, George Eliot in fiction, have marked the advance from days when, with few exceptions, only men took part in the mind-labour of successive generations. The civilising power of the highest literature has been diffused by the energies of vigorous and earnest men, William and Robert Chambers, Charles Knight, and others who are now continuing such labour. Side by side with the free literature of England, a sister literature has grown in America which adds its forces to our own. The volume of the mighty stream of English literature has increased into an expanse that can be shown here by no more than a vague suggestion of its breadth and the direction of its flow. Our last great period in English literature is marked especially by the variety of forms in which all writers who obtain a large hearing dwell on individual fidelity to duty, in a life that is sincere and simple, as the one way to the highest possible for man. It was so in all the writings of Thomas Carlyle, of Dickens, of Thackeray, of George Eliot, and of Matthew Arnold. It is so in Alfred Tennyson, whose *Idylls of the King* figure King Arthur throughout as Conscience, the king within the human breast. It is so in all the writings of Robert Browning, who warns by many forms of dramatic expression against the vague ideal; and who represents the poet in his highest utterances, as he is throughout all literature, the voice of the worker when he feels most deeply the meaning of his work.

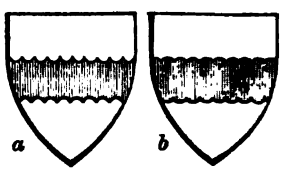
American literature is dealt with under UNITED STATES, and there are paragraphs under AUSTRALIA and CANADA on the literature of those great British colonies. There are separate articles on BIOGRAPHY, the DRAMA, LETTERS, NOVELS, NEWSPAPERS, PERIODICALS, and ROMANTICISM; and the subject of English literature may be further studied in the articles devoted to the several authors named above, and to many others whom in such a sketch it is impossible to include.

See Thomas Warton's *History of English Poetry* (1774–78; new ed. 4 vols. 1872); J. Payne Collier's *History of Dramatic Poetry* (3 vols. 1831; revised and enlarged, 1879); Henry Hallam's *Introduction to the Literature of Europe in the Fifteenth, Sixteenth, and Seventeenth Centuries* (4 vols. 1837-39); Thomas Wright's *Biographia Britannica Literaria* (vol. i. Anglo-Saxon Period, 1842; vol. ii. Anglo-Norman Period, 1849); George Lillie Craik's *Sketches of the History of Literature and Learning in England* (1844–45), expanded in 1861 into a *Compendious History of English Literature and the English Language*; S. A. Allibone's *Dictionary of English and American Literature* (3 vols. Phila. 1859–71); Thomas Arnold's *Manual of English Literature* (1862); Hippolyte Taine's *Histoire de la Littérature Anglaise* (4 vols. 1863–64; translated by H. van Laun, 1871); William Minto's *Manual of English Prose Literature* (1872); A. W. Ward's *History of English Dramatic Literature to the Death of Queen Anne* (2 vols. 1875); T. H. Ward's *English Poets* (2d ed. 4 vols. 1883); Henry Morley's *First Sketch of English Literature* (1873; enlarged in 1886), and *English Writers* (4 vols. 1887–89); Leslie Stephen's *History of English Thought in the 18th Century* (2 vols. 1876); Stopford Brooke's *Primer of English Literature* (1880); Richard Wülcker's *Grundriss zur Geschichte der angelsächsischen Litteratur* (1885); Bernhard ten Brink's *Geschichte der englischen Litteratur* (vol. i. 1877; translated by H. M. Kennedy, 1883; vol. ii. 1888); F. J. Bierbaum's *History of the English Language and Literature from the Earliest Times until the Present Day, including the Literature of North America* (Heidelberg, 1883); Gustav Körting's *Grundriss der Geschichte der englischen Litteratur von ihren Anfängen bis zur Gegenwart* (1887); George Saintsbury's *Elizabethan Literature* (1888); Edmund Gosse's *From Shakespeare to Pope* (1885), and *Literature of the Eighteenth Century* (1889); Henry Morley's *Library of English Literature* (5 vols. 1876–82); and Chambers's *Cyclopædia of English Literature* (2 vols. 4th ed. 1885).

English River, (1) an estuary on the west side of Delagoa Bay; (2) another name for the Churchill River (q.v.).

Englishry. The Danish conquerors of England drew a legal distinction between the Danes and the English; and in this point the Normans followed their example. 'The Englishry,' like 'the Jewry,' was a term of contempt. In cases of murder, the hundred was punished, unless it could make a 'presentment of Englishry,' showing that the person slain belonged to the conquered race. There are recorded cases in which the hundred incurred an additional penalty for declaring that a murdered 'Frenchman' was an Englishman. In process of time Normans and English became one people; and 'presentment of Englishry' was abolished in the reign of Edward III.

Engrailed, in Heraldry, a line composed of a series of little semicircular indents. When a partition line is engrailed, the points are turned upwards; when an ordinary is engrailed, they enter the field. Invecked is a partition line the contrary of engrailed, with the points pointing downwards and inwards.



a, Fess engrailed; *b*, Fess invecked.

Engraving, in the strictest sense of the word, is the art of scratching or incising marks or figures upon tablets of any hard substance. Certain forms of the art—such as decorative engraving for purely ornamental purposes upon metal, engraved writing upon tablets for the purpose of record, gem-engraving for the production of signets, cameo-engraving, &c.—are of extreme antiquity. But, in its more especial and restricted sense, the word engraving is understood to designate the cutting or incising of designs upon metal plates or blocks of wood, for the purpose of printing impressions from them in ink upon paper, or other similar substance. Engravings of this sort are divided into the two broad classes of engravings on metal, in which the lines to be printed are sunk or incised, and engravings on wood, in which the lines to be printed appear in relief, the wood between them being cut away. In the former the plate, having been inked and wiped on the surface, retains the ink only in its hollowed lines, from which it is conveyed to the paper by the pressure of the printing-press; whereas in the latter only the elevated portion of the surface of the block is inked by means of a roller, and being subjected to the press, it prints as a raised type. [WOOD-ENGRAVING is fully described under its specific heading; here we deal only with *Engraving upon Metal.*]

The metal most commonly used for engraving has been copper; but during the 19th century steel has been largely employed on account of its hardness, which enables it to resist the wear of printing, and to throw off a far larger number of unimpaired impressions than could possibly be obtained from a copper plate. Steel, however, is less readily engraved upon than copper, and so is apt to yield a less free and artistic result: and, by means of a recent discovery, the surfaces of copper plates can now be protected by an extremely thin coating of steel deposited by galvanic action, which enables them to yield a large number of excellent

impressions without being worn. Zinc plates have also been employed to some extent for etchings, especially by Seymour Haden, a very eminent 'painter-etcher,' who likes the 'fat,' picturesque, and varied line which this metal yields when bitten by the acid.

The earliest of the impressions taken from engraved plates are those most valued by connoisseurs, on account of their sharpness, clearness, and richness, qualities which are gradually lost as the surface of the metal becomes worn by repeated printing. The term 'working proofs' indicates trial impressions printed by engravers for their own use, to test the state of their work during its progress. 'Artist's proofs' are those bearing the signature of the painter or engraver, or of both, which is held to guarantee the quality of the impression. 'Proofs before letters' are those thrown off before the printed titling, &c. has been added; and 'open letter proofs' are those in which the letters of the title have been added merely in outline.

THE PROCESSES OF ENGRAVING ON METAL.

Line-engraving.—The chief instrument of the line-engraver is the burin or graver, a small bar of steel, usually in the form of a quadrangular prism, pointed at one end, and with the other fixed in a rounded wooden handle. This instrument is held between the engraver's forefinger and thumb, which direct the motion of the point as it is pushed forward by the pressure of the palm of the hand on the wooden handle, and incises, upon the plate of polished metal placed beneath it, a line proportionate in breadth and depth to the amount of pressure used and the angle at which the point is applied, the metal being lifted clean out of the furrow in a long strip or shaving. In this manner the design is inscribed upon the plate: and, in printing, the plate is inked, its smooth surface is then wiped clean, so as to leave the ink remaining only in the incised lines, from which it is removed to paper by being passed through the printing-press.

Etching.—In this process a polished metal plate is coated with a thin transparent surface or 'ground' impervious to the action of acid. For this purpose a composition of white wax, gum-mastic, and asphaltum is usually employed, inclosed in a ball of silk. When this ball is applied to the heated surface of the plate, the ground melts and exudes through the cloth, and is spread evenly over the metal by means of a pad of cotton-wool covered with silk, termed a 'dabber.' The plate is then exposed to the smoke of wax tapers till it becomes of a uniform black colour, which enables the etched line, disclosing the shining metal, to be visible on its surface. Upon this plate, so prepared, the design is drawn with an 'etching-needle,' a sharp steel point fitted in a handle, and held like a pencil in the artist's hand. This needle removes the impervious ground where it is applied, disclosing lines of the bare metal, which are ready to be acted upon by the acid. The back of the plate having been protected by an application of Brunswick black, it is placed in the 'acid-bath,' a flat tray filled with a mordant, usually composed of nitric acid diluted with an equal volume of water, which attacks and corrodes the metal in the lines that have been exposed to its action by the needle. After sufficient time has been allowed for the palest lines of the subject to be bitten, the plate is removed from the bath; these lines are covered with a 'stopping-out varnish' of Brunswick-black, applied with a brush, which protects them from further action of the acid; and the plate is returned to the bath, which attacks the lines still exposed. This process is repeated as often as necessary to produce the desired variety in depth of the various lines of the design. When the biting is completed, the plate is finally removed from the bath, the 'ground' is cleaned off by means of turpentine, and the design appears incised on the metal. The plate is then inked and printed in a manner similar to that employed in a plate engraved with the burin, those lines which have been longest exposed to the acid printing darkest, as they are the deepest and retain most ink. Much also can be done towards obtaining an artistic result by leaving a small coating of the ink on certain parts of the smooth surface of the plate, this film of ink printing as a delicate tint. If it should be found that the lines are too shallow, the plate may be regrounded by means of a roller charged with the 'ground' being passed over the plate. This coats the level surface with the impervious 'ground,' but leaves the incised lines free, so that they may be again subjected to the action of the acid in the bath.

During recent years various new methods of etching, and modifications of the process described above, have been introduced. These will be found clearly and fully described in P. G. Hamerton's *Etcher's Handbook*. In particular, a process for drawing the subject while the plate is exposed to the acid has been invented and much employed by Seymour Haden. He prepares the metal plate as above, and places it in a shallow bath filled with a mordant composed of hydrochloric acid, chlorate of potash, and water; and the subject is then drawn with the needle, the lines intended to be darkest being those first laid, so as to be longest exposed to the action of the acid.

It should be noticed that, while the early line-engravers worked with the burin alone, etching is combined with burin-work in most modern line-engravings; the subject being usually sketched with the etching-needle and bitten with acid, and the freer portions of foliage, &c. being also executed in a similar manner. 'Dry-point' is frequently employed in finishing the more delicate portions of line-engravings. The dry-point is an etching-needle sharpened in a particular way, and employed to scratch lines upon the bare metal. Unlike the burin, it does not cut a clean furrow out of the plate, but throws up the metal that it displaces in a ridge or 'bur,' which in printing yields a rich velvety blackness. When employed as an adjunct to line-engraving, this 'bur' is removed with the 'scraper;' and so treated, dry-point yields an extremely delicate line, very useful in finishing line-engravings and etchings. A 'ruling-machine' is also employed in producing the parallel lines representing flat skies in line-engravings.

Soft-ground Etching.—The metal plate is coated with ordinary etching-ground mixed with tallow, and a sheet of thin paper, with a certain degree of grain or texture in it, is stretched over the plate. The design is then drawn upon the upper surface of this paper with a hard black-lead pencil. On the paper being removed, it carries off adhering to its lower surface a portion of the etching-ground where pressure has been applied by the pencil-lines, exposing the metal of the plate, which is then bitten with acid, cleaned, and printed from, in the same manner as an ordinary etching. The impressions yielded by this process resemble a pencil-drawing or a lithograph.

Mezzotint-engraving.—This method differs from all other processes of metal engraving in that, while other engravers work from light to shade, and each line which they draw prints as a dark, the mezzotinter works from dark to light, and each touch which he adds to his plate prints as a light. Mezzotint-plates are prepared by the action of a kind of chisel, termed a 'cradle' or 'rocking-tool,'

which passing over its surface roughens it, raising a 'bur' of innumerable small metal points, so that if the plate were then inked and printed it would yield an impression of a uniform black. The engraver, having traced his subject on the plate, proceeds to smooth the surface by removing the 'bur' with a scraper, in proportion as he wishes to introduce light into his design; the bur being left untouched in the darkest shadows, partially removed in the half-lights, and wholly cleaned away in the high lights, in which the surface is perfectly smoothed, and brought to a high polish by means of the 'burnisher.' In modern mezzotint-plates, etching and work in stipple are frequently introduced, in a mistaken effort to obviate that softness and indefiniteness which is a characteristic of this method.

Aquatint-engraving.—In this process the polished metal plate is covered with a solution of resinous gum dissolved in spirits of wine. The spirit evaporates, leaving the resin deposited in minute granulations on the metal surface. The design is then transferred to the metal, and the plate is bitten in a bath of diluted nitrous acid, which corrodes the portions left exposed between the grains of resin. The darkest parts of the design are longest exposed to the action of the mordant, the lighter parts being successively protected by a series of 'stoppings-out,' consisting of oxide of bismuth and turpentine varnish applied with a brush in a manner similar to that employed in the 'stopping-out' of an ordinary etching. The impressions produced resemble those yielded by mezzotint, both processes working by *spaces* and not by *lines*.

Chalk or Stipple Engraving.—The metal plate is coated with an ordinary etching-ground, and the subject is drawn upon it by means of a succession of small dots produced by the point of the etching-needle. The plate is then bitten in the usual way with acid, which corrodes the metal at the points uncovered by the needle; and it is afterwards finished by dots, applied with the point of the etching-needle or burin on the bare metal.

Mechanical and Photographic Process.—Engraving in recent times has suffered much from the rivalry of photographic and mechanical substitutes. The most important of these is known as photogravure or heliogravure. The beauty of the work produced by means of this process, in the reproduction of paintings, of drawings in monochrome made for the purpose, and of photographs direct from nature, has raised it to a position in which it bids fair, at no very distant date, to supersede engraving altogether; except in so far as the burin is used to touch up and finish the plates so produced. The processes employed are described under PHOTOGRAVURE.

A photo-mechanical process which is much used in the reproduction of the plates of the older engravers and etchers, and in the production of intaglio etched plates from pen drawings, has been carried to great perfection, some of the work produced by Amand-Durand of Paris being quite equal to the finest hand etchings. A *positive* photograph is taken of the drawing or engraving to be reproduced (i.e. the lines are black, the whites clear glass); this is placed over a copper plate coated with a bituminous varnish, and exposed to the light. Where the lines of the photograph have protected the varnish from the light it remains soluble, but where the light has affected it through the glass it becomes insoluble. The varnish may then be dissolved from the lines, and the copper exposed exactly as if the etching-point had been used to make the drawing on an etching-ground. It is then etched in the usual manner, as already described, and finally touched up and improved with the graver.

There are many other mechanical and photographic processes of engraving, especially for the production of relief blocks, but as their connection with engraving is more or less remote, and they are all more or less used for the purposes of book illustration, it will be more convenient to devote a special article to describing such of them as are not well enough known by their distinctive names, to be separately treated. See the article ILLUSTRATION OF BOOKS.

HISTORY OF ENGRAVING ON METAL.

Line-engraving.—The practice of engraving metal plates, for the purpose of printing impressions from them with ink upon paper, originated with the early Italian goldsmiths, who in this manner were accustomed to take proofs of the metal objects which they decorated with engraved designs, in order to test the progress of their work; and these *nielli* (see NIELLO), or decorated plates of metal, in which the hollows were finally to be filled in with a black enamel, are regarded as the earliest engravings. A *pax* or metal plate used in the Roman ritual to receive the kiss of peace, executed by Maso Finiguerra, in 1452, for the church of San Giovanni in Florence, is considered to have been the first metal from which impressions on paper are known to have been taken. This *pax* is preserved in the Uffizi at Florence, and the only known original impression from it is in the Bibliothèque de Paris. Works of *niello*, however, were only incidentally used for taking impressions on paper; they were primarily designed as metal decorations, but they supplied the necessary hint as to the possibilities of the process, and led the way to such works as the *Kalendar*, dated 1465, and ascribed to Baldini (*c.*1436–*c.*1480), and the plates in the *Monte Santo de Dio* (1477) and in an edition of Dante (1481), both of which are ascribed to Baldini and Botticelli (1447–1515), in which we see the beginnings of metal engraving properly so called. Among the other early Italian line-engravers were Antonio del Pollajuolo (1429–98), who executed a few very scarce prints, showing that command of the figure for which he was celebrated as a painter; Robetta (*c.*1510), whose works are excellent in design, though poor in *technique;* and Andrea Mantegna (1431–1506), whose productions are distinguished by an impressive gravity and by a dignified classical feeling. Most of these engravers were themselves painters, and engraved from their own designs; but in Marc Antonio Raimondi (*c.*1488–*c.*1530) we have an engraver in the modern sense, engaged in reproducing the works of other artists. He is mainly known by his noble transcripts of the works of Raphael, in which he was aided by the master himself, who sometimes corrected his outlines upon the copper. Among the modern line-engravers of Italy may be named John Volpato (1730–1803), known chiefly by his 'School of Athens' and other plates after Raphael; Raphael Morghen (1758–1833), whose most famous plate reproduces Leonardo's 'Last Supper,' though a finer work is his rendering of Van Dyck's portrait of Francesco de Moncada; Paul Toschi (1788–1854), celebrated for his transcripts of the frescoes by Correggio at Parma; and Louis Calamatta (1802–69), who worked much after Ingres.

Among the productions of the North we find an example of line-engraving upon metal earlier in date than any afforded by the schools of Italy. This is a 'Flagellation,' forming part of a Passional series, dated 1446, a work attributed to an engraver of Upper Germany. Among the other early German engravers are 'The Master of 1464 or of the Banderoles' and 'The Master of 1466 or of the Initials ✠. ❀.' But it is in Martin Schongauer (*c.*1420–*c.*1488) that we find the first really able

and accomplished master of the German school. His admirable works—very quaint, and full of the richest decorative feeling—are extremely scarce, but they may be studied in the excellent fac-similes executed by M. Amand-Durand of Paris. Along with Schongauer may also be named Israel von Meckenen (*c.* 1480–1503), another prolific and excellent engraver. In Albert Dürer (1471–1528), however, we have the great master of the German school, alike in the admirably accomplished *technique* of his plates, in their nobility of design, power of draughtsmanship, and expressional qualities. Not far beneath him must be ranked Lucas van Leyden (1494–1533), a productive and talented workman with the burin, though he was inspired by a less lofty and profound imagination, and dealt with homelier subjects than his great contemporary. At the early age of fourteen he had already produced several very accomplished plates, and he worked unceasingly, both as painter and engraver, till his death at the age of forty. Under the influence of Dürer, there sprang up a school of engravers working after their own designs. These men, distinguished by a dexterous use of the burin, and by very considerable invention and decorative skill, are known, from the small size of their plates, as 'The Little Masters.' They include Albert Altdorfer (*c.* 1488–1538), Jacob Binck (*c.* 1490–1569), Hans Sebald Beham (1500–50), Bartel Beham (1502–40), Heinrich Aldegrever (1502–*c.* 1555), Georg Pencz (*c.* 1500–50), and Hans Brosamer (*c.* 1485–1552). In the end of the 16th century a notable school of line-engravers arose in Holland, among the members of which Henry Goltzius (1558–1617) produced portrait-engravings of extreme delicacy and finish, and Henry Hondius (*c.* 1573–*c.* 1662) is also favourably known for plates of a similar class; while Schelte Bolswert (born *c.* 1586), Paul Pontius (*c.* 1596), Lucas Vosterman (*c.* 1580), Peter de Jode (1606–60), and others were members of a school which owed its rise to the influence of Rubens. Among the more modern German line-engravers are Johann Georg Wille (1715–1807), Georg Friedrich Schmidt (1712–75), and Johann Christian Friedrich Wilhelm Müller (1783–1816), known by his fine rendering of the 'Madonna di San Sisto;' all of whom worked for a time in France.

In France some of the earliest line-engravings are the illustrations to a book by Breydenbach, published at Lyons in 1488, and reproducing woodcut views published at Mainz two years previously. Noël Garnier (working up till 1540) is known by his copies from the German engravers; but in Jean Duvet (1485–1561) France first possessed an engraver of real ability. Considerably influenced by Mantegna, he produced his 'Martyrdom of St Sebastian,' and his series of 'The Apocalypse' and of 'The Amours of Henry II.,' works of considerable inventive power. He was followed by Claude Corneille (*c.* 1550), Jean de Gourmont (*c.* 1550), Jean Cousin (1501–*c.* 1589), Pierre Woeiriot (1532), and Etienne Delaune (1519–83), an able engraver who worked after Cousin, and is also known by his graceful hunting subjects and by his series of 'The Sciences' and the 'Twelve Months.' From such men we pass to the school of Fontainebleau, formed by Rosso and Primaticcio, of which, among the engravers, the most celebrated are Antonio Fantuzzi de Trento (1508–*c.* 1550), Léonard Tiry (working 1540–65), René Boyvin (1530–*c.* 1598); and Guido Ruggieri (working about 1570), Thomas de Leu (*c.* 1560–1612), and Léonard Gaultier (*c.* 1552–1641) may be named as good engravers of portraits, leading the way to the great school of French portrait-engravers in line of the 17th century, who carried the art to the utmost conceivable perfection of which their aims and method admitted. Among these are Claude Mellan (1598–1688); Robert Nanteuil (*c.* 1623–78), one of the most spirited and manly engravers of that or of any time; Jean Morin (*c.* 1600–*c.* 1666); Gérard Edelinck (*c.* 1640–1707), a native of Antwerp, summoned to France by Colbert; Gérard Andran (1640–1703), the most able draughtsman of the school, who largely employed etching in combination with his burin-work; and Antoine Masson (1636–1700). The line-engravers of this period are seen at their highest in their portrait-subjects, which are delightfully spirited and intelligent in handling, and—being frequently, as was usually the case with Nanteuil's work, done *ad vivum*, or from the engraver's own drawing made from the life—possess the highest interest and authenticity as direct and original portraits. Following these men come a group of portrait-engravers who were more exclusively employed in rendering the works of painters, and whose work, absolutely skilful and accomplished as it was, rendering details and reproducing textures with unexampled exactitude and variety of touch, was yet somewhat less manly, direct, and simple than that of their predecessors. Among these were Pierre Drevet the Elder (1663–1738); Pierre Drevet the Younger (1697–1739), from whom we have a superb portrait of Bossuet, after Rigaud; and Jean Daullé (1703–63). To Wille, Schmidt, and Müller we have already referred as engravers of German nationality working in France. Laurent Cars (1702–71), Nicolas de Larmessin (1684–1756), Bernard Lépicié (1699–1755), and Pierre-Louis Surugne (1717–71) produced admirably faithful transcripts from the figure-pictures of Watteau, Chardin, and other contemporary painters. Charles-Nicolas Cochin (1715–88), in addition to similar work, executed a series of valuable medallion portraits of most celebrated men of the time; and Jacques-Philippe Lebas (1707–83), Claude-Augustin Duflos (1701–84), Pierre-Philippe Choffard (*c.* 1729–1809), and Augustin de Saint-Aubin (1736–1807) transcribed with vivacity the vignette book-illustrations of Gravelot and Eisen. In more recent times Louis Copia (1764–99) and Barthélemy Roger (1770–1840) ably engraved the works of Prud'hon; Charles-Clement Bervic (1756–1822) was an accomplished pupil of Wille, influenced by the classical revival inaugurated by David; after whose works Pierre-Alexandre Tardieu (1756–1844), another pupil of Wille's, engraved much, though his most important plate is 'The Earl of Arundel,' after Vandyck. In our own time Auguste Boucher-Desnoyers (1779–1857) has produced many thoroughly accomplished plates, chiefly after Raphael; and Louis Calamatta (see above), Paul Mercuri, another Italian engraver working in France, and Achille-Louis Martinet (1806–77) have also been most skilful engravers.

Among the earliest line-engravings published in England are the copperplates in 'The Birth of Mankind' (1540), and in a translation of Vesalius's *Anatomy* (1545), the illustrations of the latter having been copied from the original woodcuts by Thomas Geminus, who was also the translator; but William Rogers (*c.* 1545) is usually regarded as the first English line-engraver of mark. He is best known by his full-length of Queen Elizabeth, after Oliver. Several members of the De Passe family settled in England in the middle of the 17th century; and Renold Elstracke (*c.* 1620) and Francis Delarm (1590) were the chief engravers of the scarce and interesting historic portraits in Holland's *Basiliwlogia* (1618). A more important name is that of William Faithorne the Elder (1616–91)—a pupil, while in France, of Nanteuil's—among whose works is a portrait of Milton, '*ad vivum delin. et sculpsit, 1670.*' His plates lead us to those of William Hogarth (1697–1764), whose burin

engraved, in a sound, honest, and straightforward fashion, many of the figure-subjects executed by his brush.

Next comes a group of far more accomplished engravers, who worked in a classic and finished, if somewhat formal manner. Among these are Sir Robert Strange (1721–92), known mainly by his transcripts from the Italian masters; William Woollett (1735–85), seen at his best when reproducing the landscapes of Claude and Richard Wilson; and William Sharp (1749–1824): while William Blake (1757–1827), a true and sensitive 'painter-engraver,' won an abiding place in the history of the art by his 'Illustrations of the Book of Job.' The end of the last century and the earlier part of the present is distinguished by the achievements of the great school of English landscape-engravers in line founded by William Radclyffe (1780–1855), and including Robert Brandard (1805–62), J. T. Willmore (1800–63), and William Miller (1796–1882), whose admirable artistry translated with the most finished skill the subtlest cloud-effects of Turner. The vignette illustrations to Rogers's *Italy* (1830) and *Poems* (1834) are marvellous examples of the work, on a minute scale, of this school of engravers. Since the period of these men, line-engraving has declined in England, the popular demand now running more in the direction of etching and of various photographic reproductive processes; but within recent years we have had such accomplished burinists as G. T. Doo (1800–86), Lumb Stocks (born 1812), and C. H. Jeans (1827–79). In America, which now possesses a singularly dexterous school of wood-engravers, and also several talented etchers, comparatively little of artistic worth has been produced in line-engraving. Here the process has been chiefly used for book illustration, and for the reproduction of portraiture; and many of its practitioners have been artists of British nationality. For an account of American engravers, see W. S. Baker's *American Engravers and their Works* (Phila. 1875).

Etching.—Albert Dürer (1471–1528), so prolific as a line-engraver and a woodcut-designer, has also the distinction of being the earliest artist who used the process of etching; but the first—and as yet unequalled—master in this department is Rembrandt (1607–69), who, alike in portrait and subject etchings and in his rarer etched landscapes, is the perfect example of what a 'painter-etcher,' an etcher working direct from nature or from his own designs, should be. Much also was done by the pupils and immediate successors of Rembrandt, by such men as Ferdinand Bol (*c.* 1611–81), Philip de Koninck (1619–89); and later Adriaen Janszoon van Ostade (1610–85), Cornelis Pietersz Bega (1620–64), Nicolaas Berchem (1620–83), Paul Potter (1625–54), and Renier Zeeman (born 1612) all executed etchings worthy of preservation and study. By Van Dyck's own hand (1599–1641) is a series of masterly etchings from his portraits, plates which were afterwards completed by the burins of professional engravers. Daniel Nicolaus Chodowiecki (1726–1801), a most prolific etcher, born at Danzig, and working in Berlin, is known by his admirably spirited and graceful book-illustrations. In our own time, Jan Barthold Jongkind and Carel Nicolaas van 's Gravesande have produced landscape-etchings in essential sympathy with the work of the early Dutchmen; and Professor Wilhelm Unger is favourably known as an etcher from paintings.

In Claude (1600–82), an Italian working in France, we have an etcher who infused into his work with the needle much of that delicacy and tenderness of tone and atmosphere for which his work with the brush is pre-eminent: and Jacques Callot (1592–1635) was a spirited and prolific etcher of figure-subjects. During the 18th century the sound traditions of etching seem to have been forgotten, and its true capabilities forgone in France and elsewhere; and the revived practice of the art, upon correct lines, dates from about 1840, when painter-etchers like Charles Daubigny (1817–78) and Charles Jacque (born 1813) began to find, in a periodical entitled *L'Artiste*, an outlet for the plates which they had etched for mere love of the process and of its artistic possibilities. The *Gazette des Beaux Arts*, established in 1857, is also intimately associated with the revival of the art in France, as was also M. Cadart, the Paris publisher. Among the more eminent of the modern French etchers may be named Charles Méryon (1821–68), known by his 'views' of Paris, 'views' which are also visions; Maxime Lalanne (1827–86), one of the most graceful masters of the point; Veyrassat; Félix Braquemond (born 1833), a robust and vigorous etcher; and Jules Jacquemart (1837–80), celebrated for his delicate and sensitive renderings of old jewellers' work and other precious objects of still-life, as well as for his transcripts from pictures. We have here spoken mainly of the painter-etchers, but etching, of a particularly skilled and dexterous sort, has been largely employed in Paris as a freer, swifter, and less mechanical method than line-engraving for the reproduction of paintings. Among the most skilled of the French reproductive etchers are Leopold Flameng, Paul-Adolphe Rajon (1842–88), Charles Waltner, and Le Rat.

In England, the first representative etcher is Wenceslaus Hollar (1607–77), a native of Prague, brought to this country by the Earl of Arundel in 1637. He worked under the constant pressure of extreme poverty, and much that he produced was beneath his best powers; but the finest of his prints are monumental and exemplary as specimens of the art. 'People sometimes say to me, "What is it you see in Hollar?" and I always reply, "Nearly everything,"' writes Seymour Haden. During the years that succeeded Hollar, the true spirit of the process was lost sight of in Britain, as abroad; though the mere processes of the art were kept alive by their use in preparation and subordination to line-engraving, and by the practice of such etchers as Thomas Worlidge (1700–66) in England, and David Deuchar and John Kay (1742–1826) in Scotland. It was Andrew Geddes, A.R.A. (1783–1844), whose example first gave a wholesome and vigorous stimulus to the practice of the art; and, in particular, he produced some most effective work in dry-point. Such of the etchings of David Wilkie, R.A. (1785–1841), as the 'Gentleman at his Desk,' are excellent in aim and spirited in treatment; but both Geddes and Wilkie must be studied in the scarce original states of their plates, not in the much-worn issue of 1875. Turner (1775–1851) used etching with admirable power and unerring selection of line in the plates of his *Liber Studiorum*, where the light and shade was afterwards added by mezzotint, applied usually by the hand of a professional engraver. A considerable stimulus was given to the art in England by the establishment of the Etching Club, which began to publish portfolios in 1841; and still more by the publication, in 1868, of P. G. Hamerton's *Etching and Etchers*, and the establishment of the *Portfolio*, a magazine chiefly devoted to etchings, under his editorship, in 1870. The Etching Club included in its membership such able etchers as Samuel Palmer (1805–81), J. C. Hook, C. W. Cope, and Seymour Haden, an amateur who ranks with James M'N. Whistler at the very head of the painter-etchers working in England. Alphonse Legros and Hubert Herkomer have also done much to stimulate interest in the

art, both by the example of their works and by direct manipulative tuition. Among the younger of our able painter-etchers are William Strang and Frank Short, the former reminiscent in his work of Legros, the latter of Whistler. The more distinctively reproductive etchers include R. A. Macbeth, known by most important transcripts from Frederick Walker and George Mason, and from the works of Titian and Velasquez in Madrid and London; while Mortimer Menpes has rendered 'The Banquet of the Officers of the Archers of St Adrian' of Frans Hals in the largest dry-point on record, as well as produced many independent plates, notably two series of Japanese subjects. Among the earlier of the artists who practised etching in America may be named William Dunlap (1766–1839), the historian of American art; George L. Brown (q.v.), known by his nine 'Etchings of the Campagna, Rome' (1860); and Edwin Forbes, who, about 1876, published a portfolio of forty plates of 'Life Studies of the Great Army.' In 1866 M. Cadart of Paris established a French Etching Club in New York, which did a good deal to foster the art. The *American Art Review*, founded in 1879, during the two years of its existence afforded a means for the publication of etchings; and in 1881 an interesting exhibition of the works of American etchers was held at the Boston Museum of Fine Arts. Among the most talented of recent etchers in America may be named Frank Duveneck, who has produced some admirable Venetian street-scenes, Otto Bacher, Henry Farrer, Joseph Pennell, Stephen Parrish, Mary Nimmo Moran, Thomas Moran, and Charles Platt.

Soft-ground Etching.—This process was effectively employed by John Sell Cotman (1782–1842) in his architectural subjects, by Samuel Prout (1784–1852), and by John Ruskin (q.v.) in the illustrations to the first edition of his *Seven Lamps of Architecture* (1849); but it has now been superseded by lithography, which attains similar results in a readier way, and is much less costly in printing.

Mezzotint.—The process of mezzotint was invented by an amateur, Ludwig von Siegen (born 1609, at Utrecht), an officer who held the appointment of 'Kammerjunker' to the Landgrave of Hesse-Cassel. In 1642 he forwarded to his patron a portrait of his mother, the Dowager Landgravine of Hesse, as the first-fruits of his newly-discovered process, stating, in the letter which accompanied it, that 'how this work was done, no copperplate-engraver or artist can explain or imagine.' In 1654, after having executed other plates in the same manner, Von Siegen visited Brussels, and there came into contact with Prince Rupert (1619–82), who had already been practising etching, and to him, for the first time, the inventor disclosed his process. It was adopted by the prince, who was assisted by Wallerant Vaillant (1623–77), and was afterwards practised by Theodore Caspar von Fuerstenberg, one of whose plates is dated 1656; Johann Thomas of Ypres, who is stated to have acquired the art at Frankfort; Abraham Blooteling (1634–*c.*1695), an admirable engraver of portraits, who worked for a time in England; Gerard Valck (1626–*c.*1720); and by many of the leading Dutch painters and engravers of the century. During the 18th century mezzotint-engraving declined in Holland, and, indeed, on the Continent generally, though Jacques Christofle Le Blon (born 1670 at Frankfort, died 1741 at Paris) devised a process for printing mezzotints by means of which various colours of ink appeared in each impression. The art was to some extent revived in Vienna, about 1780, by Jacobe, who had studied in London under the great English mezzotinters of the period; and, in the same city, Johann Peter Pichler (1765–1806) executed some admirable plates, particularly his transcripts from the flower-pieces of Van Huysum.

In France we have mezzotint-plates by J. Van der Bruggen (born 1649, at Brussels), dated from Paris as early as 1681. Sebastian Barras (born *c.*1680 at Aix; died 1710), Isaac Sarrabat (working 1695–1701), and Bernard Picart (1673–1733) are other mezzotint-engravers who worked in France; but here the process was comparatively little used on account of the great excellence of the French line-engravers.

It was, however, in England that the art was most extensively and successfully practised, as is indicated by one of the phrases used on the Continent to designate mezzotint-engraving, *la manière anglaise*. The process was introduced in 1660 into England by Prince Rupert, whose method is described in Evelyn's *Sculptura, or the Art of Chalcography* (1662). He executed some fifteen plates, among which the chief are the 'Great Executioner' and the 'Standard-bearer.' Sir Christopher Wren (1631–1723) and John Evelyn (1620–1706) have been believed, on rather insufficient evidence, to have practised the art. William Sherwin's plate of Charles II. is dated 1669; Francis Place (1650–1728) scraped a few portraits, including one of Charles I., free in style and delicate in gradation; Isaac Beckett (1653–1719), and particularly John Smith the Elder (1652–1742), worked much after the portraits of Kneller; and John Faber the Younger (born in Holland, 1684; died in London, 1756) engraved series of 'The Beauties of Hampton Court' and 'The Members of the Kit-Cat Club' after the same artist, transcribed the portraits of many minor portrait-painters of the time, and also engraved many subject-pictures, one of the finest being a mezzotint from Frans Hals's 'Man playing the Guitar' (1754). Richard Earlom (1743–1822) is seen at his highest in his mezzotints from Dutch flower-pictures, prints which are unrivalled for delicacy; and among his other works are his reproductions, in combined etching and mezzotint, of Claude's *Liber Veritatis* drawings. We have now reached the perfect time of the art in England, the period of the great school of mezzotinters who reproduced with splendid power the works of Reynolds and his contemporaries, with whose style of painting, with whose broad generalising touch, the method of mezzotint is in most essential sympathy. Among the greatest of these men are James M'Ardell (1710–65), by whose prints Reynolds said 'I shall be immortalised,' Edward Fisher (1730–85), James Watson (1740–90), John Jones (1740–1810), J. Raphael Smith (1750–1812), Valentine Green (1739–1813), William Dickinson (1746–1823), S. W. Reynolds (1773 or 1774–1835), and Charles Turner (1773–1857). The mezzotint-prints executed after Sir Joshua alone include the work of about sixty different engravers. Some of these men, such as Charles Turner and S. W. Reynolds, took part in the plates of the *Liber Studiorum* of J. M. W. Turner (himself an accomplished mezzotinter, as certain plates of that series attest), and engraved the portraits of Raeburn, works especially adapted for reproduction by their method; and William Ward (1766–1826) scraped a few splendid prints after another Scottish painter, Andrew Geddes. The latest and most effective development of pure mezzotint in landscape includes the renderings by Thomas G. Lupton (1791–1873) of Turner's 'Ports' and 'Rivers' of England, and the transcripts by David Lucas (1802–81) from the works of Constable, a series executed, like the *Liber Studiorum* of Turner, under the closest supervision of the painter; who, however, did not, like Turner, himself use the scraper, though he longed to do so, writing to his engraver, 'How I wish I could scratch and tear

away with your tools on the steel.' On account of the larger number of impressions which could be printed from them, steel plates had already been introduced by the mezzotinters, but these being scraped with somewhat less facility than the copper plates formerly employed, tended much to the deterioration of the art and to the loss of its especial qualities of freedom and painter-like breadth, especially when the mezzotint work was largely supplemented, as was now commonly the case, by the burin, and by etching and stipple-engraving. By means of this modern method engravers of first-rate power, such as Samuel Cousins (1801–87), were capable of producing attractive and excellent plates; but in the hands of inferior workmen the results attained by this bastard combination of various processes were pitiably inartistic. Within quite recent years, however, there has been a distinct revival of the art upon the old legitimate lines of pure mezzotinting upon copper. One of the first inaugurators of the revival was Joseph Jossey, who engraved very sympathetically Whistler's 'Thomas Carlyle' and 'Portrait of the Artist's Mother.' William Campbell (1855–87) executed several excellent mezzotints after Burne-Jones. A powerful impetus towards right technical methods was given by Hubert Herkomer (born 1849 in Bavaria), and among his pupils D. Wehrschmidt and William Henderson have engraved excellently after Holl's portraits, and Gerald Robinson is favourably known by his delicate transcript from Van Dyck's bust portrait of Henrietta Maria in the royal collection. Seymour Haden has added mezzotint to the later states of his powerful etching from Turner's 'Calais Pier;' and F. Short, in addition to original work, has produced, in combined etching and mezzotint, some admirable copies from Turner's *Liber Studiorum*. Mezzotint was the first form of engraving practised in America, Peter Pelham (*c.*1684–1751) having removed from London and settled in Boston before 1727, the year in which he published, from his own painting, a mezzotint of the Rev. Cotton Mather, which was followed by various other portraits of eminent Americans. Among the other mezzotint engravers of America may be named Thomas B. Welch (*c.* 1814–74), and John Sartain (born in London, 1808).

Aquatint-engraving.—This method is believed to have been invented by Jean-Claude-Richard de Saint-Non (1730–1804), a French draughtsman and etcher who studied in Italy, and to have been communicated by him to Jean Baptiste Le Prince (1733–81), a native of Metz working in Paris, who sold the secret to the Hon. Charles Greville. By him it was disclosed to Paul Sandby, who was the first to practise the method in England, using it to reproduce his Welsh landscapes, and carrying it to great perfection in his 'Views in the Encampments in the Parks' (1780). It was also employed in Scotland by David Allan (1744–98), who engraved in this manner his illustrations to Ramsay's *Gentle Shepherd* (1788). F. C. Lewis (1779–1856), the best aquatint-engraver of his time, is known by his reproductions of the drawings of Claude and of Lawrence; and he added the aquatint light-and-shade to the first plate of Turner's *Liber Studiorum*, mezzotint being employed for this purpose in the rest of the subjects of the series. Catherine Prestel (died in London, 1794), a German, executed some fine plates in combined etching and aquatint; and in Spain Goya (1746–1828) employed a similar union of processes in the wild and bizarre plates which he produced. Aquatint is now little used, but in our own time Brunet-Debaines has adopted it with accomplished skill in his renderings of the landscapes of Turner.

Chalk or Stipple Engraving.—Jean Charles François (1717–69) is said to have been the first engraver to employ this process, and for its discovery he received a pension of 600 francs from the French king, along with the title of 'Graveur des desseins du Cabinet du Roi.' He used the method chiefly for the reproduction of drawings in crayons, for which it has since been very popular until the discovery of Lithography (q.v.) and of Photography (q.v.), by which such fac-similes can more accurately and readily be produced. He was followed by Giles de Marteau the Elder (1722), another able engraver. The process was introduced into England by William Wynne Ryland (born 1732; executed for forgery, 1783), who worked in this method after drawings by the old masters and the designs of Angelica Kauffman; but the most celebrated of the stipple-engravers working in England was an Italian, Francesco Bartolozzi (1725–1815). In America some good portrait engraving in stipple was produced by David Edwin (1776–1841), an Englishman who studied in his native country and in Holland, and by Ion B. Forrest (1814–70), a Scotsman trained in London.

The works dealing with the history and practice of engraving are very numerous, and every year adds many fresh volumes upon the subject. In Dr W. H. Willshire's *Introduction to the Study and Collection of Ancient Prints* (2d ed. 1877), a useful book of reference, will be found a list of nearly a hundred works devoted to engraving. For an account of technical processes, the student may consult T. H. Fielding's *Art of Engraving* (1841), P. G. Hamerton's *Etcher's Handbook* (1871), the three editions of his *Etching and Etchers*, and his *Graphic Arts* (1882). *Le Peintre-Graveur* of Adam Bartsch (Vienna, 1803–21, and Leip. 1854), with its supplements by J. D. Passavant (6 vols. Leip. 1860–64), and A. P. F. Robert-Dumesnil's *Le Peintre-Graveur Français* (8 vols. Paris, 1835–50), and the 11 volumes of its continuation by Georges Duplessis, are the standard catalogues of old prints. Among the other works that may be named are W. Y. Ottley's *Early History of Engraving* (2 vols. Lond. 1816); Georges Duplessis's *Histoire de la Gravure en France* (Paris, 1861), *Les Merveilles de la Gravure* (Paris, 1869), and *Histoire de la Graveur* (Paris, 1880); and Bryan's *Dictionary of Painters and Engravers* (edited by R. E. Graves and W. Armstrong, 2 vols. Lond. 1886–89); and there are separate monographs and catalogues dealing with the works of almost all the more important individual engravers. The extensive series of fac-similes by M. Amand-Durand of Paris from the plates of many of the old engravers should be studied by those to whom the original prints are inaccessible.

Engrossing, a term used to describe the conduct of those who buy up merchandise in large quantities to obtain command of the market. This was formerly an offence punishable by law and by municipal regulations; as were also the offences of forestalling (buying merchandise on its way to market) and badgering or regrating (buying to sell again at an unduly enhanced price). The old laws in restraint of trade were not found to work well. So far from making the necessaries of life cheap as they were intended to do, they discouraged producers and traders, and so made prices abnormally high. The English statutes on the subject were therefore repealed in 1772, and the offences of engrossing, &c. were finally abolished, both in England and in Scotland, in 1844. In the United States, engrossing is a common-law offence; and the constitutions of several states declare that monopolies are 'contrary to the genius of true government;' but with the development of modern commerce these restrictions have become obsolete, and 'rings,' 'corners,' 'syndicates,' 'trusts,' are year by year becoming more common on both sides of the Atlantic.

Engrossing a Deed means the writing it out in full and regular form on parchment or paper for signature. The person who engrosses is usually a law-stationer or clerk. In Scotland, the

corresponding term is 'extending a deed,' and till 1874 it was necessary that the person extending the deed should be named in the testing clause. See DEED.

Enharmonic, originally the name of one of the three Greek scales, is now applied to music constructed on a scale containing intervals less than a semitone—e.g. where the difference is recognised between G♯ and A♭, or D♯ and E♭. On the old organ built by 'Father' Smith for the Temple Church in London these notes had separate keys. But in modern keyed instruments, tuned, as they now universally are, in equal temperament, these notes are represented by the same sound; and the possibility is afforded of enharmonic *modulation*, in which a chord belonging to one key is, by a change merely of its notation, made the means of passing into another key. The chords commonly used in this change are the diminished seventh, or equivocal chord, which may be written in four different ways, and (less frequently) the dominant seventh, which may be changed into the German sixth. See MUSIC.

Enkhuizen, a town of North Holland, one of the 'dead cities of the Zuider Zee,' 35 miles NNE. of Amsterdam. It once sent out 400 ships to the herring-fishery, and had 40,000 inhabitants; but its harbour has gradually silted up. It was the first town to throw off the Spanish yoke (1572), and in 1625 was Paul Potter's birthplace. Pop. (1892) 6475.

Enlistment is the mode by which the British and American armies are recruited, as distinguished from the Conscription prevailing in most European countries. Enlistment in Britain was, until 1802, in the hands of middlemen, who received a commission for their trouble. Since that year it has been managed by the adjutant-general's department. Formerly, a soldier enlisted for life, and could never look forward to retiring on a pension while still possessed of a fair share of health and strength. This was changed in 1847 by an act which limited the term of enlistment to 10 years for infantry, and to 12 for cavalry or artillery. A soldier could then either quit the army without pension, or re-engage for the remainder of 21 years, at the expiration of which time he was entitled to a pension for life; and in 1868 twopence a day was added to the pay of every soldier so re-engaged. This system was not compatible with the formation of trained reserves, with which to bring the army to fighting strength in the event of war, and in consequence the 'Army Enlistment Act' of 1870 was passed. Under this act men still enlist for 12 years, but with the understanding that 7 years or less shall be passed with the colours, and the remainder in the reserve. This is known as 'short service;' and a reserve of trained soldiers has thus been formed who are liable to be called back into army service if great emergency arises during their reserve service. The Army Act of 1881 contains the law relating to enlistment. The Recruit (q.v.) no longer receives from the recruiting-sergeant the shilling which formerly obliged him to appear before a magistrate and take the oath, or pay a fine of twenty shillings. Now he is not deemed to be enlisted until he has voluntarily appeared before a magistrate, commanding officer, or other authorised person, who puts to him a series of authorised questions, and satisfies himself that the man is not under the influence of liquor. The recruit then signs the declaration, takes the oath, and is attested. A false answer to questions put on attestation is punishable by a civil court or court-martial. At any time within three months of his attestation if a recruit pays a sum not exceeding ten pounds he is entitled to be discharged, unless the country is at war. A man who has received pay as a soldier is deemed to be enlisted, even though he has not been attested, but can claim his discharge at any time within 3 months. An apprentice can be claimed by his master within one month of his enlistment, but must be under 21, have been bound by regular indenture for 4 years, and under 16 when so bound. Militiamen enlist for a term of 6 years, and may then re-enrol for another term of 6 years. See DESERTION, DISCHARGE, FOREIGN ENLISTMENT ACT, and RECRUIT; and for the manning of the navy, see NAVY.

Enna. See CASTROGIOVANNI.

Ennemoser, JOSEPH, a medico-philosophic writer, was born in 1787 at Hintersee, in the Tyrol, and commenced his medical studies at Innsbruck in 1806. On the rising of the Tyrolese against the French in 1809 he followed Andreas Hofer as his secretary; at the close of the war he went to Erlangen, and subsequently to Vienna, for the purpose of concluding his studies. In 1813 he raised a company of Tyrolese marksmen, who were of great service during the campaigns that followed. After the peace of Paris he finished his curriculum at Berlin, and devoted himself to the study of animal magnetism. In 1819 he was made professor of Medicine at Bonn, where he lectured until 1837; he then practised for a time at Innsbruck, but in 1841 removed to Munich, where he obtained a great reputation by the application of hypnotism as a curative power. He died 19th September 1854. Among his numerous writings *Der Magnetismus in seiner geschichtlichen Entwickelung* (Leip. 1819) is reckoned his principal work.

Ennis, a municipal borough of County Clare, Ireland, on the Fergus, 25 miles NW. of Limerick, and 151 WSW. of Dublin by rail, is a neat town, with some good houses. Here are the Catholic cathedral of Killaloe diocese, a fine court-house, the Clare lunatic asylum, large flour-mills, a school founded by Erasmus Smith (1689), a column to O'Connell (1863), and a memorial to the 'Manchester martyrs.' Till 1885 Ennis returned one member to parliament. Pop. (1851) 7840; (1881) 6307; (1891) 5460.

Enniscorthy, a market-town of Wexford, beautifully situated on the navigable Slaney, 78 miles S. of Dublin by rail. A cruciform church by Pugin, with a good spire, is the principal edifice. There is a large corn-trade. Pop. (1851) 5993; (1891) 5648. Enniscorthy grew up round a castle, still entire, founded by Raymond le Gros, one of the early Anglo-Norman invaders. Cromwell took it in 1649; and the rebels from Vinegar Hill (q.v.) stormed and burned it in 1798.

Enniskillen, a municipal (till 1885, also parliamentary) borough, the capital of County Fermanagh, 87 miles WSW. of Belfast, and 117 NW. of Dublin by rail, is beautifully situated on an isle in the river between Upper and Lower Loughs Erne. Around are richly cultivated eminences and many fine mansions; whilst among its own edifices are the Protestant and Catholic churches (the latter a fine modern building), the large barracks, a lofty monument to Sir Lowry Cole, and the Royal Portora School. The chief manufactures are cutlery and straw-plait. Pop. (1851) 5792; (1891) 5570. Enniskillen is famous for the victory, in 1689, of the troops of William III., under Lord Hamilton, over a superior force of James II., under Lord Galmoy. The banners taken in the battle of the Boyne hang in the town-hall. The regiment of Enniskilleners, or 6th Dragoons, was first instituted from the brave defenders of the town.

Ennius, one of the earliest Roman poets, the father of the Roman Epos, was born at Rudiæ, in Calabria, about 240 B.C., and was probably of

Greek extraction. He is said to have served in the wars, and to have risen to the rank of a centurion. In Sardinia he became acquainted with Cato the Elder, and returned with him to Rome when about the age of thirty-eight. Here he gained for himself the friendship of the most eminent men, among them Scipio Africanus the Elder, and attained (what was then exceedingly rare in the case of an alien) to the rank of a Roman citizen. He supported himself in a decent but humble manner by instructing some young Romans of distinguished families in the Greek language and literature, his accurate knowledge of which explains the influence he had on the development of the Latin tongue. He died when he had attained the age of seventy, about 170 B.C. His remains were interred in the tomb of the Scipios, and his bust was placed among those of that great family. Ennius tried his powers in almost every species of poetry, and although his language and versification are rough and unpolished, these defects are fully compensated by the energy of his expressions and the fire of his poetry. His poems were highly esteemed by Cicero, Horace, and Virgil: the last, indeed, frequently introduces whole lines from the poetry of Ennius into his own compositions. His memory seems to have been lovingly cherished by his countrymen: *Noster Ennius*, 'Our Ennius,' they used to call him. Of his tragedies, comedies, satires, and particularly of his *Annales*, an epos in 18 books, only fragments are extant. What adds to our regret is that it is believed his whole works were extant as late as the 13th century. The fragments have been collected and edited by Vahlen (1854) and by Lucian Müller (1885); the dramatic fragments by Ribbeck (1873). See also Lucian Müller, *Quintus Ennius* (1884); Ribbeck, *Römische Tragödie* (1875); Sellar's *Roman Poets of the Republic* (2d ed. 1881); and Simcox's *History of Latin Literature* (1882).

Enns, a river of Austria, rises at the northern base of a branch of the Noric Alps in the crownland of Salzburg, 12 miles S. of Radstadt, and flows 190 miles (only the last 20 navigable) in a general northerly direction, till it joins the Danube a few miles below Linz. Its chief affluents are the Salza and the Steier. From ancient times the Enns has formed the boundary between Upper Austria (Ober der Enns) and Lower Austria (Unter der Enns). Having mostly a rapid fall, it is chiefly important from the valuable water-power which it supplies.

Enoch, 'the seventh from Adam' (Jude, xiv.), 'walked with God' (Gen. v. 21–24), and, after a life of 365 years, 'was not, for God took him'—i.e. (according to Heb. xi. 5) 'was translated that he should not see death.' This early tradition recorded in Genesis is a significant expression of the faith that man when he has attained to true unity with God is capable of an eternal divine life. It is probable that the number of the years of Enoch was in some way connected with the number of days in the solar year. Partly from this, and partly from the interpretation of his name (Heb. *Hanōkh*) as 'initiated,' arose the later Jewish legend that Enoch had invented writing, arithmetic, astrology, and astronomy. He was held to have predicted the flood, and to be the possessor, through revelation, of the knowledge of all mysteries in heaven and earth. By the Arabs he is called *Idrîs* ('the experienced' or 'learned').—Enoch is the name of three other persons in the Bible, one of them being the eldest son of Cain (Gen. iv. 17).—For the Glasgow 'St Enoch,' a corruption of 'St Thenaw,' the name given by St Serf to St Kentigern's mother, see the article KENTIGERN.

Enoch, THE BOOK OF, purports to be a series of revelations made to Enoch both in heaven and on earth. Its contents embrace an apocalyptic history of the kingdom of God, and of the secret origin of the laws of nature. The book is not all by one author, and its various parts are largely interspersed with interpolations. It has been divided by scholars into (1) *an original writing*, consisting of chapters i.–xxxvi. and lxxii.–cv., of which at least chapters lxxxv.–xc. date from the last third of the 2d century B.C.; (2) *three allegories*, which are probably pre-Christian writings, but not earlier than the time of Herod, embracing chapters xxxvii.–lxxi., with the exception of later chapters liv. 7–lv. 2, and lx. 65–lxix. 25, which are distinguished as (3) *the Noachian portions*, because they purport to have been written by Noah. To these last should be added chapters cvi. cvii., and the still later chapter cviii.

The Book of Enoch, which, according to Dillmann, is of Palestinian origin, forms one of the richest sources for the knowledge of Jewish theology and speculation in the last ages before Christ. It was much used in Jewish and Christian writings of the first five centuries of our era, and a passage from it is quoted in the Epistle of Jude (verses 14, 15). Yet from about 800 A.D. the book disappeared, and only a few fragments of a Greek version (probably from a Hebrew or Aramaic original) were known till the year 1773, when three MSS. of an Ethiopic translation made from the Greek were brought by the traveller Bruce from Abyssinia. An English translation by Archbishop Lawrence appeared in 1821 (Ethiopic text, 1838). The best edition is that of Dillmann, based on a collation of five MSS. (Leip. 1851), which, with his German translation (1853), has formed the foundation of all subsequent studies on the book.

See Drummond, *The Jewish Messiah* (1877); Bissell, *The Apocrypha of the Old Testament* (New York, 1880); Schodde, *The Book of Enoch*, a translation with introduction and notes (Andover, 1882); vol. iii. of Stanley's *Jewish Church* (new ed. 1883); and the account both of the book and of the recent literature relating to it in Schürer's *History of the Jewish People in the Time of Christ* (Eng. trans. 2d div. vol. iii. Edin. 1886).

Enos (the ancient *Ænos*), a seaport of the Turkish province of Adrianople, on a rocky isthmus near the mouth of the Maritza, about 35 miles NW. of Gallipoli. It has some trade in wool, cotton, leather, wax, &c., but its harbour is now very shallow and choked up with sand. Pop. 8000, principally Greeks.

Enriquez Gomez, ANTONIO (properly ENRIQUEZ DE PAZ), a Spanish poet, the son of a baptised Portuguese Jew, was born at Segovia early in the 17th century. He entered the army in his twentieth year, and rose to the rank of captain; but in 1636 fled to Amsterdam, and, having there professed the Jewish faith, was in 1660 burned in effigy at a Seville auto-da-fé. The date of his death is not known. For his twenty-two comedies, of which some passed as Calderon's, and his poems, see Ticknor's *History of Spanish Literature*.

Enschede, a town of Holland in the province of Overyssel, 30 miles ENE. of Zutphen. Rebuilt since its destruction by fire in 1862, it has large yarn and cotton mills. Pop. (1892) 16,178.

Ensign was, until 1871, the title given to officers of the lowest commissioned rank in the British infantry (the corresponding rank in the cavalry being Cornet), because they carried the regimental Colours (q.v.) or ensign. Formerly this was a duty attended with much danger when in action, and considered highly honourable; but colours are no longer taken into battle, and officers of the rank of ensigns and cornets are now called sub-lieutenants.

ENSIGN is also the name of the distinguishing flag on board ship. See FLAG.

Ensilage. See SILAGE.

Enstatite, an important rock-forming mineral. It is essentially an anhydrous silicate of magnesia, but usually contains also small percentages of alumina and ferrous oxide. It belongs to the pyroxene group of minerals.

Entablature, that part of a design in classic architecture which surmounts the Columns (q.v.), and rests upon the capitals. It is usually about two diameters of the column in height, and is divided in every style of classical architecture into three parts—architrave, frieze, and cornice. These parts vary in their relative proportions in different styles. In Doric architecture, for example, if the entablature be divided into eight equal parts, two of these form the height of the architrave, three that of the frieze, and three that of the cornice. In the other styles, the relative proportions are as three, three, and four.

Fig. 1.—Example of Doric Entablature.

The *Architrave* is the horizontal portion which rests immediately upon the abacus of the column. It is usually ornamented with horizontal mouldings, with flat spaces or *fasciæ* between. The upper moulding always projects farther than the others, so as to throw off the rain. This moulding varies in different styles. In Doric (fig. 1) it is a plain square projection, with small pendants or *guttæ* under the triglyphs. In the other styles it is generally an ogee or talon moulding. These mouldings are frequently enriched with leaf ornaments, and in very florid designs the fasciæ are also enriched.

The *Frieze* is the middle portion of the entablature, between the top of the architrave and the bed of the cornice. In the Doric style it is ornamented with triglyphs or slight projections, divided by angular grooves into three parts. The spaces between the triglyphs (called metopes) are square, and are either plain or enriched, either with figure-sculpture, as in the Parthenon, or with bulls' heads, pateræ, or other ornaments. In the other styles the frieze is never cut into portions, but is either left quite plain or ornamented with figure-sculpture or scroll-work. The former is most usual in Greek art, the latter in Roman. In late Roman works the frieze is sometimes *swelled* or made to project with a curve.

The *Cornice* forms the upper portion of the entablature. It is divided into several parts. The lower moulding or mouldings resting on the frieze are called the bed-mouldings, the lower member of the upper projecting part is called the Corona (q.v.), and between the two there are frequently introduced modillions and dentil bands. The bed-moulding is generally of an oval or echinus form, and is frequently enriched with the egg and tongue or leaf ornaments. The upper moulding of the corona is generally of a *cyma recta* form (see COLUMN, fig. 1), and is often ornamented with lions' heads. These represent the openings through which the rain was at first led off from the roof-gutters cut in the top of this moulding, and were retained as ornaments after their original use was discontinued. The corona projects well over the frieze and architrave, and protects them from rain, while at the same time, by its broad shadow, it gives repose and variety of effect to the building. The *soffit*, or under side of the corona, is frequently panelled and ornamented with pateræ.

Origin.—The component parts of the entablature are said, with some appearance of truth, to owe their origin to the forms of the construction of the oldest temples. These were of wood, and were put together in the manner most natural for that material. The square beams laid across from post to post are represented by the architrave; the triglyphs of the frieze are copied from the ends of the cross-beams; the cornice is taken from the boarding which covered the rafters and ties of the roof—projected so as to throw off the rain; and the dentils and modillions show the ends of the rafters left uncovered. It is not supposed that these features were intentionally imitated by the classic architects, but that the original wooden construction produced forms which were afterwards traditionally though unconsciously followed.

Whatever the origin of the entablature may have been, it is a remarkable fact, as connected with Greek and Roman art, how persistent the entablature was as a feature in the decoration of all classic styles. So long as buildings consisted of one story in height, this was quite natural; but after this simple system was abandoned, and when, as in Roman architecture, several series of columns and entablatures were piled one above the other—not used constructionally, but simply applied to the face of the building—the cornice, frieze, and architrave still retained their places and proportions. In the revived Roman art of the 16th century the entablature was used in a manner still further removed from its original purpose (fig. 2).

Fig. 2.—Example of Composite Entablature.

The strict proportions of the various parts were entirely lost sight of. The frieze was increased in height, so as to admit of small windows, to light the Entresol (q.v.) or mezzanine, and in the French and English forms of the Renaissance the various members become still more attenuated and altered from the original design (see RENAISSANCE). But in no modification of classic

architecture, however debased, is the entablature wanting. The architrave, frieze, and cornice are essential portions of every classic design.

Entada, a genus of leguminous climbing shrubs (sub-order Mimoseæ) remarkable for their great pods. The egg-sized seeds of *E. gigalobium* are carried by the Gulf Stream not only to the Canaries, but to Nova Zembla, where their occurrence suggested the name of 'Chestnut Bay.'

Entail. The desire to preserve in our own family land which we have either inherited or acquired appears to be inherent in the human mind. Arrangements of this nature were not known to primitive peoples, among whom land descended according to strict customary rules which could not be altered by the act of an individual owner. In some of the ancient Greek states owners of property were permitted to name successors to their estates, and to appoint a substitute who should take the estate on the failure of him first named. The substitute so appointed was permitted to succeed on the death of the institute (as he was called) without leaving issue or without alienating the estate. Under the Roman law the practice of settling land upon a series of heirs, by means of *Fideicommissa* (q.v.), grew up, and was sanctioned by the state. These deeds, in their early form, contained merely a substitution of heirs. But by the later law a much fuller form of settlement was admitted, whereby the estate was protected from every sort of alienation. The limitation to a particular line of descent, the prohibition to alienate or burden with debt, and the still more peculiar feature of the declaration of forfeiture in case of non-compliance are to be found in both forms. There are, however, two points in which the Roman law differed from modern laws of entail. It did not recognise the right of Primogeniture (q.v.), and after the legislation of Justinian the limitation of the deed was restricted to four generations. For the right of primogeniture, as recognised in deeds of entail, we are indebted to the feudal law. That system, which has united with the civil law to form a basis for the codes of modern Europe, did not, in its original form, recognise the right of a holder of land to alienate his feudal benefice, or even to alter the succession, because on the failure of heirs the feu returned to the superior. But the right of the eldest son to represent his father, both in the duties and privileges of the fief, if not an original principle of the system, was universally recognised in the days of its greatest power.

In *England*, the Saxons seem to have prohibited the alienation of lands by those who had succeeded to them under condition that they should not alienate. The law of primogeniture was not recognised. But after the Norman Conquest feudal grants were often made 'to A and the heirs of his body,' or 'to A and his heirs, if he shall have heirs of his body.' The estate thus given was regarded as a fee-simple conditional; on the birth of an heir of his body, A would acquire the fee; and, like other owners in fee after the 13th century, he was at liberty to alienate. To prevent this, the feudal lords obtained the enactment of the statute *De Donis*, by which it was directed that the fee given with the words above quoted should in all cases descend according to the form of the gift; so that, in the case supposed, A would not have a fee-simple, an estate to him and his heirs-general, which he was free to alienate, but a fee-tail—i.e. a fee *taillé* or cut down, which he could not alienate so as to bar the rights of his issue. Under the statute, lands might be settled in tail, or in tail male, or in tail special—i.e. on a man and the heirs of his body by a particular wife. A settlement in tail special was somewhat analogous to a settlement in Frankmarriage (q.v.).

The restraints on alienation thus imposed were contrary to sound policy, and the courts permitted tenants in tail to bar or cut off the entail; a tenant in possession was permitted to bar all rights of other persons, and so to turn his own estate into a fee-simple. From the time of Edward IV. down to 1833 this was effected by means of fictitious actions, called Fines and Recoveries; for these cumbrous and expensive forms the 3 and 4 Will. IV. chap. 74 substitutes a simple disentailing deed. A strict settlement of land usually begins with an estate for life to an existing person, followed by an estate tail to his son. When the donee of the estate tail comes into possession, he can disentail and alienate at his own discretion. If not in possession, he can dispose of his own rights and those of his issue; but he cannot destroy the entail, so as to bar remaindermen and reversioners, and turn his estate into a fee-simple, unless with the consent of the 'protector of the settlement,' who is usually the tenant for life. An estate tail is a freehold of a limited description. Tenant in tail in possession may commit Waste (q.v.). Formerly, an estate tail was not liable to the debts of the tenant, but by 1 and 2 Vict. chap. 110 this restriction has been removed. Copyhold lands have been held not to fall under the operation of the statute *De Donis*. A limitation, therefore, which in a freehold creates an estate tail, in copyhold lands creates a fee-simple conditional, according to the old common law, except where the custom of the manor is to the contrary. But, by trust-conveyances, copyhold estates may be settled in the same way as freeholds. The rules against Perpetuities (q.v.) prevent property from being tied up for an indefinite period; but family estates are usually re-settled by owners and heirs of entail in each generation. Lord Cairns's Settled Land Act, 1882, has given to tenants for life absolute power of sale upon notice to the trustees of the settlement, and without petition to the court, the price being invested for the persons interested under the settlement. By a series of statutes in England, tenants for life have also received large powers of managing and improving their estates.

In *Scotland*, as in England, entails appear first to have taken their rise from the feudal usages, and from the Roman law, the forms of which were closely followed by conveyancers. It has been observed by Lord Kames that, while the feudal system was in its vigour, every estate was in fact entailed, because no proprietor had any power to alter the order of the succession. But when the stricter feudal principles gave way, and the power of alienating land began to be recognised, the holders of estates sought by deed to secure in their own families the lands which they possessed. The form first adopted for this purpose was the simple destination, whereby the estate was simply limited to a particular series of heirs, without prohibition to alienate, or declaration of forfeiture for contravention of the will of the grantor. In this form the deed must have resembled the early English entails. The feudal law of primogeniture having been received as a principle of common law, the estate would naturally descend from father to son in the line indicated by the deed. But, as it was held that those succeeding under this deed were not restrained from alienating, the practice of adding prohibitory clauses was introduced. Entails in this form were held to bind the heir from granting gratuitous alienations; but he was not restrained from selling the estate, or burdening it with debt. Early in the 17th century a further addition was made to the form of the deed by the introduction of irritant and resolutive

clauses—i.e. clauses declaring the act of alienation to be null, and to infer the forfeiture of the estate. The form thus adopted, which resembles closely the form of the Roman deed already noticed, was fortified by a decision of the Court of Session on the Stormonth entail in 1662, holding that an estate so protected could not be attached by creditors. This decision created much difference of opinion amongst lawyers as to the power of the grantor thus to protect an estate from the onerous act of the heir. In consequence the famous Scotch Entail Act, 1685, chap. 22, was passed, by which it was enacted that an estate conveyed by a deed fortified by prohibitory, irritant, and resolutive clauses, and recorded in a particular register, should be effectually secured in the line of destination. This act has always been most strictly viewed by Scottish lawyers; and entails which have been found deficient in any of the prescribed requisites have been regarded by the courts as utterly ineffectual. The operation of the old entail act was found, notwithstanding, to be of the most oppressive character. Statutes were in consequence passed from time to time, empowering heirs of entail to exercise larger powers of ownership than could be granted under the Act of 1685, and to make provisions for their families. Chief among these were the Montgomery, the Aberdeen, and the Rosebery Acts. At length, by 11 and 12 Vict. chap. 36 (known as the Rutherfurd Act), the power of fettering lands by a strict entail has been finally destroyed. By this act, heirs under an existing entail may disentail, with the consent of certain heirs next in succession; and in all entails made after 1st August 1848, and also in old entails where the heir in possession was born since 1st August 1848, the heir of entail in possession may, by means of a simple deed of disentail, free his estate from the restrictions of the entail. A statute in 1875 gave the heir in possession larger powers of permanent improvement and the right of buying out the interest of the next heirs at a compulsory valuation; and the Entail (Scotland) Act, 1882, gave further powers of disentailing in the case of entails made since 1848, and in all cases a practically absolute power of sale to be exercised on petition to the court, the price being invested for behoof of the heirs of entail. From statistics returned to parliament in 1882, it appeared that disentailed land was rapidly re-entailed in Scotland.

In *America*, before the Revolution, the English law as to estates tail prevailed. But in the United States, the law of entails has been gradually abandoned by the several states; and property can now be fettered to a limited extent only, by means of executory Devises (see WILL). In *Germany*, family settlements of a very strict character, and 'private laws' regulating the descent of property in certain noble houses, are permitted by the laws of some of the states which form the German empire. In *France*, the power of creating entails has varied much at different periods, from the right to make a perpetual entail, which appears to have been the original principle, to a limitation to four, and at one time to two degrees. But by the Code Napoléon, arts. 896–897, entails are now absolutely prohibited. In *Spain*, also, entails, till then permitted under certain restrictions, were entirely abolished by the Cortes in 1820. Thus it will be seen that the right of securing land in a particular family, which commends itself to the natural feelings, has been found so oppressive in operation, and so injurious to the public interest, that, after an existence of more than 600 years, it has been practically discarded almost simultaneously by the general consent of modern nations.

See Williams's *Principles of the Law of Real Property*; Sandford's *History and Law of Entail in Scotland*; *Reports by H.M. Consuls on Systems of Land Tenure* (1870); and *Cobden Club Essays* on the same subject.

Entellus Monkey, or HANUMÂN (*Semnopithecus Entellus*), the most sacred monkey of the Hindus, worshipped as half divine, and regarded as the host of ancestral souls. The body is 4½ feet in length, from ashy-gray to dirty yellow in colour; the face is dark, with bushy grayish-white whiskers; and the tail is longer than the body. Entellus

Entellus Monkey (*Semnopithecus Entellus*).

monkeys live in troops, are noisy and quarrelsome, and do much mischief near towns and plantations, but are nevertheless reverenced and petted. Their home is in the 'hot tropical plains of the north-western Gangetic provinces,' but they have been introduced elsewhere. They are sometimes confused with the Langoor, and probably with others. For the mythology, see HANUMÂN.

Entente Cordiale (Fr., 'cordial understanding'), a term which originated, according to Littré, in the French chamber of deputies in 1840–41, and which has been used especially to denote the friendly relations and disposition existing between France and Great Britain.

Enteric Fever. See TYPHOID FEVER.

Enteri'tis (Gr. *enteron*, 'an intestine'), inflammation of the bowels. Under this name are grouped cases of every possible degree of severity. In the slighter forms the symptoms are, generally speaking, lassitude, loss of appetite, foul tongue, vomiting (if the upper part of the intestine be affected), griping pains, diarrhœa (if the lower part be involved). Such cases are very rarely dangerous, except in young children; for their treatment the measures recommended under Diarrhœa are usually effective. The severer forms of the disease usually depend either on external injury or on internal mechanical causes. It is often associated with Peritonitis (see article PERITONEUM, Vol. VIII., page 55). The treatment must depend on an accurate diagnosis. The symptoms are pain, tenderness, fever, prostration; generally obstinate vomiting with constipation, owing to paralysis of the portion of gut affected; and rapid failure of strength, without delirium or insensibility. If enteritis does not arise from mechanical obstruction, it may be combated by hot fomentations, with moderate leeching and counter-irritation, and the internal administration of opium. Injections of warm water, or of asafœtida and turpentine (see CLYSTER), should be at the same time given to clear the lower bowel; and all purgatives, except in some cases castor-oil, should be avoided. The disease is, however, one of great danger, often rapidly fatal, and should never be incautiously treated with domestic remedies.

In the Lower Animals.—Among horses, inflam-

mation of the bowels generally results from some error of diet, such as a long fast followed by a large, hastily devoured meal, such as raw potatoes, boiled or indigestible and easily fermentable food, or large draughts of water at improper times. When thus produced, it is frequently preceded by colic, affects chiefly the mucous coat of the large intestines, and often runs its course in from eight to twelve hours. With increasing fever and restlessness, the pulse soon rises to 90 or upwards, and, unlike what obtains in colic, continues throughout considerably above the natural standard of 40 beats per minute. The pain is great, but the animal, unless delirious, instead of recklessly throwing himself about, as in colic, gets up and lies down cautiously. Respiration is quickened, the bowels torpid. Cold sweats, stupor, and occasionally delirium, precede death. When connected with, or occurring as a sequel to influenza, laminitis, and other complaints, the small intestines are as much affected as the large, and the peritoneal as well as the mucous coat of the bowels. When the animal is seen early, whilst the pulse is still clear and distinct, and not above 70°, and the legs and ears warm, bloodletting is useful, as it relieves the overloaded vessels, and prevents that extravasation of blood which speedily becomes poured out in the interior of the bowels. This disease should be treated as follows: Care should be taken not to further irritate the bowels by the administration of purgative or even aperient medicines, as the supposed constipation is due to the bowels having lost their function—loss of function being one of the phenomena of inflammation—and not to a dry condition of their contents. Anodynes and sedatives, as laudanum in two-ounce doses, or belladonna extract in two or three drachm doses, should be repeated every two hours until pain is relieved. Morphia and atropia subcutaneously injected are also now largely used by veterinarians with fomentations to the surface of the abdomen and an occasional clyster of warm water. No attempt should be made to force the bowels to action after apparent recovery, or the inflammation may be re-excited.

Enteritis in cattle is mostly produced by coarse wet pasture, acrid or poisonous plants, bad water, and overdriving. The symptoms are fever and thirst, a quick but rather weak pulse, restless twitching up of the hind limbs, tenderness of the belly, moaning and grinding of the teeth, and torpidity of the bowels. Calves generally die in three or four days, other cattle in a week or nine days. Enteritis in sheep mostly occurs in cold, exposed localities, and where flocks are subjected to great privations or improper feeding. The symptoms and treatment resemble those of cattle. The treatment prescribed for the horse is applicable to the cow, the doses being one-third larger.

Enteropneusta, a class of worm-like animals, including Balanoglossus (q.v.) and Cephalodiscus (q.v.). It is of great zoological importance because of the characters in which the members resemble vertebrates. The name, literally 'gut-breathers,' refers to the paired respiratory pouches opening from the front part of the alimentary canal.

Entomology (Gr. *entomon*, 'an insect,' *logos*, 'a discourse'), the study of Insects (q.v.).

Entomostraca, a general name for the lower orders of Crustacea, including Phyllopods, Ostracods, Copepods, and Cirripedes. See CRUSTACEA.

Entophytes. See (in article Parasitic Animals) PARASITISM; also PLANTS (DISEASES OF), FUNGI.

Entozoa, internal parasites such as Tapeworms (q.v.). See PARASITIC ANIMALS.

Entr'acte, in Music, is an instrumental piece, composed in the form of a short symphony or overture, to be performed between the acts of a play.

Entrecasteaux. See D'ENTRECASTEAUX.

Entre Douro e Minho, or, as it is frequently called, MINHO, a province of Portugal, in the extreme north-west of the country, is bounded on the N. by the river Minho, and on the S. by the river Douro. Area, 2810 sq. m.; pop. (1881) 1,014,768. It has been called the Paradise of Portugal. The climate is agreeable and healthy. The chief productions are wine, oil, flax, maize, wheat, barley, oats, and vegetables. Wine is shipped largely at Oporto, the capital. Along the coast are numerous fisheries, at which great numbers find employment. The province of Minho consists of three districts, Braga, Vianna, and Oporto.

Entrenchments are the earthen parapets thrown up to give cover against the enemy's fire, and the ditches or trenches from which the earth is obtained for them. They may be either of the most hasty or of the most deliberate kind. Of the former class are the various patterns of shelter-trench, in which the men stand, kneel, or lie in the trench 1 foot 6 inches to 3 feet deep, and fire over a parapet 1 foot 6 inches to 2 feet 9 inches above the ground-level, and also the different saps used for siege purposes, in which the trench forms the roadway towards the fortress attacked, and the parapet gives cover to the troops using it. The deliberate kind include all field and permanent works, having a thick parapet of considerable height, over which the men fire, and by which they are protected, while the ditch from which the earth for the parapet has been dug forms an obstacle in its front (see FORTIFICATION). The term is also used for any fence, building, wood, or other natural cover that has been scientifically prepared for defence.

Entre Rios ('between rivers'), a province of the Argentine Republic, in the 'Mesopotamia Argentina,' between the Paraná and the Uruguay (whence its name). Estimated area, 29,021 sq. m., or a little larger than Portugal; pop. (1886) 180,000. The country is chiefly pastoral, but in 1888 there were 326,000 acres under cultivation, 260,000 being devoted to maize and wheat. The province is fertile and well watered, being even subject, in the south, to annual floods; nevertheless, the climate is very healthy. Lime and gypsum are worked. In 1887 the province had 233 miles of railway. The capital is Paraná (q.v.).

a, Entresol.

Entresol is a low story between two main stories of a building, generally above the first story, but in London most usually between the ground-floor and the first story. *Mezzanine* is another name for the entresol, as also for its low, broad windows.

Entropium, or ENTROPION (Gr. *en*, 'in,' and *trepō*, 'I turn'), inversion of the edge of the eyelid, consequent either on loss of substance on its inner surface, or on excessive action of the muscle (the orbicularis palpebrarum) which closes the lids. The eyelashes are turned inwards and rub upon the globe during the movements of the lids, producing much irritation, and sometimes opacity of the cornea. Temporary relief may be obtained by plucking out the misdirected lashes by the roots;

but the radical cure of severe entropium requires a careful adaptation of the surgeon's art to the circumstances of the particular case, and should not be attempted by unskilled hands. The most common cause of entropium is granular conjunctivitis. See EYE (DISEASES OF).

Entry, FORCIBLE. See FORCIBLE ENTRY.

Envelopes. Until the introduction of the penny-postage system, envelopes for written letters were very little adopted; it was far more customary to secure by wafer or sealing-wax the folded sheet of paper on which the letter was written. When the postage was rendered uniform for all distances, and prepayment enforced, or at least recommended, it was supposed that stamped envelopes would be convenient coverings for letters, sealing the letter and paying the postage at one operation. These, however, were soon found to be inconvenient, and the great development of envelope manufacture has taken place in the direction of unstamped varieties of envelopes, to which, of course, adhesive stamps can be attached. During the last half-century this development has taken place to an extent that no one could have contemplated. Several large firms in England and Scotland, as well as abroad, are engaged in it, and the quantity of envelopes turned out is simply enormous; the largest producers being Messrs Pirie of Aberdeen, whose turn-out amounts to upwards of thirteen millions per week.

In the manufacture of envelopes, the web of paper is first cut by machine-power, sometimes into rectangular, but more commonly into lozenge or diamond-shaped sheets of large dimensions. These sheets are then placed in convenient piles, and each pile is placed under a series of dies, which are pressed by steam-power down through the pile, thus cutting out a number of very much smaller sheets, termed 'blanks,' of the exact shape of the required envelope, when unfolded and spread out flat. The next process is that of folding and gumming, which is done by hand, or by machine, but chiefly by the latter. In hand-folding, girls fold with wonderful rapidity, having guides to aid them in folding at the proper place; and the gum is applied to the various parts with a small brush. This process is, however, so very slow that it has now been almost superseded by machine folding and gumming. In machine-folding the process is as follows: The blanks are placed in a pile on the front part of the machine, which is self-feeding; the machine being set in motion, the automatic feeder comes forward, and, in lifting the blank, gums the bottom flap, at the same time gumming the upper or open flap, and deposits the blank in an open frame. A plunger descends and forces the blank through the frame to a door. Folders press down the four flaps, fastening the lower one only, the door is lowered, and the envelope is by this action dropped into an endless chain, where it is held in position by means of pins. The envelope then passes through a drying process, and comes out at the other end of the machine ready to be packed up and despatched. The quantity of envelopes that can be made on such a machine is ninety per minute. Where twelve of these machines are working at once, it will be seen that a million envelopes are put out of hand in a very short time. Nearly a million and a half of enveloped letters pass through the post every day in the United Kingdom, most of the envelopes for which are of home manufacture; and besides this, a large export trade is maintained. The stamped envelopes all go to Somerset House, to have the stamp impressed upon them, which is done by a beautiful machine, chiefly invented by Mr Edwin Hill, in which embossing and colour-printing are ingeniously combined. These envelopes are sold by the Stamp-office, between which and the Post-office a monetary adjustment becomes necessary.

Environment, a modern term for the influencing surroundings of an organism. Neither plant nor animal can be understood as a rounded-off unity; the whole life or function is made up of action and reaction between the organism and its environment. Streams of matter and energy from without preserve the relative constancy of the organism, as of a special wave-crest in the sea; while changes in the streams have their corresponding changes within. The plant or animal has obviously a strong unity of its own, but even that is in part due to ancestral welding under the hammers of the environment. It may seem, too, to vary of itself like a fountain in the air, but throughout all its rises and falls there blows the wind of the environment. The influence of outside conditions has been recognised by most naturalists from the time of Hippocrates, and is taken for granted in our everyday speech and action. There is considerable difference of opinion, however, as to the importance and degree of this influence. Thus Buffon, Treviranus, and Geoffroy St Hilaire regarded the surroundings as *directly* hammering changes on the organism; while to Erasmus Darwin and Lamarck internal changes arose as *indirect* functional results of new environment. Charles Darwin allowed a measure of truth in both these positions, but emphasised the indirect destructive action of the animate and inanimate environment in the struggle for existence. These three positions are still held, some emphasising one, others another, the majority combining the three (see EVOLUTION).

The external influences may be classified in four groups: (1) Molar or Mechanical; (2) Chemical; (3) Molecular or Physical; (4) Vital or Animate. A few instances of each kind of influence will be given; for details, the reader must be referred to Semper's *Animal Life*, and an appendix paper to that classic work.

(1) *Molar or Mechanical Influences.*—Confined space brings about a dwarfed brood. Currents mould the sponges and corals, chisel the shells, cut up the water leaves; and the wind blows the trees out of shape. Vertical pressure may broaden out the form or produce latent life; while the very weight of structures effects many changes, from the mode of an egg's dividing to the slope of a tree's branches. On the whole, however, the mechanical hammers effect least.

(2) *Chemical Influences.*—Subtler but more potent are the influences which we group together as chemical. Good aeration—i.e. abundant oxygen—quickens development and stimulates the whole life. The 'vital combustion' is more rapid. In drought some animals become desiccated (see DESICCATION), and the Axolotl (q.v.), removed from the watery bed into less moist environment, becomes an Amblystoma. The composition of the medium seems to have a great influence on the forms and phases of simple unicellular life, and even a comparatively high animal like the Brine-shrimp (q.v.) was converted by Schmankewitsch from one species into another by gradually altering the salinity of the water. Food may be included under this group, and its influences are the greatest. To Claude Bernard the whole problem of evolution was very much a question of variations in nutrition. It is the food, to a large extent, which conditions the cyclic changes in cell-life from an active ciliated phase to a passive amœboid or encysted one (see CELL). Parasites in their passivity illustrate a nemesis at least exaggerated by their copious nutrition. Abundant food is associated with growth and asexual multiplication; the plant

sends out its runners, the plant-lice continue their rapid parthenogenesis (see APHIDES), but a check to nutrition hastens the sexual climax. Good nutrition tends towards the production of female offspring; by increasing the quantity and quality of food Yung nearly doubled the normal percentage of females among his tadpoles; while starved caterpillars and tadpoles tend to turn out mostly males. According to Sutton, hypertrophy of one part over another has been the principal process in the transition from hermaphroditism to unisexuality, while Barfurth emphasises the importance of fasting as a progressive factor in evolution. From the cell-cycle to the colour of canaries' feathers, the importance of the food-factor is widely demonstrable.

(3) *Physical Influences.*—Heat stimulates growth and hastens the reproductive maturity, while cold tends to dwarf and often produces coma. Maupas increased the rate of reproduction in an Infusorian five times by an elevation of 17° C. in the temperature of the water. Dallinger has recently described how the monads which he succeeded in educating to stand a temperature high above the usual fatal point became not a little altered at the crisis of each successive elevation. Weismann has shown how an artificial winter induces the winter colouring of a certain Butterfly (q.v.). The sunlight which kills the floating germs has a beneficent action on most organisms, very notably on plants. In some cases it seems to affect colour, and Poulton has altered the colour of his Caterpillars (q.v.) by the tint of the glass under which they lived, or has produced golden chrysalids by keeping them in gilded boxes. Electric and probably magnetic energies seem to have influences, but these cannot yet be said to be intelligible.

(4) *Vital Influences.*—In the web of life organisms influence one another indirectly in a hundred ways, but they have likewise their direct influences. There are animate as well as inanimate 'hammers.' Sea-spiders specifically alter Hydroids, and Semper also notes the mutually influencing associations of a snail and a coral, of an Annelid and an Antipathes (a genus of Zoantharia). Crustacean parasites may very effectively alter their crustacean hosts, and internal guests have also marked results. Nor have insects worked about plants for millennia without leaving direct mechanical imprints of their footsteps. Finally, man's influence in Domestication (q.v.) may be mentioned.

Hundreds of cases of external influence, now on one system, now on another, are known, but few are thoroughly understood. The observation of the results is one thing, their rationale another. In a general way, barring purely mechanical modifications, the influences are referable to two classes—one set increasing constructive processes, storage of energy, passivity, anabolism; the other set increasing destructive processes, expenditure of energy, activity, katabolism.

The susceptibility of organisms to outside influences is very varied. Simple and young forms are evidently more in the grip of external circumstances than are complex and adult organisms. The cell, the seedling, the child, are more impressible than the worm, the tree, the man. Passive forms also, like sponges and algæ, corals and trees, are much more under the tyranny of surroundings than active organisms with devices at command for parry or escape. The vegetative system, again, is oftener affected than the reproductive, and thus doubtless many environmental influences affect only the individual 'body,' and are not transmitted to the species.

The degrees of influence are also very varied. The dints of the environment may be deep or superficial, very direct or very remote in their results. A primary influence from without may have more than one result within the organism, by starting correlated variations. The influence may remain without apparent result in the individual, and yet the nemesis may be evident in the offspring. Influences may also accumulate within the organism without any evident outcrop for a time, but at length an indirect, at first sight spontaneous, change may be the far-off result. The influence of environment in forcible distribution, in a cataclysmic destruction of local fauna, and the countless indirect results of changed conditions must also be kept in view.

The action of the environment as a factor in organic evolution is very variously estimated by different schools of naturalists (see EVOLUTION). It is still undecided how far characteristics impressed upon an individual organism by outside forces can be transmitted. If the influence send its roots deep into the organism, it may probably affect the reproductive elements, and thus become transmissible; but according to Weismann and others, no facts demonstrating such cases are as yet known. It must not be forgotten, however, that no organs of the body are really insulated, and that changes from without may be transmitted by infinitesimal degrees for each individual generation, till they eventually, if the conditions remain constant, accumulate into a specific character. In opposition to Weismann's view, Professor G. H. T. Eimer's work (1888) on the *Origin of Species*, as based on the inheritance of acquired characters according to the laws of organic growth, should be consulted (see HEREDITY).

Finally, as there is no doubt as to the importance of environmental conditions for at least the individual organism, the influence of human environment must be recognised as a biological fact of the greatest social moment.

See Semper's classic work, *The Natural Conditions of Existence as they affect Animal Life* (Inter. Sc. Series, 1880); G. H. T. Eimer, *Die Entstehung der Arten* (1888); J. Arthur Thomson, 'Synthetic Summary of the Influence of the Environment upon the Organism,' *Proc. Roy. Phys. Soc. Edin.* ix. (1888), pp. 446–99.

Envoy, a diplomatic minister of the second order—i.e. inferior in rank to an ambassador. Like the latter, he receives his credentials immediately from the sovereign, though he represents not his prince's personal dignity, but only his affairs. The envoy is thus superior in rank to the Chargé d'Affaires (q.v.). See also AMBASSADOR, and CONSUL.

Eocene System, in Geology. This is the lowest or oldest series of strata included in the Tertiary division. The name Eocene (*eos*, 'dawn,' *kainos*, 'recent') was introduced in 1830 by Lyell, whose classification of the Tertiary formations was based on the proportions of living species of molluscs which the strata contain. The oldest members of the series, containing as they do only an extremely small proportion of such recent forms (according to Lyell, 3½ per cent.), were looked upon as indicating the dawn of the existing state of the molluscan fauna. With necessary modifications, Lyell's classification has maintained its place, but the names of the various subdivisions of the Tertiary strata, first suggested by an examination of the European deposits, are now used without reference to the precise percentage of living molluscan species which the beds may chance to contain. The Eocene beds rest unconformably upon the Chalk or Cretaceous strata—hence there is a break in the succession. A movement of elevation followed upon the close of the Cretaceous period, and the sea disappeared from middle Europe. Probably the British area at this time was connected with what are now the opposite coasts of the Low Countries and

France, and considerable denudation of the later Cretaceous deposits supervened. Ere long, however, partial subsidence set in, and at the beginning of Eocene times the sea commenced to invade those regions in the south-east of England, the north of France, and the low grounds of Belgium, in which we meet with the oldest accumulations of Tertiary times.

The Eocene system, as developed in England, occurs chiefly in two districts, called respectively the London and Hampshire basins. In the north of France it forms another large basin, in the centre of which is Paris, and it likewise spreads over a considerable area in Belgium. The strata are partly of fresh-water and partly of marine and brackish-water origin, and consist principally of more or less unconsolidated sands, clays, loams, marls, &c., with which are here and there interstratified layers of limestone and lignite. Grouping the Anglo-French and Belgian strata together, we have the following succession:

	England.	France and Belgium.
Upper Eocene.	Barton Clay and Upper Bagshot Sands	Gyps marin: Sables moyens.—Wemmelian.
Middle Eocene.	Bracklesham Beds: Middle Bagshot Sands.	Calcaire grossier.—Lækenian: Bruxellian.
Lower Eocene.	Lower Bagshot Sands	Wanting in France: Panisellian, Upper Ypresian.
	London Clay and Bognor Beds	Wanting in France.—Lower Ypresian.
	Oldhaven Beds	Not recognised.
	Woolwich and Reading Beds	Argile plastique: Lignites du Soissonnais.—Upper Landenian.
	Thanet Sands	Sables de Bracheux.—Lower Landenian and Heersian.
	Wanting	Montian.

In the south of Europe the Eocene system is developed on a much larger scale. In place of the limited basins of the Anglo-French and Belgian areas we encounter a thick and widespread series of limestones and calcareous sandstones. These accumulations appear on both sides of the Mediterranean, in Spain, and in Morocco. They enter largely into the composition of the Apennines, the Alps, the Carpathians, and the Balkans; they extend through Greece, Egypt, and Asia Minor, and thence through Persia and the Himalayas to the coasts of China and Japan. The most characteristic feature of these thick calcareous beds is the occurrence in prodigious numbers of nummulites—a foraminifer. Another noteworthy feature of the Eocene system of southern Europe is the occurrence in the Alpine region of Bavaria of certain sandstones, &c. (locally called *Flysch*), in which appear many gigantic erratics of various crystalline rocks—the precise source of which is not known. They may possibly have been derived from the archæan masses of Bohemia. In North America the more important Eocene strata are the great lacustrine deposits of the Rocky Mountain region and the plateaus lying to the west. But marine deposits of the same age occur also along the borders of the Atlantic, the Mexican Gulf, and the Pacific.

The flora of the Eocene is represented chiefly by dicotyledonous and monocotyledonous plants, and had a prevalent Indo-Australian character. Palms, screw-pines, cypresses, and various proteaceous plants grew in England in early Eocene times, and with these were associated species of custard apple, gourd, melon, oak, walnut, magnolia, &c. Amongst the forms of later Eocene times were species of gum-tree, nettle-tree, and banksia, fan-palms and screw-pines, aroids and cacti. Evergreens were represented by laurels, cypresses, and yews, while deciduous trees were represented by species of maple, plane, willow, poplar, elm, beech, chestnut, hornbeam, walnut, fig, &c. The fauna, like the flora, is also indicative of somewhat tropical conditions. Among the characteristic molluscs were species of Conus, Voluta, Cypræa, Oliva, Nautilus, &c. Sharks were numerous, such as Otodus, Lamna, and Carcharodon; and reptiles were represented by turtles, terrapins, snakes, lizards, crocodiles, and alligators. None of the great Mesozoic Saurians, however, survived into Tertiary times. Among the more remarkable birds were Odontopteryx, the jaws of which had tooth-like denticulations, and Dasornis, akin apparently to the extinct gigantic Dinornis of New Zealand. Early forms of modern types were also present, such as species of heron, gull, vulture, buzzard, woodcock, quail, pelican, flamingo, ibis, &c. Many of the mammals of Eocene times were remarkable for the union of characters intermediate between marsupials and carnivores. Tapir-like animals, such as Palæotherium, seem to have abounded. Another common form was Anchitherium, which had affinities to the Palæotheres and true horses. There were also many hog-like animals with intermediate or generalised characters, as well as transitional hornless forms of deer and antelopes. From the Eocene also come the earliest of the Prosimiæ—the lemuroid Cænopithecus, as well as ancestral forms of bats, hedgehogs, and squirrels. From the American Eocene lacustrine beds have been obtained remains of some very remarkable types. Among these are four-toed and five-toed ancestors of the horse, and Dinoceras, an animal as large as the elephant, furnished with three pairs of horns and two long tusk-like canines (see Dinocerata). Another strange order of animals (Tillodonts) combined characters which are now met with in such distinct groups as the ungulates, rodents, and carnivores.

The Eocene deposits of the Anglo-French and Belgian area appear to have accumulated in an inland sea opposite the mouths of one or more great rivers—the rivers evidently draining a continental land surface. In south Europe large areas which are now land were under water in Eocene times. The Mediterranean at that period extended considerably farther north and south than it now does, while eastwards it stretched into Asia, and seems to have communicated with the Indian Ocean. At this time the Pyrenees, the Alps, the Carpathians, and even the Himalayas were inconspicuous heights. Since the Nummulitic sea washed their base, they have been upheaved for thousands of feet—the old floor of that sea is now met with in the Alps at heights of over 10,000 feet, and in the Himalayas at an elevation of not less than 16,500 feet.

Eolian Harp. See Æolian Harp.

Eolipile. See Æolipile, Hero.

Eon de Beaumont, Charles Geneviève Timothée d', known as the *Chevalier d'Eon*, was born at Tonnerre, in Burgundy, in 1728, studied law, and became an advocate. He attracted the notice of the Prince de Conti by some political writings; and in 1755 was introduced by the latter to Louis XV., who employed him in diplomatic missions to Russia and Austria. After serving a short time in the army, not without distinction, he was sent to London in 1762 as secretary of embassy, and shortly after was made minister plenipotentiary. On the death of Louis XV., the French ministry deemed it prudent to recall him, as they were afraid he might betray their secrets to the English government, which made him brilliant offers. After much negotiation, Eon consented to surrender certain compromising papers, and submit to the condition imposed by Louis XVI. of wearing feminine garb, which he had often before assumed as a disguise, and which he now wore till his death. The doubt as to his sex, fostered by his parents in his childhood, was maintained, for reasons which can only

be conjectured, till the end of his life. On the outbreak of the French Revolution, while he was again in London, he offered his services to the French nation, but nothing came of his offer. He maintained himself by giving lessons in fencing till in 1796 he was disabled by an accidental wound, after which he was reduced to great destitution. He died 21st May 1810, when an examination of his remains by a surgeon settled the question of his male sex, and put an end to the curiosity of the English public. His writings appeared at Amsterdam (1774) under the title of *Loisirs du Chevalier d'Eon*. The *Mémoires* which bear his name are not genuine. See Captain B. Telfer, *The Chevalier d'Eon de Beaumont* (1885), and the article 'D'Eon,' by Professor Laughton, in vol. xiv. of *Dict. Nat. Biog.* (1888).

Eos. See AURORA.

Eosin. See DYEING.

Eötvös, JOZSEF, Hungarian author, born 3d September 1813 at Buda, was educated at home by a tutor of republican sentiments, and studied philosophy and jurisprudence at the university of Pesth (1825–31). He became an advocate in 1833, but soon resolved to devote himself exclusively to literature, in which field he had already won a great reputation by two comedies and a tragedy. After his return from a journey abroad he published a work on prison reform (1838). This was followed (1838–41) by his great novel *Karthausi* ('The Carthusians'). He now began to distinguish himself in politics as a writer of incisive articles on the liberal side represented by Kossuth. *The Village Notary* (1846; Eng. trans. 1850) is marked by variety of incident, easy vigour of style, humour, and freshness. It was followed in 1848 by a powerful novel describing Hungary in 1514. When the revolution of 1848 broke out, Eötvös was for a time Minister of Public Instruction. In Munich he wrote a work (1854) on the influence of the ideas of the 19th century on the state and on society. In 1851 Eötvös returned to Hungary. In 1859 he published anonymously a notable book (in German) on the guarantees for the power and unity of Austria. In 1867 he was appointed Minister of Worship and Education; and he died at Pesth, 3d February 1871.

Eozoön, the name given in 1864 by Sir William Dawson to an assumed organism whose remains constitute reefs of rock in the Archæan System (q.v.) in Canada; apparently a large foraminifer, which must have grown in sheets on the sea-bottom. Occurring as it does in rocks not formerly supposed to be fossiliferous, it would be the oldest known organism, and would deserve its name *Eozoön* ('Dawn-animalcule') *canadense*. The late Dr Carpenter strongly maintained the organic nature of Eozoön, but of late years the belief that it is inorganic has gained ground. Messrs King and Rowney were the first in Britain to express this belief. This is likewise the view held by mineralogists and petrologists generally. In 1878 Professor Möbius subjected Eozoön to an exhaustive examination, and came to the same conclusion. He shows that the so-called 'proper-wall' or 'nummuline layer' of the supposed fossil consists simply of fibrous calcite. Under the microscope no 'delicate pores' or fine 'vertical tubes' appear in this fibrous band, but the fibres consist of minute four-sided needle-like prisms, lying close side by side.

Epacridaceæ, a small order of heath-like shrubs or small trees, usually indeed reckoned as the Australian sub-order of Ericaceæ, from which they are chiefly distinguished by the epipetalous stamens destitute of the peculiar specialisations of anther dehiscence or appendages. Many species —e.g. *Epacris grandiflora*, &c., are cultivated in our greenhouses along with the heaths proper. A few produce edible berries. See CRANBERRY.

Epacts (Gr., 'additions'), in Ecclesiastical Chronology, a set of nineteen numbers used for fixing the date of Easter and other church festivals, by indicating the age of the moon at the beginning of each civil year in the lunar Cycle (q.v.). At the reformation of the calendar in 1582 it was found that the Golden Numbers could no longer by themselves serve the purpose of adjusting the double reckoning by lunations and by the tropical or true year; and thus, instead of adopting the more rational computation, the Roman Church devised the artificial and involved method of epacts. The main point to determine is the age of the moon (in entire days) at the beginning of each civil year, or the number of days between the end of the ecclesiastical year in December and the 1st January succeeding. Thus, subtracting 354 days (12 lunations) from 365, we should have 11 days for the first annual epact, then 22 for the year following, then 3, 14, 25, 6, 17, 28, 9, 20, 1, 12, 23, 4, 15, 26, 7, 18, and 29; the series of 19 numbers being obtained in succession by adding 11, and when the sum exceeds 30, subtracting that number. This illustration, however, is simpler than any actual case, by reason of the leap-years, which require 12 to be added for the following epact, and of the fact that no lunation is exactly 30 days long. When the lunar cycle of 19 years is completed, the epacts recur again in the same order. In the Anglican reckoning, as distinguished from the Roman, it is noteworthy that the Gregorian epact for any year is the same as the Julian epact for the year preceding, owing to the coincidence that 11, the number of days lost on the Julian account before our parliament adopted the reformed Calendar (q.v.), is also the number of days between the lunar and the solar years. The epact determines by subtraction the date of the first new moon in January; then by adding 29 and 30 alternately the successive new moons throughout the year are assigned to their respective dates. See Delambre's *Astronomie Moderne*, vol. i. 4–32.

Epaminondas, the most eminent of Theban generals and statesmen, and one of the noblest figures in Greek history, was born towards the end of the 5th century B.C. He was descended from an ancient but impoverished family, and led a retired life till his fortieth year, profiting by the instructions of Lysis the Pythagorean, an exile from Tarentum, who inspired him with enthusiasm for the elevated ideas which it was the object of his life to realise. Plutarch tells us that Epaminondas saved the life of Pelopidas in battle in 385, which was the beginning of one of the most famous friendships of antiquity. After the desperate but successful stratagem by which his fellow-citizens recovered the *Cadmeia* and expelled the Spartans (379), Epaminondas stepped forward immediately into the ranks of the patriots; and, when sent to Sparta in 371 to negotiate a peace between the two countries, displayed as much firmness and dignity as eloquence in the debate which ensued upon the question whether Thebes should ratify the treaty in the name of all Bœotia, the result of which ratification would have been equivalent to a recognition of her claim to supremacy over the Bœotian towns. To this the Lacedemonians demurred, and the war was again resumed; Epaminondas was appointed to the chief command, and along with Pelopidas, with an army of but 6000 men, defeated twice that number of the enemy at Leuctra (371). Two years later, with Pelopidas, he marched into the Peloponnesus, and incited several of the allied tribes to fall away from Sparta. On his return to Thebes, Epaminondas

was accused of having violated the laws of his country by retaining the supreme power in his hands beyond the time appointed by law, but was acquitted in consequence of his open and animated defence. In the spring of 368 the war between Thebes and Sparta was renewed with increased fury, and Epaminondas made a second and somewhat unsuccessful invasion into the Peloponnesus, receiving on his return a check from Chabrias at Corinth. To atone for this unsuccessful undertaking he advanced with 33,000 men into Arcadia, and joined battle with the main body of the enemy near Mantinea, in the year 362 B.C. Epaminondas charged at the head of his men, and broke the Spartan phalanx, but was mortally wounded in the breast by a javelin. Being told by the physicians that he would die as soon as the weapon was extracted, he waited till he heard that the Bœotians had gained the victory, then drew out the javelin with his own hand, exclaiming: 'I have lived long enough.' See his Life by Cornelius Nepos, and, in German, Bauch (1834) and Pomtow (1870).

Epaulette (from the French *épaule*) is a fringed shoulder-knot worn since 1795 by commissioned officers of the British navy, sub-lieutenants wearing one of gold lace, and other ranks two. Crowns, anchors, and stars worked in silver on the epaulette, and the size of the cords of the epaulette itself, indicate the degree of rank. Previous to the Crimean war officers of the British army wore gold epaulettes, and the men worsted ones. Many foreign nations still retain them for both naval and military officers.

Epée, CHARLES MICHEL, ABBÉ DE L', instructor of the deaf and dumb, was born at Versailles, 25th November 1712. Taking orders, he became a preacher and canon at Troyes, but eventually, on account of his Jansenist opinions, was deprived of this office, and now lived in retirement in Paris. In 1765 he first began to occupy himself with the education of two deaf and dumb sisters; and, as he asserts, without any previous knowledge of Pereira's efforts in the cause, invented a language of signs, by which persons thus afflicted might be enabled to hold intercourse with their fellow-creatures. His attempts being crowned with success, he determined to devote his life to the subject. At his own expense he founded an institution for the deaf and dumb, which was first publicly examined in 1771, and from 1778 received an annual subsidy. It was not, however, converted into a public institution till two years after his death, which took place 23d December 1789. He wrote two or three works on his system, for an estimate of which see Hartmann's *Deafmutism* (Eng. trans. 1881).

Epeira, a genus of spiders, the type of a family called Epeiridæ, including the common Garden Spider (*Epeira diadema*). See SPIDERS.

Eperies (Slovak *Pressova*), an old town of Hungary, on the Tarcza, 150 miles NE. of Pesth by rail. It is the seat of a Greek Catholic bishop, and has a college, with 500 students. A conflagration of 7th May 1887 destroyed 400 houses and most of the chief public buildings. It manufactures earthenware, linens, and woollens, and has some trade in corn and Tokay wine; whilst in the vicinity are the Sovar saltworks. Pop. 10,139.

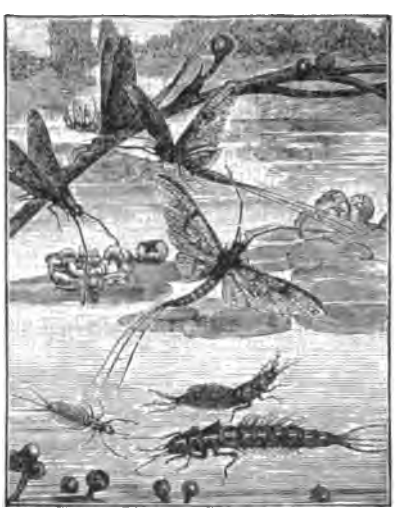
Epernay, a town in the French department of Marne, is the headquarters of the *Vins de Champagne*, and is situated in the midst of a rich vine-growing district, on the left bank of the Marne, 19 miles WNW. of Chalons. It is handsomely built, clean, and well paved. Its environs consist, for the most part, of elegant villas, with vaults attached, belonging to the Champagne wine-merchants. Epernay manufactures large quantities of earthenware from a clay obtained in the neighbourhood, and called *Terre de Champagne;* also hosiery, refined sugar, and leather. It has a brisk trade in bottles, corks, wire, &c., as well as wine. Pop. (1872) 12,877; (1886) 17,799; (1891) 17,952.

Ephah, a measure of capacity in use among the Hebrews, equivalent to about 8¾, or, according to others, 6·468, imperial gallons.

Ephemera ('day-fly' or 'May-fly'), a genus of well-known insects which appear in vast numbers on summer evenings from rivers, canals, and ponds, and after a short merry life disappear as suddenly as they came. The genus Ephemera is type of the family Ephemeridæ or May-flies in the wide sense. The family is often ranked within the Pseudo-neuroptera sub-order of Orthoptera, not far from Dragon-flies.

A thin delicate body, with filmy wings, of which the anterior are much the larger and sometimes the only pair; rudimentary mouth-parts in the adults, which fast throughout their short aerial life; a long-lived voracious larval existence in the water, with so-called tracheal gills for aquatic respiration, are striking features of the Ephemerids. The antennæ are short and awl-shaped; the eyes of the males are very large; the head-shield is enlarged, covering the rudimentary mouth-parts; the middle ring of the thorax is exaggerated; the legs are delicate; the thin abdomen ends in two or three long filaments.

The life-history of these delicate ephemeral insects is very interesting. The eggs are laid in the water and give rise to aquatic larvæ, which live sometimes two or three years, moulting many times.



Metamorphoses of the May-fly.

They prefer running water, hide under stones or make burrows in the mud, have well-developed mouth-parts, and feed hungrily enough on other insects. The tracheæ or air-tubes, as the figure shows, are expanded in plate-like or tuft-like paired structures down the sides of the posterior body. A pupa stage eventually follows, during which the larva acquires wings and other adult structures, but the insect which emerges and leaves the water is, curiously enough, not yet ready for its short adult life. Though it has wings, it is still encumbered by a delicate robe. This sub-imago, as it is often called, finds some resting-place on grass stem or tree trunk, gets rid of its last encumbrance, and begins its life of a day. The cast-off ghost-like exuviæ are found in great

numbers. In the summer evening the males and females enjoy a brief merry love-dance. The females are fertilised, the eggs are dropped into the water, and then sometimes in a single day the bright crowd is gone. It is literally true that at the moment of their climax they die.

The most familiar species is *Ephemera vulgata*, the common May-fly, the green drake (sub-imago) and gray drake of anglers. Palingenia, Heptagenia or Bætis, Cloë, Cænis, are almost common genera. The adult larvæ are used for bait; the corpses of the adults are sometimes abundant enough to serve as manure. The Ephemerids date back to the Devonian epoch. See ANGLING.

Ephemera (from Gr. *epi* and *hēmera*, 'on a day'), or FEBRIS DIARIA in Latin, a fever which lasts only a single day, or part of a day, and is generally dependent on some slight local irritation. It hardly requires any other treatment than the removal of the cause, if known.

Ephemeris (Gr., 'for the day'). See ALMANAC, and DIARY.

Ephesians, EPISTLE TO THE, one of the letters attributed to the apostle Paul, and supposed to be written during his imprisonment either at Cæsarea or at Rome. It falls into two parts, separated by the doxology, iii. 20, 21, the first part being doctrinal and the second practical. The earliest MSS. have not the words 'at Ephesus' in i. 1, and the hypothesis of Ussher (1650) that the letter was an encyclical writing sent to a number of churches in proconsular Asia has found favour with many scholars. Some hold that it is 'the epistle from Laodicea' mentioned in Col. iv. 16, and Tertullian tells us that Marcion called it the 'Epistle to the Laodiceans.' It has a very remarkable similarity to the Epistle to the Colossians, and De Wette held that it is 'little more than a verbose amplification' of the latter; but Holtzmann has shown that each of the two epistles is equally indebted to the other. Its authenticity, denied by De Wette (1843) and most later critics, has been defended (among others) by Rückert, Klöpper, Schenkel, and Reuss.

See the special commentaries by Rückert (1834), Eadie (1854), Hodge (1856), Ellicott (3d ed. 1864), Ewald (1870), and Dale (1882); also H. Holtzmann, *Kritik der Epheser und Kolosserbriefe* (1872).

Ephesus, one of the twelve Ionic cities of Asia Minor, was situated in Lydia, near the mouth of the river Cayster, in the midst of an alluvial plain. It was long before Ephesus acquired any political importance, in spite of being a sacred city from an early period. Subdued first by the Lydian, and next by the Persian kings, it was included, after the death of Alexander the Great, in the territories of Lysimachus (281 B.C.), by whom it was greatly strengthened. Ultimately it came into the possession of the Romans; and in the time of Augustus, when Strabo wrote, it was 'the greatest place of trade of all the cities of Asia west of the Taurus.' This was also its condition when visited by St Paul, who resided here three years; but the destruction of its great temple by the Goths, in 262 A.D., gave it a blow from which it never recovered. In 431 it was the scene of the *third* general council of the Christian Church. Its general history, while a city of the Byzantine empire, was unimportant, and before the days of Tamerlane it had almost completely perished.—The ruins of Ephesus comprise a stadium 687 feet long, fragments of a great theatre (alluded to in the account of St Paul's preaching in the city), of an odeum or music-hall, and of various walls and towers, belonging to the Greek, Roman, and Byzantine eras. About a mile north-east of the ancient city was the site of the famous Temple of Diana. This marvellous building, one of the seven wonders of the world, was originally built by Chersiphron; but on the night (as is said) when Alexander the Great was born (356 B.C.), it was fired by Herostratus, an Ephesian, thereby to immortalise his name. It was afterwards rebuilt by the inhabitants in a style of greater splendour than before, the very women contributing their ornaments to secure the necessary funds. It was the largest Greek temple ever constructed. Its length, according to Pliny, was 425 feet, its width 220; and the number of its columns 127, each 60 feet high. The site of the temple was discovered by Mr Wood in 1869, and excavations, continued until 1874, have greatly extended our knowledge of this 'wonder of the world.' But even more wonderful than the temple itself were the numberless statues and pictures which it contained, executed by the best masters of Greece. The altar of the goddess was principally adorned with the works of Praxiteles. Plundered of its treasures by Nero, and burned (as has been mentioned) by the Goths, it was most likely finally destroyed by the iconoclasts, in the reign of Theodosius I., who issued his celebrated edict against the ceremonies of the pagan religion 381 A.D. The site of Ephesus is now occupied by some wretched villages, the principal of which is Ayasaluk.

See Falkner, *Ephesus and the Temple of Diana* (1862); J. T. Wood, *Discoveries at Ephesus* (1877); Fergusson, *The Temple of Diana at Ephesus* (1883); and the articles ARTEMIS and SEVEN SLEEPERS.

Ephod (called in the LXX. *epōmis*; in Vulg. *superhumerale*), a principal part of the official dress of the Jewish High-priest (q.v.). The description of its form in Exodus, xxviii. 6 *et seq.*, and xxxix. 2 *et seq.*, is not quite clear, and the common notion that it consisted of two shoulder-pieces, one on the back and the other on the breast, and fastened together by onyx-stone brooches, is incorrect. It may be described as a vest covering the breast and waist, open in front, and continued behind over the back up to the neck, where it divided into two cape-like ends, which were extended to cover the shoulders both before and behind. These ends being fastened in front above the breast, and the vest below being also fastened by a band of one piece with it, kept the ephod firmly on the body, while the arms were left free. The material of the ephod was of gold thread, and blue, purple, scarlet, and white twined byssus yarn. On the top of each shoulder was placed an onyx stone. The stones were inclosed in 'ouches' of plaited gold, and were not used as brooches, but as significant ornaments, the names of the twelve tribes being engraved on them—six on each.

An essential part of the high-priest's ephod was a square bag made of the same materials, and serving as a receptacle for the Urim and Thummim (q.v.). It was a span long each way, and was placed over the middle of the front part of the ephod, and just above its waist-band, being suspended from the shoulder-parts of the ephod by rings and chains of gold. On its front side it had twelve precious stones, set in plaited gold, and placed in four rows, the name of one of the twelve tribes being engraved on each stone.—Ephods made of common byssus were worn in the time of Samuel and Saul by all priests. According to some scholars, the golden ephod of Gideon at Ophra (Judges, viii. 27) was a kind of image.

Eph'ori (Gr., 'overseers'), an order of magistrates in ancient times which appears to have originated at Sparta, and to have been peculiar to the Doric governments. Herodotus attributes their creation to Lycurgus, and Aristotle to Theo-

pompus (770–720 B.C.). Their duty was to superintend the internal administration of the state, especially affairs of justice, and to oversee some part of the education of youth. They were five in number, were elected by and from the people—on which Aristotle observes that through them the *dēmos* enjoyed a participation in the highest magistracy of the state—and held their office only for one year. Their influence gradually increased, for their powers were so ill defined that it was difficult to say what was *not* under their cognisance and authority. Ultimately the kings themselves became subject to the supervision of the ephori; thus, Cleomenes was brought before them for bribery, Agesilaus was fined, and Pausanias imprisoned. They also transacted the negotiations with foreign powers, subscribed treaties, raised troops, intrusted the army to the king or some other general, and, in fact, acted as the executive of the state. Their authority was at last destroyed by Agis and Cleomenes, who put the whole college to death, and restored the old Spartan constitution (226 B.C.). See Dum, *Entwickelung des Spartanischen Ephorats* (1878).

Ephraem Syrus, 'the prophet of the Syrians,' a celebrated teacher, orator, and hymn-writer of the Syrian Church, was born at Nisibis about 306. After Nisibis was taken by the Persians in 363 he removed to a cave near Edessa, which was already a chief seat of Syrian learning. He there devoted himself to prayer and fasting, and the study of the Scriptures. He died at Edessa about 373. His day is in the Roman Church the 1st of February, and among the Greeks and Maronites the 28th of January. Ephraem's strict orthodoxy, his asceticism, and his great learning were the admiration of his contemporaries; and the works he has left behind him, written in a fervid and popular style, sustain his reputation as an orator and poet. He was a most fertile writer. Part of his works have come down to us in their original Syriac, part in Greek, Latin, and Armenian translations. Of the Syriac writings the chief are his commentaries (based on the Peshito), extending to nearly the whole of the Old Testament, and they include also numerous discourses and elegies, mostly written in lines of seven syllables, grouped in strophes of from four to twelve lines each. Ephraem counteracted the influence of the Gnostic hymns of Bardesanes and Harmonius by writing better hymns of a strictly orthodox tendency. The Greek writings which bear his name are mainly sermons and short religious treatises. An edition containing 156 of these was published by Edward Thwaites at Oxford in 1709. The standard edition is that of Assemani, in 6 vols. folio (3 vols. Greek texts, and 3 vols. Syriac texts, with Latin translations, Rome, 1732–46). The Syriac text of his select works was edited by Overbeck (Oxford, 1865). A tasteful English translation of a number of pieces by Ephraem was published by Henry Burgess, under the titles *Select Metrical Hymns and Homilies of Ephraem Syrus* (3 vols. 1853). Ephraem's Commentaries on the Epistles of St Paul are extant in Armenian (ed. by Aucher, Venice, 1836). See treatises on Ephraem and his works by Lengerke (1831), Alsleben (1853), Gerson (1868), and Zingerle (1876).

Epiblast. See ECTODERM, EMBRYOLOGY.

Epicharmus, a famous Greek poet, was born in the island of Cos, in the 6th century B.C. He spent the latter part of his life at the court of Hiero of Syracuse, and died at the age of ninety. Epicharmus is called by Theocritus the father of comedy, and Plato assigns to him a place among comic writers as high as that of Homer among epic poets. None of Epicharmus's works survive entire; but we possess several fragments and the titles of thirty-five. They embraced a wide variety of topics, mythological, social, and political. From one of them Plautus borrowed the plot of his *Menaechmi*. See Lorenz, *Leben u. Schriften des Epicharmus* (1864).

Epic Poetry (Gr. *epos*, 'a word,' 'a discourse') is that class of poetry which produces an imaginative description of events, real or fictitious, but considered as having already happened; as opposed to lyric poetry, which is an imaginative expression of internal subjective emotions with respect to external and objective facts. Of more complex character than the narrative ballad poem, the epic obviously is one of the earliest poetical forms in which the primitive imagination has found expression. It is impossible to classify the epics of various races, but a distinction has been made between 'epics of growth,' which consist of collections of ballads or poems composed by different authors, at different times, and dealing with a connected series of events, such as the *Mahábhárata*, the Nibelung story (Icelandic version), and the *Kalevala*, as contrasted with 'epics of art,' in which the events are grouped around some great structural thought by a single poet, like the *Odyssey*, the *Æneid*, *Paradise Lost*, and *Jerusalem Delivered*. Such epics as the *Iliad* and the *Shah Nameh*, again, belong to both classes at once. The term heroic epic, or heroic poem, is properly applied to such works as the *Iliad* and *Odyssey*, Virgil's *Æneid*, the *Poem* proper of the Cid, Tasso's *Jerusalem Delivered*, and Ariosto's *Orlando Furioso*, and others, which describe the achievements of the gods and heroes of antiquity, or of the little less mythic knights of medieval chivalry. Poems, again, like Milton's *Paradise Lost*, Spenser's *Faerie Queene*, and Dante's *Divina Commedia*, are sacred epics; Lucan's *Pharsalia* and the *Lusiads* of Camoens, historical epics. Such poems as Scott's *Marmion* are genuine miniature epics, while Tennyson's *Idylls of the King*, from its artistic consecutiveness of motive, belongs also to the family; to quite another class—the mock-epic—belong such poems as Pope's *Rape of the Lock*, Butler's *Hudibras*, and the like. Poems of epic character are still written by ambitious poets, the fate of Glover's *Leonidas* not serving as sufficient warning; but the real epic of our modern civil and domestic life is the prose novel. The narrative and the descriptive poem are still written, but seldom with much success at great length. Even the dramatic poem in its ancient sense seems a form uncongenial to modern wits.

Epictetus, a celebrated disciple of the Stoa, was born at Hierapolis, in Phrygia, about 50 A.D. He was at first the slave of Epaphroditus, a freedman of Nero, at Rome, and endured his severe treatment with characteristic stoic equanimity. After being manumitted he devoted himself to philosophy, and was banished by Domitian, along with several other philosophers, from Rome. He settled at Nikopolis, in Epirus. He left no works behind him, but his pupil Arrian, the historian of Alexander the Great, collected his maxims with affectionate care, in the work entitled *Enchiridion* ('Handbook') and in eight books of Commentaries, four of which are lost. These reveal the simple and noble earnestness of the philosopher's character, as well as that real heartfelt love of good and hatred of evil which is often assumed to be an exclusively Christian feeling. Epictetus believes in our 'resemblance' to God, in our 'relationship' to him, and in our 'union' with him through the coincidence of the 'will' and the 'soul;' he recognises the contest between good and evil, the life-struggle in the heart, the divine life against which the law in the members wars; and he affirms the necessity of

'invoking God's assistance in the strife,' that the inner life may become pure as God is pure. His ethics teach self-renunciation, endurance, and the duty of confining the ambition within the limits of the attainable. The most complete edition is that of Schweighaüser (1799–1800). See STOICISM.

Epicurus, an illustrious Greek philosopher, was born 341 B.C., in the island of Samos, where his father, Neocles, was a schoolmaster. At the age of eighteen he repaired to Athens, but his stay was short, and he returned to Asia. He had attached himself to the study of philosophy, especially that of Democritus; his own scheme of physics is evidently based on the atomic system of Democritus. At Mitylene, in his thirty-second year, he first opened a school of philosophy; and there and at Lampsacus he taught for five years. In 307 B.C. he returned to Athens, and established a school of philosophy in a garden which he purchased and laid out for the purpose. From this circumstance his followers were called the 'philosophers of the garden.' Although Epicurus laid down the doctrine that pleasure is the chief good, the life that he and his friends led was one of the greatest temperance and simplicity. They were content, we are told, with a small cup of light wine, and all the rest of their drink was water; and an inscription over the gate promised to those who might wish to enter no better fare than barley-cakes and water. The calumnies which the Stoics circulated concerning him are undeserving of notice, and were at no time generally believed. Epicurus's success as a teacher was signal; great numbers flocked to his school from all parts of Greece and from Asia Minor, most of whom became warmly attached to their master, as well as to his doctrines, for Epicurus seems to have been characterised not less by amiability and benevolence than by force of intellect. He died 270 B.C., in the seventy-second year of his age.

Epicurus was a most voluminous writer. According to Diogenes Laertius, he left 300 volumes on Natural Philosophy, Atoms and the Vacuum, Love, the Chief Good, Justice, and many other subjects. These works are lost: the only writings of Epicurus that have come down to us are three letters, a few fragments from the *Volumina Herculanensia*, and a number of detached sentences or sayings, preserved by Diogenes Laertius. The principal sources of our knowledge of the doctrines of Epicurus are Cicero, Plutarch, and, above all, Lucretius, whose great poem, *De Rerum Natura*, contains substantially the Epicurean philosophy.

Although the majority of Epicurus's writings referred to natural philosophy, he seems to have studied nature with a moral rather than a scientific design. According to him, the great evil that afflicted men—the incubus on human happiness—was fear; fear of the gods and fear of death. To get rid of these two fears was the ultimate aim of all his speculations on nature.

He regarded the universe (*to pan*) as corporeal, and as infinite in extent and eternal in duration. He recognised two kinds of existence—that of bodies, and that of *vacuum*, 'the void'—i.e. space, or the intangible nature. Of his bodies, some are compounds, and some atoms or indivisible elements, out of which the compounds are formed. The world, as we now see it, is produced by the collision and whirling together of these atoms. He also held the doctrine of perception by *images* (Gr. *eidōla*), which are incessantly streaming off from the surface of all bodies, and which are necessary to bring us into *rapport* with the world without. In psychology he was a materialist, holding that the soul is a bodily substance, composed of subtile particles disseminated through the whole frame.

In seeking to understand the phenomena of the heavens he has no scientific end in view; his sole object is to enable the mind to account for them to itself, without the necessity of imagining any supernatural agency at work. He did not deny that there are gods; but he strenuously maintained that as 'happy and imperishable beings' they could have nothing to do with the affairs of the universe or of men. 'Beware,' he says, 'of attributing the revolutions of the heaven, and eclipses, and the rising and setting of stars, either to the original contrivance or continued regulation of such a being. For business, and cares, and anger, and benevolence are not accordant with happiness, but arise from weakness, and fear, and dependence on others.'

Having proved in his psychology that the dissolution of the body involves that of the soul, Epicurus argues that the most terrible of all evils, death, is nothing to us, 'since *when we are, death is not; and when death is, we are not.* It is nothing, then, to the dead or the living; for to the latter it is not near, and the former are no longer in existence.'

He held that pleasure was the chief good, and it is from a misapprehension of the meaning of this word as used by him that the term Epicurean came to signify one who indulged his sensual appetites without stint or measure. At the same time it is easy to see that the use of the word 'pleasure' was calculated to produce the mischievous results with which the later Epicureanism was charged. (For the Cyrenaic hedonism, see ARISTIPPUS.) According to Epicurus, the sources and tests of all ethical truth are the feelings, and these are two, pleasure and pain. We delight in the one, and avoid the other instinctively. 'When we say that pleasure is the end of life, we do not mean the pleasures of the debauchee or the sensualist, as some from ignorance or from malignity represent, but freedom of the body from pain, and of the soul from anxiety. For it is not continuous drinkings and revellings, nor the society of women, nor rare viands, and other luxuries of the table, that constitute a pleasant life, but sober contemplation that searches out the grounds of choice and avoidance, and banishes those chimeras that harass the mind.' Epicurus rests justice on the same prudential basis as temperance. Denying any abstract and eternal right and wrong, he affirms that injustice is an evil, because it exposes the individual to disquietude from other men; justice is a virtue, because it secures him from this disquietude. The duties of friendship and goodfellowship are inculcated on the same grounds of security to the individual.

Among the Romans the system of Epicurus was adopted by many distinguished men. Horace, Atticus, and Pliny the Younger were Epicureans; Seneca, nominally a Stoic, drew much from Epicurus; and the great poem of Lucretius must have recommended the system to many. In modern times Epicureanism was resuscitated in France by Père Gassendi, who published an account of Epicurus's life and a defence of his character in 1647; and many eminent Frenchmen have professed his principles.

See ATOM, DEMOCRITUS, LUCRETIUS; Zeller's *Philosophy of the Stoics, Epicureans, and Sceptics* (trans. by Reichel; new ed. 1880); W. Wallace, *Epicureanism* (1880); and monographs by Gizycki (Halle, 1879) and Kreibig (Vienna, 1885).

Epicycle. See PTOLEMAIC SYSTEM.

Epicycloid is the name of a peculiar curve. When a circle moves upon a straight line, any point in its circumference describes a Cycloid (q.v.); but if the circle moves on the convex circumference of another circle, every point in the plane of the first circle describes an epicycloid; and if on the concave circumference, a hypocycloid. The circle that moves is the generating circle; the other, the base. The describing point is not necessarily in the

circumference of the generating circle, but may be anywhere in a radius or its prolongation. It has many remarkable properties, and is even useful in the practical arts. The teeth of wheels in machinery must have an epicycloidal form, in order to secure uniformity of movement.

Epidaurus, a town of ancient Greece, on the eastern shore of the Peloponnesus, in the district of Argolis. During the most prosperous period of Grecian history Epidaurus was an independent state. The form of government was originally monarchical, but, after many vicissitudes, it eventually became and remained oligarchical. At an early period Epidaurus became one of the chief commercial cities of the Peloponnesus. It was chiefly famous for its temple of Æsculapius, to which patients resorted from all parts of the Hellenic world, seeking a cure for their diseases. The site of this temple, about 5 miles west of the town, is still called Hieron, 'the sanctuary.' Epidaurus had also numerous temples and a magnificent theatre, at present in a more perfect state of preservation than any in the Peloponnesus, and with sufficient accommodation for 12,000 spectators. At the modern *Epidavro*, a small village, in January 1822 a congress from all parts of Greece assembled, and promulgated the constitution known as the constitution of Epidaurus.

Epidemic (Gr. *epi*, 'upon,' and *dēmos*, 'the people'), a disease which attacks numbers of persons in one place, simultaneously or in succession, and which in addition is observed to travel from place to place, often in the direction of the most frequented line of communication. In early days, before the doctrine of contagion was advanced, it was thought that the cause of all disease, both endemic and epidemic, existed in the atmosphere. Hippocrates, while recognising this conclusion as correct regarding the former class of disease, ascribed the latter to something divine or to some unknown and inexplicable cause. Sydenham, the father of English medicine, took a similar view, believing that epidemic diseases were to be attributed to 'a hidden constitution of the air.' Hence the term so frequently used, even in later days, of 'the epidemic constitution.' No doubt there is some foundation for this, seeing that all the great epidemics of ancient time—notably the famous pestilence of the 14th century known as the Black Death—were preceded or accompanied by violent climatic changes, earthquakes and other geological disturbances. But in our age, with the advance that has been made in medical research, the majority of physicians and scientific men are agreed that there is no necessity to go out of the way to seek for an ill-defined and mysterious cause for epidemics, but that the matter may be fairly attributed to well-ascertained and clearly intelligible influences. Examples of these may be adduced in the effect of poverty and overcrowding upon typhus, and inefficient sanitation in the production of typhoid. That famine has much to do with epidemic disease is generally well recognised, so much so that one particular form—relapsing fever—is commonly known as the famine fever. It must still be admitted that there is room for argument on the subject, and so recently as 1884 Dr Norman Chevers, then president of the Epidemiological Society, at a meeting held in connection with the Health Exhibition, attributed typhus fever to the prevalence rather of what he termed an atmospheric wave than to any effect produced by badly ventilated dwellings, though he admitted that this, like the drinking of impure water in cases of typhoid, might be the exciting cause (Health Exhibition Conferences). Epidemics are transmitted from person to person, it is now all but universally agreed, through the medium of minute living organisms, varying in nature according to the different classes of disease. Among the more famous epidemics may be mentioned the Black Death, already alluded to; the Sweating Sickness, which first made its appearance in England in 1485, and afterwards in this and succeeding years became very conspicuous; and a peculiar form of epidemic affection, characterised by gangrene of the hands and feet, which was variously known to ancient writers as *Ignis Sacer*, *Arsnea*, *Mal des Ardens*, and at a later period as *St Anthony's Fire*. The chief epidemics of the 19th century have been cholera, diphtheria, cerebro-spinal meningitis, yellow fever, and relapsing fever. See ENDEMIC for further information on this subject; also CONTAGION, INFECTION, FEVER, CHOLERA, PLAGUE, SMALL-POX, &c.

EPIDEMIC MENTAL DISEASES.—When we consider how ordinary and normal thoughts and emotions spread from one man to many, and sway multitudes to the same views and actions, it is no longer a mystery that morbid conditions of the mind should become at times no less epidemic than physical diseases. Such, at least, is the fact. A mental disorder may spread from man to man, and may involve whole nations. It depends for its propagation, like an epidemic disease, first upon external circumstances, and secondly, upon the peculiar condition or constitution of the individuals affected. Like the bodily affection, the causes which provoke the insanity and the tendency to be affected may have been in process of development for years. Both attack the weak rather than the strong; both exist for a season, and disappear. In the case of the mental malady, the external influences—those which constitute the moral atmosphere—are ignorance or imperfect knowledge, the power of one mind over another, the influence of language, the diffusion of particular opinions, the tendency to imitate. It is probable, however, that physical causes exercise an important influence in the production of such general mental conditions. In 1842 and 1844 there occurred in Germany and France, among the military, epidemics of meningitis with delirium, or inflammation of the membranes of the brain, when no moral factors were at work, but when diet, temperature, &c. were to blame. But even where the origin cannot be so distinctly traced, the co-operation of external as well as psychical agents may be legitimately predicated. It would accordingly be illogical to limit the production of the Dancing Mania (q.v.), which occasionally, during several centuries, swept over Europe, to the reaction succeeding the dread of the end of the world, which had previously prevailed epidemically. An examination of about a hundred manifestations such as that alluded to, collected from various sources, demonstrates that not merely the intoxication of joy, but the most absurd forms of belief—that dreams, delusions, superstitions, corruptions of language, all instincts and passions, even movements and cries, may assume the form, and, to a certain extent, may follow the laws of epidemic diseases. There are records of a histrionic plague, when crowds conceived themselves players, and traversed the streets, and sank and died, repeating verses, and exhibiting extravagant gesticulations; and of whole communities being stricken with nightmare, which was so general as to be supposed contagious. There have been epidemics of homicidal and suicidal mania. In one age hundreds are found possessed by Satan; in another, larger numbers converted into wolves; and the leaping ague of Forfarshire in the 18th century and outbursts of pyromania in various places remind us that there may be still in the constitution of the human mind, and in the education and the habits

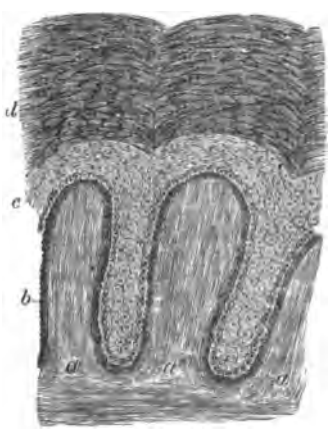
of life prevailing, elements capable of realising the catastrophe suggested by Bishop Butler's question: What is to prevent a whole nation becoming mad? The instances of epidemic mental disease recorded in the following table have been selected from a vast number of others, with a view of showing not the frequency or extent of such affections, but the range of the phenomenon through the powers and propensities of our nature.

Popular Name.	Form of Disease.	Year.
St Vitus's Dance	Choreamania	1374.
Werewolf Superstition	Lycanthropia	Various.
Possession	Demonomania	1642, &c.
Convulsionaries	Theomania	1731.
Incendiarism	Pyromania	1800.
Witchcraft	Demonopathia	Various.
Suicide	Melancholia	"
Visions	Delusions	"

There appears to be no guarantee that the present and future generations shall be exempted from similar visitations, except in the universal diffusion of knowledge and sound thinking, for it is invariably in the darkness of ignorance or in the twilight of imperfect knowledge that the moral plague comes.

See DISEASE, INSANITY, FLAGELLANTS; also Hecker's *Epidemics of the Middle Ages* (Eng. trans. 1846); Calmeil, *De la Folie* (Paris, 1845); Ackermann, *Ueber die Ursachen epidemischer Krankheiten* (Berl. 1873); Küchenmeister's *Zeitschrift für Epidemiologie* (1874 *et seq.*); *Psychological Journal* (*passim*); Parkin's *Epidemiology* (2 vols. 1880).

Epidermis (Gr. *epi*, 'upon,' and *derma*, 'the skin'), scarf-skin or cuticle, forming an external covering of a protective nature for the true skin or corium. Its under or attached surface is accurately moulded upon the true skin, and when the two are separated the cuticle presents impressions which exactly correspond to the elevations and depressions in the corium. The thickness of the epidermis varies from $\frac{1}{810}$ to $\frac{1}{10}$ of an inch, according to the amount of protection which the delicate and sensitive corium requires in different localities. Thus, it is thickest and hardest in the palms of the hands and soles of the feet, but this is not altogether the result of an increased growth due to intermittent pressure, for the difference is well marked even in the fœtus. The epidermis consists of many layers of stratified cells superimposed on each other; and since they cover a free surface exposed to the air, the cells are classed in the group of stratified epithelia. The cells vary in shape, those placed next the corium being elongated in form, while those most superficial are flat and scale-like. On this account it is usual to describe the epidermis as consisting of two strata—an outer or *superficial horny stratum*, and a deeper or *mucous stratum* (or *rete Malpighii*). The *horny stratum* consists of cells, many of which have lost their nuclei and assumed the form of hard flattened scales of polygonal outline. The deepest layer of this stratum consists of closely packed cells with indistinct outlines and a clear, almost homogeneous, appearance, which has given them the name of the *stratum lucidum*. The superficial cells of the horny layer are regularly cast off by desquamation, and replaced by those beneath them. In reptiles and amphibians this layer is periodically cast off in a more or less entire state, a new one being previously formed beneath it; and in man desquamation in large patches occurs after certain diseases, especially scarlet fever.



Perpendicular Section of the Skin of the Leg of a Negro (magnified 250 diameters):

a, *a*, papillæ of the cutis; *b*, deepest intensely coloured layer of perpendicularly elongated cells of the mucous layer; *c*, upper stratum of the same layer; *d*, horny layer.

The *mucous stratum* lies next the corium. It consists of nucleated cells of various shapes. Those next the corium are elongated and placed perpendicularly to its surface. Above these are cells more rounded or polyhedral in outline, and possessing many spines or prickle-like processes, by the points of which the cells adhere to each other, and thus leave fine lymph channels through which the nutrient plasma is transmitted to the cells. The colouring matter of the epidermis is found in the cells of the mucous stratum. A more or less dark pigment is often deposited in the face, neck, and hands of the fair races of men during exposure to the sun, forming isolated colour-spots called freckles; but in the dark races the pigment-granules are distributed throughout the cells of the mucous stratum, the deepest or perpendicular cells being the darkest. Instances of white negroes are on record, not as a consequence of change of climate, but as an abnormal condition of the epidermis. Fine nerve-fibrils penetrate between the cells of the mucous stratum, and undergo a certain amount of ramification, but do not form a network. In some reptiles, and in the Edentata among mammals, the epidermis forms large plates or scales, while epidermal appendages assume various forms—e.g. hair, nail, spines, bristles, feathers, claws, hoof, horns, &c.

In *plants* the epidermis is formed of flattened cells, usually only one layer deep, frequently bearing hairs and stomata. The exposed cell-walls upon the outer surface are frequently thickened as the cuticle.

Epidote. Under this name are included several minerals, which are of some importance as rock-formers. Only two need be mentioned here, *Zoisite* and *Pistazite*, or *Epidote proper*. Zoisite, or lime-epidote, is a silicate of alumina and lime, the alumina sometimes being replaced by ferric oxide to the extent of 2 or 3 per cent. It crystallises in rhombic prisms, which are often curved or sharply bent. Usually it occurs as large imbedded crystals or as foliated and columnar aggregates, chiefly in crystalline schists, especially such as are rich in amphiboles. It is generally light-coloured—white, yellowish, or brownish-gray. Its hardness = 6½. Pistazite, or epidote proper, is a silicate of alumina and lime in which the alumina is replaced by ferric oxide up to 17 per cent. or thereabout. Hence it is often spoken of as iron-epidote. It has a peculiar dark yellowish-green colour, known as pistachio-green. It crystallises in monoclinic prisms, and has a hardness similar to that of zoisite. The largest and best developed crystals are met with amongst the crystalline schists and gneisses, and not infrequently in metamorphosed limestones. In eruptive rocks it occurs only as a decomposition-product after pyroxenes, amphiboles, micas, and felspars.

Epigastrium (Gr. *epi*, 'over,' and *gastēr*, 'the stomach'), the part of the Abdomen (q.v.) which chiefly corresponds to the situation of the stomach, extending from the sternum towards the navel or umbilicus. It is called in popular language the pit of the stomach.

Epigene (Gr. *epi*, 'upon,' *gennaō*, 'I produce'), a term applied to those geological agents of change which affect chiefly the superficial portions of the earth's crust, as the *atmosphere*, *water*, *plants*, and *animals*. See GEOLOGY.

Epigenesis, a technical name for the modern conception of the development of the organism by the growth and differentiation of a simple germ—i.e. by the division or segmentation of a fertilised egg-cell. This conception, now a commonplace, was first definitely enunciated by Harvey (1651), and was reasserted with cogent demonstration by Wolff in 1759, in opposition to the generally received theory that the germ contained a preformed miniature model of the organism which only required to be unfolded. See EMBRYOLOGY.

Epiglottis, a cartilaginous valve which partly closes the aperture of the larynx. See LARYNX, and DIGESTION.

Epigoni. See ADRASTUS.

Epigram, a word derived from the Greek and literally signifying an 'inscription.' The epigrams of the Greeks were simply inscriptions on tombs, statues, and monuments, written in verse, and marked by great simplicity of style, but having little in common with what is now understood by the name. The founder of the art was Simonides of Ceos, many of whose epigrams were inscribed on the tombs of the heroes who fell in the Persian war. It was among the Romans that the epigram first assumed a satirical character; the greatest Roman masters were Catullus and, in particular, Martial, whose obscenity unhappily was more easily imitated than his genius. In modern times an epigram is understood to be a very short poem, generally from two to eight lines, containing a witty or ingenious thought expressed in pointed phraseology, and in general reserving the essence of the wit to the close, as the serpent is fabled to keep its sting in its tail. It may be the medium for the expression of almost any feeling, provided only it is in form brief, pointed, and exquisite. Epigram, however, fits best the expression of satire—an admirable example is that of Rogers:

> Ward has no heart, they say, but I deny it;
> He has a heart, and gets his speeches by it.

The Latinists Scaliger, Buchanan, More, Stroza, and John Owen (1560–1622) wrote epigrams, and the form has been kept in an artificial life by Vincent Bourne, Porson, and Walter Savage Landor. And the excellent *Epigrams of Art, Life, and Nature* (1884), by William Watson, show that the art is not yet quite forgotten. In earlier generations of English literature the epigram was a favourite form, almost every poet in the 16th and 17th centuries having written them. John Heywood 'invented and did' as many as six hundred; other past but forgotten masters are Thomas Freeman, Samuel Sheppard, Thomas Bastard, Thomas Bancroft, and Henry Parrot. A few examples by Herrick, Quarles, and Ben Jonson still survive, while many thousands that cost much labour in the making sleep in secure oblivion. The French excel all other nations in the epigram. Their earliest epigrammatist of any note was Clement Marot (1495–1544); their best are J. B. Rousseau, Lebrun, Voltaire, Marmontel, Piron, and Chénier. The epigrams of German writers are for the most part happily expressed moral proverbs (*Sinngedichte*), but the *Xenien* of Schiller and Goethe contain not a few sharp and biting verses of a satirical character. Logau's famous *Deutscher Sinngedichte Drey Tausend* appeared in 1654; later epigrammatists were Kleist, Opitz, Gleim, Hagedorn, Klopstock, A. W. Schlegel, Lessing, and Herder. A large collection of English epigrams was that of Weever (1599). Good epigrams have been written by Cowley, Waller, Dryden, Prior, Swift, Addison, and Young; but the greatest master of the epigrammatic spirit in our literature is Pope. See Booth, *Epigrams, Ancient and Modern* (1863); Dodd, *Epigrammatists of Medieval and Modern Times* (2d ed. 1875); and W. D. Adams, *Book of Epigrams* (1879).

Epigraph (Gr. *epi*, 'upon,' and *graphō*, 'I write'), a terse inscription placed upon architectural or other monuments, for the purpose of denoting their use or appropriation, and very frequently worked in and forming part of their ornamental details. See INSCRIPTIONS; and E. S. Roberts, *Introduction to Greek Epigraphy* (Cambridge Univ. Press, 1888).

Epilepsy (*epilepsia*, 'a seizure') is a chronic functional disease of the nervous system, manifested by recurring attacks of sudden insensibility or impairment of consciousness, commonly accompanied by convulsive seizures of a peculiar kind. The term is not now applied to such symptoms when they are due to organic disease of the brain, heart, or other organs. Thus, we apply the name syncope to sudden unconsciousness from failure of the heart; and we speak of Eclampsia (q.v.) or epileptiform convulsions when the cause is apoplexy, or tumour of the brain, or disease of the kidneys, or teething. It is the underlying morbid condition, not the mere seizures, that constitutes the disease. Epilepsy affects all races of man, and is not unknown among lower animals. Its striking phenomena have been described by the oldest medical writers. By the ancients it was regarded as due to demoniac possession, or to the anger of an offended deity. Their physicians, likewise considering its cause to be supernatural, called it the *morbus sacer*. Hippocrates alone, to his credit be it said, maintained that its origin was no more supernatural than that of any other disease. The Romans regarded it as an evil omen if any one took a fit during the conduct of public business, and adjourned the meeting for the day. Hence they termed it *morbus comitialis*. The common English name, derived from one of its most prominent symptoms, is the 'falling sickness.'

The phenomena of the disease are so multiform that it is impossible here to do more than describe the main types of its severe, slight, and irregular forms. (1) In the *severe form*, or epileptic 'fit' proper (the *grand mal* of the French), the patient, it may be without warning, utters a strange inarticulate cry, and falls suddenly to the ground insensible, as if struck by lightning. He usually has no time to save himself, but knocks against any object near him, and may thus receive serious injury, or he may fall into the fire, or into water. He becomes deadly pale, his body rigid, with the back arched and the features set, and he ceases to breathe. Soon the colour changes, the face becomes livid purple, the veins of the neck swell up and pulsate, the eyeballs protrude, a gurgling sound is heard in the throat, and death seems imminent. But almost immediately breathing begins again, and the whole body is thrown into a series of successive convulsive twitchings or jerkings. The trunk and limbs are thrown about in various ways, the face is hideously contorted, the tongue jerked out between the teeth and often bitten, the jaws convulsed so that the teeth may be broken. A blood-stained foam escapes from the mouth. After about two or three minutes the jerkings cease, leaving the patient prostrate and comatose for a time. Then he may open his eyes, look around him with a dazed expression, and go to sleep. On awaking he is quite unconscious of what has

happened; he may have a severe headache, or be morose and irritable; in rare cases, he feels much freer mentally than before the fit. Sometimes a condition of homicidal mania follows the fit, when the patient attacks any one he may see. The fits are usually separated by intervals varying from some hours to some months; but a very grave condition supervenes (called the *status epilepticus*) when one fit succeeds another before the stage of coma has passed off. The attacks may be preceded by a distinct 'warning,' or *aura*, as it is called. These may be very short, or may permit of the patient putting himself in a position of safety before the attack comes on, or even of preventing it. The *aurae* vary greatly, but in each case the same *aura* usually precedes the fits. There may be peculiar sensations, such as flashes of light, perceptions of colour, strong odours, or strange tastes or sounds, or visions of various forms, peculiar sensations running up from the fingers or toes towards the head, or sinking at the heart or at the pit of the stomach, or twitchings of groups of muscles.

(2) *Slight Forms* (Fr. *petit mal*).—These are often spoken of as 'faints,' 'turns,' 'sensations,' 'giddiness' (see VERTIGO); and, though they are as truly epileptic as the attacks above described, they are usually regarded as altogether trivial. There may be merely a momentary confusion of thought or loss of consciousness. Thus, one while in the act of speaking may suddenly stop, stare fixedly, become pale and unconscious. In a second or two he is quite himself again, and may finish the sentence he had begun, or he may make some random remark, or perform some absurd act automatically, before he comes quite round. In other cases there may be a momentary giddiness, when objects seem to rotate, or the patient himself seems to be wheeled round, and then unconsciousness supervenes. Or there may be a feeling of faintness, or a momentary twitching of one or two groups of muscles, with pallor of the face and unconsciousness.

(3) *Irregular Forms of Epilepsy.*—Dr Hughlings Jackson has investigated a form in which there are spasms of the same nature as those in the severe fit, but limited to single groups of muscles, or spreading from one group to another, while consciousness is either not lost at all, or only at a late stage in the attack. In other forms, complicated and purposelike acts may be carried out in an automatic manner, of which the patient afterwards retains no recollection. Under this category come many attacks of kleptomania, dipsomania, and many motiveless murders.

The mental condition of epileptics between the attacks varies much. In about one-third of all cases the mind seems to be unimpaired. Napoleon Bonaparte, Peter the Great, Mohammed, and Julius Cæsar are examples of epileptics with highly developed mental faculties. In the majority of cases, however, there is some defect, which may be merely a gradually increasing failure of memory, or insanity, or hopeless imbecility. Very often there is uncertainty of temper, moroseness, or criminal tendencies. The mental deterioration seems to be influenced more by the early commencement and duration of the disease, and by the frequency of the fits, than by their severity or their form. The disease may begin at any period of life, perhaps most commonly between the thirteenth and seventeenth years. The fits may occur during sleeping or waking. They are themselves rarely fatal, except by some accident, such as suffocation, burning, or injury, or when they succeed each other so rapidly that the patient does not become conscious in the interval.

The brain after death presents no appearance that can be called characteristic of the disease. In most cases it appears typically healthy. Such abnormal conditions as are present are in most cases accidental, or the consequences of the repeated fits. In some cases thickening of the skull or of the membranes, or tumours in the brain, are present, and have by their irritation caused the fits. Probably the brain changes are too fine to be detected by our present means of research. Up till recently it was always taught that the medulla oblongata acted as the starting-point of the fits, spasm of its vaso-motor centre causing contraction of the vessels of the brain, and cutting off its supply of blood—a condition which experiment has shown to produce convulsions. Lately the view has been gaining ground that the change begins in the nerve-cells of the gray matter of the surface of the cerebrum, and that it is due to an inordinate discharge of nerve energy.

The causes of the disease are often altogether obscure. The two factors of most importance are, first, the inheritance of nervous instability from ancestors who have suffered from epilepsy or some other form of nervous disease, or who have damaged their nervous systems by alcoholic or other excess; and secondly, alcoholism on the part of the patient himself. Teething in children, fright, mental excitement, injuries to the head, or intestinal worms are not infrequent causes.

Treatment.—During the onset, when the aura is prolonged, the fit may sometimes be arrested by a bandage tied tightly round the limb along which the peculiar sensation passes, or in other cases by stimulation of the nostrils by snuff or ammonia. In such cases the appropriate remedy should be always ready at hand. During the attack there is nothing to be done except to put the patient into the horizontal position, loosen his neckcloth, and let him have plenty of air. The most severe fits usually terminate spontaneously, and any treatment beyond endeavouring to prevent suffocation is unnecessary and often injurious. After the fit is over, the patient should be allowed to sleep. In the general management of the case between the fits, a quiet, regular life, if possible in the country, with a moderate amount of physical and mental exercise, should be enjoined. The calling must be such that there is no risk to life in the event of a fit occurring. Children should be educated, but not overpressed. The dietary should be simple and digestible, with much milk, eggs, and vegetables, but without altogether excluding meat. Alcohol, coffee, and tea should be absolutely forbidden. Marriage seems to have no effect on the disease, but it must be remembered that the children of such unions are apt to suffer from nervous disease. Intermarriage of epileptics should be absolutely discouraged. With regard to the medicinal treatment, although there is no specific against epilepsy comparable to the action of quinine in malaria, the bromide compounds are the most efficacious. But it is essential to success that their use be persevered in steadily for long periods. The mistake commonly made is to use the remedy for a week or two after the attacks, and then to discontinue it till the next fit occurs. The patient should be aware that hope of cure cannot be held out to him unless he persists faithfully with the treatment. In all cases sources of irritation must be carefully sought for; their removal often serves to cure the disease. Cerebral surgery has achieved brilliant results recently in the removal of such sources of irritation to the brain as diseased bones of the skull, and even tumours in the organ itself; but operations on the brain are always such serious matters that they are not to be undertaken without due consideration of the risks run not only to life, but to usefulness of limbs, and after careful comparison of these dangers

with the benefit likely to be derived from surgical interference.

Epilobium (or WILLOWHERB, from its characteristic habit and silky-tufted seeds), a widely diffused herbaceous perennial genus of Onagraceæ, common in moist places. *E. angustifolium* is one of the most familiar denizens of the cottage garden, and is also common in shrubberies. In arctic regions its young shoots are sometimes eaten in case of need, and in Kamchatka a kind of beer is made from the sugary pith. This species, with several others, is common in North America, where it is sometimes called *fire-weed*, since it often covers the scenes of great forest fires, and sometimes *slink-weed*, from a belief that it causes cows to 'slink' or miscarry. About a score of other species are occasionally seen in gardens.

Epilogue (Gr. *epi*, 'upon' or 'after,' and *logos*, 'a speech') means, in oratory, the summing up or conclusion of a discourse; but in connection with the drama it denotes the short speech in prose or verse which was frequently, in former times, subjoined to plays, especially to comedies, as contrasted with the Prologue at the beginning. The epilogue was always merry and familiar in its tone, and was intended to establish a kindly understanding between the actor and the audience, as well as to conciliate the latter for the faults of the play, if there were any, and to send them away in good humour. One of the neatest and prettiest epilogues ever written, and one which completely realises what an epilogue should be, is that spoken by Rosalind at the conclusion of Shakespeare's *As You Like It*.

Epimenides, a Greek poet and priest, sometimes included among the 'seven sages,' was born in Crete in the 7th century B.C. According to one tradition, during a sleep of fifty-seven years he received the divine inspiration which determined his future career. (Goethe wrote a poem on the subject, *Des Epimenides Erwachen*.) He was reputed to have lived for 299 years. Epimenides went to Athens about 596 B.C., where, by the performance of various mystical rites and sacrifices, he stayed a plague with which the inhabitants were afflicted, and co-operated with Solon in reforming the Athenian constitution. He was the 'prophet' quoted by St Paul in Tit. i. 12. That he wrote the epic poems attributed to him, the longest of which was on the Argonautic expedition, is considered highly improbable. Compare Schultess, *De Epimenide Crete* (Vienna, 1877).

Epinal, the capital of the French department of Vosges, delightfully situated at the western base of the Vosges Mountains, on the Moselle, 46 miles SSE. of Nancy by rail. It is a clean, well-built town, surmounted by the ruins of an old castle, whose gardens are much admired. Among its buildings are the church of St Maurice, founded about 960, the museum, and a library of 28,000 volumes. Epinal manufactures cotton, paper, &c. Pop. (1872) 10,938; (1891) 18,983, an increase largely due to the influx of Alsatians.

Epinay, MADAME D', a French writer, born about 1725, at nineteen married her cousin. The union proved an unhappy one, and she struck up liaisons with men of genius—first with Rousseau, for whom in 1756 she built a cottage (the now famous Hermitage) near the valley of Montmorency, and then with Grimm. She spent her last years in comparative solitude, and died 17th April 1783. Her *Conversations d'Émilie* (1774), a work on education, was crowned by the French Academy. Her *Mémoires et Correspondance* (1818) is an autobiographical romance. See ROUSSEAU; and Perey's *Jeunesse de Mdme. d'Epinay* (1882).

Epiornis. See ÆPYORNIS.

Epiphanes. See ANTIOCHUS.

Epiphanius, a Christian bishop and writer of the 4th century, was born of Jewish parents in Palestine. He was educated among the Egyptian monks, who imbued his mind at once with a fervent piety and an intolerant bigotry that together led him in after-life into most unchristian excesses. He rose gradually to the rank of Bishop of Constantia (formerly Salamis) in Cyprus, and continued in that office from 367 till his death in 403. His polemical zeal was conspicuously manifested against Origen. He had proclaimed him a heretic in his writings, and in 394 he went to Palestine, the stronghold of Origen's adherents, and called upon John, Bishop of Jerusalem, to condemn him. Both in this instance and in his conduct to Chrysostom afterwards, he displayed a tyrannical and intolerant passion. Among his writings, collected by Petavius (2 vols. Paris, 1622), the most important is his *Panarion*, or catalogue of all heresies (80 in number), a work which strikingly shows his unfitness for the task of a historian. See a monograph by Lipsius (Vienna, 1865).

Epiphany (Gr. *Epiphaneia*, 'manifestation') denoted, among the heathen Greeks, the appearance of a god to a worshipper. The word was subsequently used to designate the manifestation or appearance of Christ upon earth to the Gentiles, with especial reference (in the Western Church) to his adoration by the Magi (q.v.). This occasion is commemorated on 6th January, the 12th day after Christmas, and hence the Epiphany is also called Twelfth Day (q.v.). Until the latter end of the 4th century, the 6th January was a festival in honour of Christ's nativity and baptism. See BEFANA.

Epiphytes (Gr. *epi*, 'upon,' *phyton*, 'a plant'), often and popularly, but less correctly, called Air-plants, are plants which are not rooted in the ground, but are attached to trees, &c. Mosses and lichens themselves, growing upon trees, may be called epiphytes, but the term is generally used of phanerogamous plants. It is chiefly in warm and moist climates that phanerogamous epiphytes are found, and in those which are also moist, although many exhibit considerable endurance of drought. Most of them prefer shady situations. Within the tropics, they often form an interesting and remarkable feature of the vegetation. Some of the Bromeliaceæ (as *Tillandsia*), Cactaceæ, Araceæ, Gesneraceæ, and other orders are epiphytes; most frequently, however, the Orchidaceæ. See ORCHIDS, TILLANDSIA, &c.; and Kerner's *Pflanzenleben*.

Epirus ('mainland'), the ancient name of a part of Greece, extending between Illyria and the Ambracian Gulf, and from the Ionian Sea to the chain of Pindus. It was a wild and mountainous region, heavily wooded, and producing but little corn, though celebrated for its cattle and horses, and for its breed of Molossian dogs. The principal rivers were the Aous, Arachthus, Thyamis, and Acheron (q.v.); the chief towns, Dodona (q.v.) and Ambracia (q.v.). Anciently, as to-day, the inhabitants were only half Hellenic, the Greek colonies being confined to the coast and southern portion. Of the Molossian kings of Epirus, the most famous is Pyrrhus (q.v.), who long waged successful war against the Romans. On the conquest of Macedonia by the Romans (168 B.C.), the most revengeful measures were put in force against the Epirotes, who had assisted Perseus, the Macedonian king. Æmilius Paulus, the Roman general, plundered and razed to the ground seventy towns of Epirus, and sold into slavery 150,000 of the inhabitants. From this period, Epirus shared the vicissitudes of the Roman and Byzantine empires,

until 1204, when one of the Comneni made himself independent. Petty princes ruled the country until the 15th century, when it was finally conquered by the Turks (see SCANDERBEG). Epirus, peopled largely since the 14th century by Albanians (see ALBANIA), formed latterly a part of the Turkish vilayet of Janina. Under pressure from the great powers, Turkey ceded the strip of territory east of the river Arta to Greece in 1881.

Episcopacy. See BISHOP.

Episcopius, SIMON (properly *Biscop*), the leader of the Arminian party after the death of its founder, was born at Amsterdam in 1583, and studied (from 1600) at Leyden. Arminius and Gomarus were his teachers in theology, and on the death of the former in 1609 Episcopius was obliged, on account of his known attachment to Arminius' views, to leave Leyden for Franeker. In 1610 he became pastor at Bleyswich, a village near Rotterdam, and in the following year he was one of five 'Remonstrants' appointed by the government to meet five 'Contra-Remonstrants' at a conference at the Hague. When Gomarus resigned his chair at Leyden, Episcopius was appointed his successor (1612). Called with twelve other Arminian theologians to the bar of the Synod of Dort (1618), Episcopius (with the rest) was condemned and banished from the country. He removed to the Spanish Netherlands, where he wrote his famous Arminian *Confessio* (published in 1622). On the renewal of the war between Spain and Holland, he found refuge in France, where he lived mostly at Paris and Rouen, and published a series of able controversial treatises. Permitted in 1626 to return to his native country, he was for several years a preacher at Rotterdam, where he wrote his *Apologia pro Confessione* in 1629. From 1634 he was professor at the Arminian College at Amsterdam, and here he produced his *Institutiones theologicæ* and *Responsio ad Quæstiones Theologicas*, two works which are mutually complementary, and which, though the former was left incomplete at his death in 1643, present an ample apology not only of Arminian theology, but of the Christian revelation itself. Episcopius everywhere lays the utmost stress on the personal responsibility of man in relation to divine grace, denies the doctrine of original sin, and treats Christian faith not as a doctrinal theory, but as the potentiality of right moral conduct. Yet it cannot be denied that, in his view of the Trinity, the Son and the Holy Spirit are partakers of divine power and glory *non collateraliter sed subordinate*, and that he held it enough to believe that the Holy Spirit proceeds only from the Father, and is the spirit of the Son. This rationalistic development of Arminian doctrine by Episcopius went far beyond the famous Five Articles of 1610, but in the next generation was generally adopted by the Arminian party. His works were collected in 2 vols. (Amst. 1650–65). The best Life is Philip Limborch's *Historia vitæ Simonis Episcopii* (Amst. 1701). See ARMINIUS, CALVINISM; and Sepp, *Het godgeleerd onderwijs in Nederland* (1873).

Epistles. See BIBLE.

Epistolæ Obscurorum Virorum ('Letters of Obscure Men') is the title of a collection of satirical letters which appeared, in dog-Latin, at the commencement of the 16th century, and professed to be the composition of certain ecclesiastics and professors in Cologne and other places in Rhenish Germany. They were directed against the scholastics and monks, and lashed with merciless severity their doctrines, writings, morals, modes of speech, manners of life, follies, and extravagances, and thus helped in no small degree to bring about the Reformation. The controversy of Reuchlin with the baptised Jew, Pfefferkorn, concerning Hebrew books, gave the first occasion to the *Epistolæ*, and it is probable that their title itself was suggested by the *Epistolæ Clarorum Virorum ad Reuchlinum* (1514). On the first appearance of the work, it was fathered on Reuchlin; afterwards it was ascribed to Reuchlin, to Erasmus, and to Hutten. By many it has been held that Hutten was the chief author, and Crotus Rubianus his chief assistant in the work, which appeared at Hagenau in 1516 (but professedly at Venice). But though Hutten certainly wrote the letters which appeared in 1517 as a second part of the *Epistolæ Obscurorum Virorum*, it cannot be said to have been proved that he had any share in the first part, of which Crotus Rubianus would accordingly be the chief author, as he certainly was the suggester of the scheme. The circumstance of the *Epistolæ* being placed in the *Index Expurgatorius* by a papal bull helped to spread it not a little. Among the numerous editions of the work, the best is Böcking's, with commentary, in his edition of Hutten's works (1869). See D. F. Strauss's *Ulrich von Hutten* (Eng. trans. 1874), and Mark Pattison's *Essays* (2 vols. 1889).

Epitaph (Gr. *epi*, 'upon,' and *taphos*, 'a tomb'), any commemorative inscription upon a monument. Naturally, brevity and point are the principal things to be aimed at in such memorials, and, as the elemental human emotions are ever the same, we find a striking similarity between ancient and modern epitaphs. The oldest we have are those of the Egyptians, written on the sarcophagi, but these are brief and formal, being merely a record of the name and condition of the deceased, with a prayer to Osiris or Anubis. Quite different are the early Greek epitaphs, which often both in form and substance evince fine literary skill. The earlier examples are mostly in elegiac verse. None are better than those of heroes who have fallen in battle, and of these the classical example is that on the three hundred martyrs to patriotism at Thermopylæ, ascribed to Simonides:

> Go tell the Spartans, thou that passest by,
> That here obedient to their laws we lie.

The Roman epitaphs usually contain a more or less bare record of facts. On the urns the letters D. M. or D. M. S. (*Diis Manibus* or *Diis Manibus Sacrum*) are usually followed merely by the name of the deceased, his age, and condition, with the name of the person who caused the urn to be made. These characters were often adopted from mere conservatism by Christians, and we find them conjoined with purely Christian sentiments in the catacombs at Rome. The ashes of the dead were usually placed along the sides of the great highways leading into Rome, hence the appropriateness of the common commencement, *Siste Viator*—the 'stop passenger' to be seen in so many of our English churchyards. One feature not uncommon in Roman inscriptions was an execration upon the disturber of the sepulchre—the reader will remember that on Shakespeare's tomb at Stratford-on-Avon, most probably from the pen of the great dramatist himself.

Long after the Roman empire had crumbled into ruins, the Latin tongue continued to be used for inscriptions, but in England we occasionally find French used as early as the 13th century. It was hardly, however, till the time of Elizabeth that epitaphs became really literary; then and after we find them written in admirable epigrammatic form by Ben Jonson, Milton, and many others. Pope's English epitaphs were long famous, and also those by Dr Johnson in Latin. The latter's answer to the famous round-robin signed by Gibbon, Burke, Sir Joshua Reynolds, Sheridan, Warton, and others,

requesting that he should write the epitaph for Goldsmith in English, was that 'he would never consent to disgrace the walls of Westminster Abbey with an English inscription.' It is no doubt true that no language lends itself so well to dignity in brief simplicity as the Latin, but the argument from its stability and universality becomes weaker with every generation.

The naturally epigrammatic turn of the French mind peculiarly adapts it for the epitaph, and in French collections very felicitous examples are to be found both in Latin and in French, such as the 'Tandem felix!' of the Count de Tenia; the touching epitaph to a mother, 'La première au rendez-vous;' and that written by Piron for himself after his rejection by the Academy:

Ci-gît Piron, qui ne fut jamais rien,
Pas même Académicien.

A large number of the earlier monuments, and consequently of the epitaphs of this country, were destroyed by unfortunate iconoclastic zeal at the Reformation, and after the triumph of the Puritan revolution. The epitaphs to be found in our parish churchyards display every variety of taste, from pure pathos, simplicity, and dignified eulogy to painful would-be wit and even vulgar buffoonery.

See Weever's *Ancient Funerall Monuments* (1631; ed. by Tooke, 1767); Philip Labbe, *Thesaurus Epitaphiorum* (Paris, 1666); De la Place, *Recueil d'Épitaphes* (3 vols. Paris, 1782); Pettigrew's *Chronicles of the Tombs* (1857); Northend, *Book of Epitaphs* (New York, 1873); J. R. Kippax, *Churchyard Literature: a Choice Collection of American Epitaphs* (1876); and W. Andrews, *Curious Epitaphs* (1883).

Epithalamium, a species of poem which it was the custom among the Greeks and Romans to sing in chorus near the bridal-chamber (Gr. *thalamos*) of a newly-married pair. Sappho, Anacreon, Stesichorus, and Pindar composed poems of this kind, but only scanty fragments have been preserved. The epithalamium of Peleus and Thetis by Catullus is one of the finest specimens of Latin poetry extant; but probably the most splendid epithalamium in all literature is that of our own poet Spenser. Latin examples are extant by Statius, Ausonius, Claudianus, and other poets. A collection of Latin epithalamia is to be found in Wernsdorf's *Poetæ Latini Minores* (4th vol. part 2, Helmst. 1789).

Epithelium is the term applied in anatomy to the cell-tissue which, in layers of various thickness, invests not only the outer surface of the body, and the mucous membranes connected with it—as, for example, those of the nose, lungs, intestinal canal, &c.—but also the closed cavities of the body, such

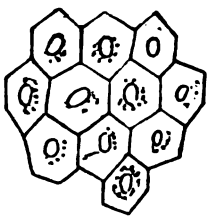


Fig. 1.
Epidermis (still soft like the epithelium of internal parts) of a two months' human embryo. Mag. 350 diam.

Fig. 2.
Epithelial cells of the vessels; the longer one from the arteries, the shorter ones from the veins.

as the great serous membranes, the ventricles of the brain, the synovial membranes of joints, the interior of the heart and of the blood-vessels proceeding to and from it, the ducts of glands, &c. The thickness of this tissue varies extremely with the position in which it occurs. In some parts it consists of numerous strata of cells, collectively forming a layer of more than a line in thickness; in other parts it is composed of only a few strata, or often of only a single stratum of cells, and can only be detected by the microscope. The cells of which the epithelium is composed are usually soft nucleated cells; they may be rounded, polygonal, fusiform, cylindrical, or conical in shape, and sometimes they possess vibratile cilia. No blood-vessels exist in epithelial tissues, although minute channels may be found between the cells, by means of which the plasma derived from subjacent blood-vessels may pass for the nutrition of the cells. In many cases nerve fibrils are abundant.

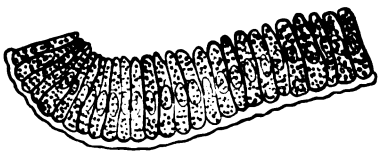


Fig. 3.
Epithelium of the intestinal villi of the rabbit. Mag. 300 diam.

Epithelia may be classified (*a*) according to the embryonic layer from which they are developed; (*b*) according to their function; (*c*) according to their shape and arrangement. Following the latter method, we have (*a*) *simple epithelium*, consisting of a single layer of cells which may be: (1) *Pavement*, consisting of polygonal plates or scales joined together by their edges. They constitute the variety known as pavement or tessellated epithelium, and occurring as an investment of the serous membranes, of most synovial membranes, of the lining membrane of the heart and of the veins, of the canals of glands, &c. (2) *Columnar or cylinder epithelium*, as in the intestine from the stomach to the termination of the alimentary canal, in the excretory ducts of all the glands opening into the intestine, &c. Illustrations of this cylinder epithelium are given in the article DIGESTION. (3) *Spheroidal or glandular epithelium* is chiefly characteristic of the terminal recesses of secreting glands. (4) *Ciliated epithelium* consists of cells which bear on their free ends spontaneously moving filaments called *Cilia* (q.v.). (*b*) *Stratified epithelium* consists of cells arranged in many layers, and the individual cells present every variety of shape. As a rule the deepest cells are columnar, and those on the surface flattened and scale-like, but overlapping one another at their margins. It occurs on the anterior

Fig. 4.
Ciliated cells from the finer bronchial tubes. Mag. 350 diam.

Fig. 5.
Stratified pavement epithelium investing a simple papilla (with blood-vessels in the interior) from the gums of a child. Mag. 250 diam.

surface of the cornea of the eye, in the mouth, pharynx, œsophagus, &c., but its most extensive distribution is in the Epidermis (q.v.). (*c*) *Transitional epithelium* is intermediate between the forms already described, and may be grouped under the three terms columnar, ciliated, and scaly transitional, according to the kind of cell which is most superficial. In the case of the columnar and ciliated varieties there are smaller cells irregularly disposed between the fixed ends of the large ones, and this constitutes the only difference between these and the columnar and ciliated cells already described.

Scaly transitional epithelium is found lining the urinary Bladder (q.v.) and ureters. The superficial cells are flattened scales when the bladder is distended, but cubical when empty. Moreover, the free surface of the cells is smooth, but on the deep aspect they are moulded over the rounded ends of the pear-shaped cells beneath. Irregular cells fill up the intervals between the tapering ends of the pyriform cells.

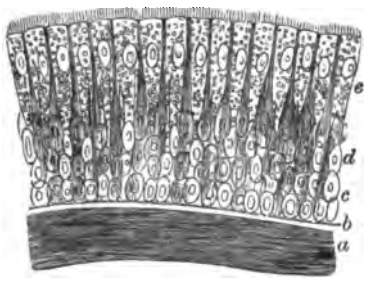


Fig. 6.

Ciliated epithelium from the trachea of a man. Mag. 350 diam. *a*, outermost part of the elastic longitudinal fibres; *b*, homogeneous outermost layer of the mucous membrane; *c*, deepest round cells; *d*, median long cells; *e*, outermost conical ciliated cells.

In all the varieties of epithelium the layer of external cells is being constantly disintegrated and replaced by the layer immediately beneath. The polygonal or pavement epithelium mainly acts like the epidermis, as a protecting medium to the soft parts beneath. The cylindrical epithelium additionally takes an active part in the process of secretion. Illustrations of the function of the cells forming this variety of epithelium are given in the articles CELL, CILIA, DIGESTION; and the subject is further noticed under the head SECRETION.

Epizoa, animals that live on the bodies of other organisms in various degrees of parasitism. See PARASITIC ANIMALS, BUG, FLEA, MITE, TICK, &c.

Epizoötics (Gr. *epi*, 'upon,' and *zōon*, 'an animal') are diseases of animals which manifest a common character, and prevail at the same time over considerable tracts of country. A curious circumstance in connection with them is that they usually follow the same line of route as the diseases of the human race; and, as a rule, when there has been a great epidemic, it has been followed or accompanied by an equally destructive pestilence among animals. The cause of epizoötics is not altogether clear, but there can be little doubt that insufficient food and overcrowding have great influence. Being apt to take on a low type of fever, they are better treated by supporting than by reducing remedies. Influenza in horses, and pleuro-pneumonia and vesicular epizoötic in cattle, are examples.

Epoch, in Astronomy, is an abbreviation for 'longitude at the epoch;' it means the mean heliocentric longitude of a planet in its orbit at any given time—the beginning of a century, for instance. The epoch of a planet for a particular year is its mean longitude at mean noon, on January 1, when it is leap-year, and on December 31 of the preceding year, when it is a common year. The epoch is one of the elements of a planet's orbit. For epoch in chronology, see CHRONOLOGY.

Epode is the last part of the chorus of the ancient Greeks, which they sung after the strophe and antistrophe, when the singers had returned to their original place. The name was applied also to a species of lyric poem invented by Archilochus, in which a longer verse is followed by a shorter one, as the *Epodes* of Horace. See CHORUS.

Eponym (Gr. *epi*, 'on,' and *onyma*, 'a name'), a mythical personage created to account for the name of a tribe or people; thus Tros is the eponymous hero of Troy, Italus was assumed as ancestor of the Italians, &c. For the Assyrian eponym canon, see ASSYRIA.

Epping, a market-town of Essex, in a pleasant healthy situation, at the north end of Epping Forest, 16 miles NNE. of London. It is noted for its cream, butter, sausages, and pork. Pop. of parish, 2343.—Epping (formerly Waltham) Forest, where kings hunted in olden days, once covered all Essex, and extended almost to London. Inclosures gradually curtailed it from 60,000 acres to 12,000 in 1793, and to less than 4000 in 1871, when (the government refusing to stir in the matter) the corporation of London undertook the preservation of all that was left, and the recovery of the more recent inclosures. As an outcome of their exertions, and at a cost of about half a million of money, 5600 acres of Epping Forest were declared free to the public by the Queen on 6th May 1882. Reached easily from Loughton, Chingford, and other stations, Epping Forest is still a glorious place alike for naturalist and mere holiday-maker. Its 9 square miles of almost unbroken woodland, which at High Beech or Queen Victoria's Wood attain a height of 759 feet above sea-level, form one of the most extensive and beautiful pleasure-grounds in Europe. Separated by a stream from Epping Forest is Hainault Forest (the 'garden fair' of Mr Besant), which was disafforested in 1851. Here, till 1820, stood Fairlop Oak, the scene of a July fair, as famous in its way as the old Epping stag-hunt on Easter Monday. See E. N. Buxton, *Epping Forest* (1884); and W. R. Fisher, *The Forest of Essex* (1887).

Eprouvette is a machine for proving or testing the strength of gunpowder. The *gun* eprouvette does this by measuring the amount of recoil produced on a small gun swung like a pendulum; the *mortar* eprouvette by measuring the distance to which a ball is projected. A third pattern is shaped like a small pistol, with an extremely short barrel, closed by a flat plate connected with a strong spring. On firing, the plate is driven back to a distance indexed according to the strength of the powder.

Epsom, a small market-town of Surrey, on the margin of the Banstead Downs, 15 miles SSW. of London. The sulphate of magnesia springs, which made Epsom so fashionable a resort in the later half of the 17th century, gave name to the Epsom salt formerly manufactured from them. The church, rebuilt in 1824, contains monuments by Flaxman and Chantrey. The Royal Medical College (1851), on the Downs, provides education for the sons of medical men, and affords a home to decayed members of the profession and their widows. Pop. (1841) 3533; (1891) 8417. On the Downs, 1½ mile S. of the town, the famous horse-races are held yearly (see DERBY DAY, and HORSE-RACING). The grand stand was built in 1829–30, at a cost of £20,000, and accommodates 7500 spectators.

Epsom Salt, or SULPHATE OF MAGNESIA, $MgSO_4 7H_2O$, was originally obtained by evaporating the waters of the springs at Epsom. It was soon found that sea-brine also contained large quantities, and the manufacture at Epsom was therefore given up. At present it is found native in various parts of America, and large quantities are manufactured near Genoa, by a chemical process, from a rock containing magnesia and sulphide of iron. In England, as well as in America, varieties of magnesian limestone are extensively treated with sulphuric acid for its production, with the result that the market is well supplied with this useful remedy.

Epsom salt forms small needle-like crystals, which have a bitter saline taste and neutral reaction. It is a well-known useful purgative medicine, acting as a refrigerant, and sometimes as a diuretic. Its disagreeable bitter taste may be relieved by the addition of a little sulphuric acid (as in Henry's solution) or syrup of lemon. It is given in doses of ½ oz. to 1 oz. or more, but in every case it is of importance that plenty of water be drunk along with it (one or more tumblerfuls). See MAGNESIUM.

Epworth, a market-town of Lincolnshire, in the 'Isle' of Axholme, 10 miles NNW. of Gainsborough. The great John Wesley was a native, as well as Alexander Kilham, founder of the Methodist New Connection. Pop. of parish, 2178.

Equations. The statement in symbols of the relationship of equality existing between two algebraic expressions is termed an equation. Such expressions generally contain at least one unknown quantity. Thus $x - 2 = 4 + 3$ is an equation denoting that if 2 be deducted from some unknown quantity denoted by x, the remainder will be equal to 4 + 3, that is 7; therefore the value of x in this equation is evidently 7 + 2, or 9. Any equation in one variable x may be reduced to a form such as $F(x) = 0$, where $F(x)$ is a function of x, and this may be considered as the standard form of all equations. When written fully in the most general manner, this may be said to be equivalent to the equation

$$a_0x^n + a_1x^{n-1} + a_2x^{n-2} + \ldots + a_{n-2}x^2 + a_{n-1}x + a_n = 0.$$

This is said to be an equation *in* x, the variable involved; a_0, a_1, a_2, $\ldots$ a_n are the coefficients, either numerical or algebraical quantities. Any quantity which, when substituted for x, reduces the left-hand side to zero—i.e. any quantity which *satisfies* the equation, is termed a *root* of the equation. The main problem in equations is that of finding all the possible roots; this done, a *complete solution* is obtained. The theory of equations is a most important branch of algebra.

Identical equations are those which are always true, whatever be the value of the quantities involved; *conditional* equations are satisfied only by certain values for x. Equations are usually classified according to their *degree*, which is defined as being the highest degree of the involved variable. The equation written above as the standard form is, for example, of the nth degree. Simple equations, or equations of the first degree, are those in which x or the unknown quantity appears only in the first power; when x appears in the second power, the equation is quadratic; when x is in the third power, cubic, and so on. Equations of the first, second, third, fourth, fifth, &c. degrees are sometimes called linear, quadratic, cubic, quartic (or biquadratic), quintic, &c. equations. See Burnside and Panton, *Theory of Equations* (1881); Todhunter's treatise on the same subject (new ed. 1880); or Chrystal's *Algebra*, part i. chaps. 14–19.

Equation in astronomy means the corrections or reductions which must be applied to observations in order either to free them from error or otherwise to reduce them to some form more suitable for purposes of calculation. For the *Equation of Time*, see the article DAY. *Personal equation* is a correction which has to be applied to astronomical (or other) observations in order to remove relative error due to some peculiar mode of observation on the part of the observer. In astronomical observatories it is the practice to find this personal equation for all the observers with reference to one single observer, and the observations are all reduced by its application, so that finally they are tabulated as if made by one observer. The phrase has passed into common language, and is often used to denote that modification which is requisite in the statements or judgments of any person who in such matters is not free from bias or idiosyncrasy. There are also *equations to the centre*, allowing for the difference between the place of a planet as supposed to move in a circle and its actual place in an ellipse; and *equations of equinoxes*, between mean and apparent equinoxes. *Equation of payments* is an arithmetical rule for ascertaining at what time it is equitable for a person to pay a whole debt which is due in different parts, payable at different times. Equations are constantly used in Chemistry (q.v.).

Equator. The Terrestrial Equator is the great circle on the earth's surface dividing the earth into the northern and southern hemispheres, and halfway between the poles.—The Celestial Equator is the great circle in the sky corresponding to the extension of the equator of the earth.

Equatorial, an important instrument for observing and following a celestial body in any part of its diurnal course. It consists, in the usual form, of two axes, one fixed square across the end of the other, thus ⊤. The cross axis (called the *declination axis*) revolves in bearings fixed to the upright one (called the *polar axis*), which again turns in bearings supported by a fixed pillar, resting on a solid foundation. Across one end of the cross axis is rigidly fixed a telescope, and on the other end slides a counterbalancing weight. Thus the telescope can be turned freely in any direction, and clamped by suitable mechanism. As erected for use, the upright axis is fixed to point directly to the pole of the heavens. It being then revolved, the other axis will trace with its ends the line of the celestial Equator (q.v.). By this motion the telescope sweeps the sky from east to west, and by rotating the cross axis it sweeps from north to south. The amount of rotation of each axis is measured by a graduated circle fixed to it, and thus the position of any heavenly body observed is known. Conversely, by setting the circles and observing the time, the telescope may be set so as to point to any star, even if it be one invisible to the naked eye. The hour circle, on the polar axis, measures the right ascension of the star, and the other, or declination circle, its declination. The equatorial can hardly be called an astronomical instrument. It is rather a convenient method of mounting large astronomical telescopes. For if the telescope be pointed to any star and clamped, while the *polar* axis is regularly revolved by clockwork, the star remains steadily in the field of view. See TELESCOPE.

Equerry, in the household of British sovereigns, is an official in the department of the Master of the Horse (q.v.), whose main duty is to accompany the sovereign when riding in state. The royal princes have also equerries.

Equestrianism. See RIDING AND DRIVING.

Equestrian Order, or EQUITES. This body originally formed the cavalry of the Roman army,

and is said to have been instituted by Romulus, who selected from the three principal Roman tribes 300 equites. This number was afterwards gradually increased to 3600, who were partly of patrician and partly of plebeian rank, and required to possess a certain amount of property. Each of these equites received a horse and 'barley-money' from the state; but about 400 B.C. a new body of equites began to make their appearance, who were obliged to furnish a horse at their own expense, although they received regular pay. These were probably wealthy *novi homines*, men of equestrian fortune, but not descended from the old equites. Until 123 B.C. the equites were exclusively a military body; but in that year a measure was carried transferring the judicial functions from the senate to the equestrian body, which now became a distinct order or class in the state, and was called *Ordo Equestris*. In 70 B.C. Sulla deprived them of these powers; but their influence did not then decrease, as the farming of the public revenues had fallen into their hands; and after Sulla's death they shared their former privilege with the senate. Under the emperors, when the requisite fortune of an eques seems to have been about £3230, the state still furnished horses for what was no longer the national cavalry; but as the honour, indiscriminately conferred, fell into contempt, foreign auxiliaries took the place of the old knights, and the body gradually became extinct.

Equidæ. See HORSE.

Equilibrium, the state of rest or balance of a body or system, solid or fluid, acted upon by various forces. See STATICS, and HYDROSTATICS.

Equinia. See GLANDERS.

Equinoctial is the same as the celestial Equator (q.v.). The equinoctial points are those in which the equinoctial and the Ecliptic (q.v.) intersect. Equinoctial time is time reckoned from the moment in each year when the sun passes the Vernal Equinox (see EQUINOXES). This instant is selected as a convenient starting-point of a uniform reckoning of time for the purposes of astronomical observers.

Equinoctial Gales. One of the most widespread beliefs in, at least, the British Islands is that there occurs an unusual frequency of gales and storms about the times of the spring and autumn equinoxes. This belief is, however, unsupported by the records of carefully conducted observations. Thus at Gordon Castle, in Strathspey, upwards of fifty years' observations show, on the contrary, fewer storms on the five days from the 21st to the 25th of March and September than on the five days preceding and the five days following these dates. Long-continued observations at other places are equally decisive against the popular belief.

Equinoxes. Sometimes the Equinoctial Points (see EQUINOCTIAL) are called the equinoxes. More commonly, by the equinoxes are meant the times when the sun enters those points —viz. 21st March and 22d September, the former being called the Vernal or Spring Equinox, and the latter the Autumnal. When in the equinoxes, the sun, through the earth's rotation on its axis, seems to describe the circle of the equator in the heavens, and the days and nights are of equal length all over the world. At the vernal equinox, the sun is passing from south to north, and in the northern hemisphere the days are lengthening; at the autumnal, he is passing from north to south, and the days are shortening. As the earth moves more rapidly when near the sun, or in winter, the sun's apparent motion is not uniform, and it happens that he takes eight days more to pass from the vernal to the autumnal equinox than from the latter to the former. The equinoctial points are not stationary. See ECLIPTIC, PRECESSION.

Equisetaceæ. See HORSE-TAILS.

Equity, EQUITABLE RIGHTS, &c. Equity (Lat. *æquitas*) signifies moral justice, of which laws are the imperfect expression; or the spirit of justice which enables us to apply and interpret laws rightly. Thus, the equity of a statute means the fair and wise construction of it, according to the intention of parliament, as distinguished from the literal and technical construction of the words used. It is impossible that any system of positive law should provide a rule suited to every case that arises; even good laws may work injustice, unless they are interpreted by men having discretion and authority to control their rigour and supply their deficiences. In the Old Testament and in the New, we constantly meet with the distinction between form and substance, between the letter which killeth and the spirit which maketh alive. The early Roman law was, like that of Moses, a system of forms and ceremonies; but the prætors, who had jurisdiction in commercial cases, soon found it necessary to go beyond the limits of custom and tradition. They assumed the *nobile officium* of deciding in accordance with equity; and their decisions formed the *jus honorarium* (magistrate's law, as distinguished from the customary law of the people). Courts of equity do not exercise an arbitrary discretion; they proceed on principles. The prætor, on entering upon his office, published an edict, setting forth the principles by which his judicial conduct would be guided; and as each prætor naturally adopted what was sound in the edicts of his predecessors, a system of equity was gradually developed. Ultimately, in the reign of Hadrian, the edicts of the prætors were consolidated in a single document called the Perpetual Edict (see EDICT).

In England, all the courts apply equitable principles in construing statutes and formal instruments; but the term equity has acquired a peculiar importance, by reason of the part which the Court of Chancery (q.v.) took in supplementing and controlling the rules of the common law. The common lawyers protested against the arbitrary nature (as it seemed to them) of equitable jurisdiction; they said that equity meant only the length of the chancellor's foot. But before the end of the 17th century this reproach was removed; the rules of equity were reduced to a system; and the Chancery jurisdiction was firmly established. The powers of the court were of three kinds: 1. Exclusive, as in the administration of trusts. When the legal ownership of property was conveyed to a trustee, he was the only person whom a court of law could recognise as owner; but a court of equity would protect the equitable estates of the persons beneficially entitled (see TRUST and USE). 2. Concurrent, in cases where law and equity both provided a remedy. Thus, in a case of breach of contract, the law would give damages to the party wronged; but equity could, in a proper case, go further, and compel specific performance of the contract. 3. Assistant, where equity only interfered to make legal process more effective. Courts of law, for example, formerly refused to allow a party to be called as a witness; a court of equity would order a party to make discovery to his opponent of such facts as the opponent had a right to know.

The principles of equity, as applied by the Court of Chancery, are summed up in certain maxims of wide significance: 'Equity follows the law'—i.e. equity will not set aside a rule of law (such as the rule of primogeniture), but will seek to apply

existing rules in a spirit of justice. 'Equity assumes that to be done which ought to be done:' when, for example, a man sells his land, equity treats the purchaser as owner, even before the formal conveyance has been executed. When a man deposits the title-deeds of his land with a banker, in consideration of a loan, this is a good Equitable Mortgage; the borrower is not allowed to plead the absence of a written agreement as an excuse for withdrawing from the transaction; equity will even compel him to execute a formal mortgage, if the lender requires it. 'Equity looks to the substance, and not to the form:' a legal mortgage of land, for example, is, in form, an absolute conveyance; but equity treats it as a security for money. The mortgagee is legal owner; but the mortgagor retains his Equity of Redemption—i.e. his right to have the estate again on paying principal and interest of the loan. 'He who seeks equity must do equity'—e.g. a mortgagor seeking to redeem must pay off all incumbrances held by the mortgagee who has the legal estate.

It is difficult to overestimate the advantages gained by the application of equitable principles to the law of property and contract. But these advantages were counterbalanced in England by the defects of Chancery procedure, and the inconvenience caused by the existence of two sets of courts, applying different rules to the same subjects. Chancery reform has now removed the scandals of the old system. Equitable powers were conferred on the courts of common law by Acts for the improvement of procedure. Finally, the Judicature Acts, which came into force in 1875, effected a fusion of law and equity, so that in every branch of the Supreme Court equitable claims may be made, and equitable defences pleaded. Law and equity are administered concurrently; where they conflict, the rules of equity prevail. Certain classes of business, relating to trusts, mortgages, property of infants, &c., are reserved to the Chancery Division of the High Court of Justice.

In America, and in the British colonies, the distinction between law and equity is or has been recognised as in England. In Scotland, the *nobile officium* of the Roman prætor is exercised by the Court of Session. For an outline of the English system, see Snell's *Principles of Equity*.

Equivalents, in Chemistry. See ATOMIC THEORY.

Era. See CHRONOLOGY.

Eradicated, in Heraldry, is said of a tree, or part of a tree, torn up by the roots.

Erard, SÉBASTIEN, French musical instrument-maker, chiefly famous for his improvements and inventions in connection with the pianoforte and harp, was born at Strasburg on 5th April 1752. Proceeding to Paris when sixteen, he shortly afterwards started business as a pianoforte-maker in that city, constructing his first pianoforte, one of the earliest made in France, in 1776 or 1777. The outbreak of the Revolution drove him to London; but in 1796 he returned to Paris. From 1808 to 1812 he was again in London. He died near Passy on 5th August 1831. He was the inventor of the harp with double pedals, and he also improved the sound-body of the instrument. The pianoforte with double escapement was likewise invented by Erard.

Erased.

Erased, in Heraldry, signifies violently plucked or torn off, and showing a ragged edge; as opposed to couped or cut, which shows a smooth edge. The term is chiefly applied to the heads and limbs of animals.

Erasi'stratus, one of the most famous physicians and anatomists of ancient times, was born in the island of Ceos about 300 B.C., settled in Alexandria, and died in Asia Minor. He founded a school of medicine, wrote several works on anatomy—in which branch he was most celebrated—on practical medicine, and pharmacy. He believed that the heart was the origin both of the veins and arteries. Of his numerous writings only some obscure fragments and titles have been preserved. See the article ANATOMY; and Hieronymus, *Erasistrati et Erasistrateorum Historia* (Jena, 1790).

Erasmus, DESIDERIUS, was born at Rotterdam, probably in the year 1467, the date given on the pedestal of his statue in his native town. A reference in his own works, however, as also his epitaph at Basel, assigns the date 1466. He was the son of one Gerhard, and Margaret, the daughter of a physician. As of illegitimate birth, he had no surname; and the name by which he is known, Desiderius Erasmus, is but the rendering in Latin and Greek of *Gerhard* ('the beloved'). Erasmus first attended school at Gouda, but while still a mere child he was sent to Utrecht, to fill a place in the choir of the cathedral of that city. He was next removed to a famous school of that time—that of the 'Brothers of the Common Life,' at Deventer, where, by his own account, he was exercised mainly in composing, repeating, and learning the silliest Latin verses. The study of Greek had as yet made but slight progress out of Italy; but Erasmus was fortunate in receiving some little instruction in that language from Alexander Hegius, the head of Deventer school, and a scholar of considerable reputation. An outbreak of the plague, of which his mother died, led to his quitting this school and retiring to Gouda, the residence of his father. Gerhard dying soon after, Erasmus and his only brother were left to the care of three trustees, who grossly neglected their charge. One of the three was bent on the brothers' entering a monastery, and with this in view, instead of sending them to a university, for which they were now ripe, placed them at another school of the Brothers of the Common Life at Bois-le-Duc. Again the plague drove Erasmus to Gouda, where his guardians tried every means to persuade him and his brother to become monks. As a compromise, Erasmus agreed to enter the Augustinian college of Sion, near Delft, on the condition that it should be left to him to leave the college if he saw fit. Here, accordingly, for the next six years he lived the life of a monk, though in his case the discipline was somewhat relaxed in the hope of his being induced eventually to adopt the monastic life. It was undoubtedly this personal experience of the ways of living and thinking of the monks that made Erasmus their relentless and lifelong enemy.

Deliverance at length came to him from the Bishop of Cambrai, who engaged him as his private secretary, and undertook to provide him with means to prosecute his studies. A few months later, and after having taken priest's orders, Erasmus went to Paris, supplied, though not overliberally, with funds by the bishop. The Collége Montaigu, where he pursued his studies, was notorious among all the colleges of Paris for the severity of its discipline, the scantiness and wretchedness of its fare, and the general squalor of its domestic arrangements. The new studies of the Renaissance had as yet made but little way in Paris; but Montaigu above every other college was still fast in the bonds of scholasticism. To Erasmus, therefore, whose constitution was delicate to fragility, and who from the very outset seems to have been awake to the intellectual revolution that had come upon Europe, all his surroundings in

Paris at this time were in the highest degree distasteful. To the end of his life he never forgot his experiences at Montaigu; and not the least important of his subsequent achievements was the service he did in helping to discredit the frivolous dialectic which he had there seen in its most absurd form.

With the exception of a visit to the Bishop of Cambrai on account of his health, Erasmus resided mainly in Paris till 1498, gaining a livelihood by instructing private pupils. Of these pupils, Lord Mountjoy deserves special mention, as he always remained one of Erasmus's best friends and most generous patrons. It was on the invitation of Mountjoy that Erasmus, probably in 1498, paid his first visit to England. This visit is one of the most important epochs in the life of Erasmus. Oxford was the chief place of his residence, and there he not only had in Linacre a better teacher of Greek than he could have found in Paris, but in his intercourse with Colet, a man of nobler stamp than himself, he received an impetus, which if it did not actually give a new bent to his studies, at least lifted his life to a higher plane of endeavour. Through the influence of Colet, his contempt for the schoolmen was intensified, and his thoughts set on the consecration of his studies to a more rational conception of religious truth. During this visit, also, began his famous friendship with Sir Thomas More, through whom on the present occasion he was introduced to Prince Henry (afterwards Henry VIII.), then only a boy of nine.

In 1500 Erasmus was again in France, and for the next six years he made his abode mainly in Paris, with occasional visits of longer or shorter duration to Orleans, and in the Low Countries. To these years belong his *Adagia* (afterwards published in greatly enlarged form in 1515), a collection of Greek and Latin proverbs, with running commentaries, and his *Enchiridion Militis Christiani* (The Christian Soldier's Dagger). A second short visit to England in 1506 cemented still more closely his friendship with More, and gained him a valuable friend in Warham, Archbishop of Canterbury and Lord Chancellor of England. During the same year he carried out a journey to Italy, which for long had been his passionate desire. At Turin he received the degree of Doctor of Divinity; at Bologna he witnessed the military triumph of the bellicose Pope Julius II.—a spectacle which Erasmus always spoke of as a disgrace to Christian Europe; and at Venice he made the acquaintance of the famous printer Aldus Manutius. During his sojourn in Italy he acted for some time as tutor to Alexander, Archbishop of St Andrews, natural son of James IV. of Scotland, who afterwards fell with his father at Flodden. His visit closed with a short stay in Rome, where he was received in a manner that proves the great reputation he had already won in letters. Altogether, as was to be expected from the different temper and aims of the two men, Erasmus carried away from Italy a far more friendly impression than Luther after his memorable visit about the same date. The accession of Henry VIII., of whom great things were expected as a patron of learning, and the special invitation of Lord Mountjoy, induced Erasmus once more to make his home in England. On his journey from Italy to that country he conceived the plan of his *Encomium Moriæ* (Praise of Folly), which on his arrival he threw upon paper in the course of a week. In this satire, written in the full maturity of his powers, we have Erasmus in his happiest and most distinctive vein, as the man of letters and the general critic of men and things. While its general tone is that of playful banter, it is yet inspired by the most serious purpose, as specially appears in its biting sarcasm at the expense of kings and churchmen. Seven editions of this work were issued within a few months.

During this his third and longest visit to England, Erasmus resided chiefly in Cambridge, where he acted as Margaret professor of Divinity, and professor of Greek. After 1514 Erasmus's changes of abode for the next few years are so frequent that it becomes puzzling to follow him. In 1514 he was in Basel, back in England the same year, again in Basel in 1515, and once more in England —the last of his visits to that country. From 1517 to 1521 he lived at Louvain, taking a keen interest in the progress of the new studies at the famous university of that place. Meanwhile, his literary labours were unceasing. In 1519 appeared the first edition (afterwards greatly enlarged) of his *Colloquia*, the most famous of all his works, and usually regarded as his masterpiece. It consists of a series of familiar dialogues on the everyday topics of the time—social, religious, and political; and the audacity and incisiveness with which it handles the abuses of the church in large measure prepared men's minds for the work of Luther. In 1516 his edition of the New Testament, virtually the first of the Greek text, was published at Basel; and in 1519 his edition of St Jerome in nine folio volumes. In both of these works the dominant aim of Erasmus was to introduce a more rational conception of Christian doctrine, and to emancipate men's minds from the frivolous and pedantic methods of the scholastic theologians. By such labours, as by his *Adagia* and *Encomium Moriæ*, Erasmus had shown the need for a general reform in the church. When the Lutheran revolution came, therefore, Erasmus found himself in the most embarrassing position. The upholders of the old order fell upon him as the author of all the new troubles, and the followers of Luther, on the other hand, bitterly assailed him for what they deemed his cowardice and inconsistency in refusing to follow up his opinions to their legitimate conclusions.

From the date of Luther's final breach with Rome, the life of Erasmus was one long controversy, which seriously marred the honour and happiness of his declining years. In 1521 he left Louvain, where the champions of the old faith had made his stay unendurable, and took up his abode at Basel. In this city, with the exception of a sojourn in Friburg from 1529 to 1535, Erasmus spent the rest of his life. To Basel he had always been attracted as the home of the great printer Froben, as well as by the excellence of its climate, and he now found it the quietest spot in the general din of religious strife. To the very last his labours were incessant and almost incredible. In addition to the toil of editing a long succession of classical and patristic writers, he was engaged in controversies which would have incapacitated most men for peaceful study. The most important of these controversies were those with Ulrich von Hutten, with Luther, and with the Sorbonne. In accordance with his fiery character, Hutten judged Erasmus with the greatest severity for not taking his place by the side of Luther. With the great Reformer himself, Erasmus, after long hesitation, crossed swords in his *De Libero Arbitrio* (1523), in which he assailed one of the fundamental positions of the Lutheran theology—that all human action is determined by divine necessity. Attacked by men like Hutten on the one side, he was as fiercely assailed on the other by the Sorbonne, the great surviving stronghold of obscurantism alike in theology and secular studies. By his *Ciceronianus*, a satire on the pedantic imitation of Cicero, Erasmus raised against himself a new set of adversaries—those humanists, namely, who set style above matter. Yet in spite of all these contro-

versies, Erasmus during his last years enjoyed fame and consideration beyond that of any man of letters before or since. Letters and presents came to him from all the crowned heads of Europe; and churchmen in the highest position deemed it an honour to be among his correspondents.

Erasmus's health had never been robust even in youth, and from a comparatively early age he had been afflicted with the stone. As he advanced in life, his sufferings grew upon him, and it was only by the most careful ordering of diet, and by his overpowering instinct for study, that he accomplished the work he did. From 1534, a disease resembling gout in its symptoms subjected him at times to excruciating pain. On 12th July 1536, after nearly a month's attack of dysentery, he died, retaining to the last his gay and genial humour.

Erasmus stands as the supreme type of cultivated common sense applied to human affairs. In his latter years he fell upon a time when other qualities were needed in the best interests of humanity; but such as he was, few men have done more to advance truth, and to prepare men's minds for its acceptance. No man of letters has ever attained to anything approaching the influence wielded by Erasmus during his own century. Yet Erasmus was no creative genius, and he produced no single work which has a place in the first rank of the world's masterpieces. He owed his position to the wonderful range of his activity, to his astonishing productiveness, to the breadth and sanity of his views, and to the delightful qualities of wit, humour, and unfailing vivacity which distinguish all his work. He has himself indicated his services to Europe with exactness and precision. He rescued theology from the pedantries of the schoolmen, and referred it to its original sources; he did more than any other single person to advance the cause of the new studies of the Revival of Learning; he exposed the abuses of the church, and he protested in the interests of the people against the thoughtless tyranny of their rulers. His attitude towards the Lutheran revolution has exposed him to the obloquy of Protestants and Catholics alike. By both he has been accused of cowardice and insincerity, because he insisted in maintaining his neutral position. But this is merely to say that Erasmus had the defects of his qualities. Constitutionally, he was averse to all extremes, as he distinctly showed in his antagonism to the excesses of humanism in its neo-pagan developments, not less than to what he considered the excesses of the German Reformation. If he had not the energy to head a revolution, he had at least in eminent degree the courage of the scholar, as the long catalogue of his works, produced in chronic weakness of health, amply proves. As to his personal qualities, it should be sufficient to say that he enjoyed the friendship and esteem of men of so different, yet each in his own way of so high a type, as Bishop Fisher, Colet, and More. His personal appearance corresponded to his mental and moral qualities. He was slightly under the middle height, but of graceful figure; his features were delicate and mobile; and he spoke in tones low but beautifully clear and distinct.

An edition of his works was published at Basel in 9 vols. in 1540; the standard edition is that of Le Clerc (Lyons, 10 vols. 1703–6). See Lives of Erasmus by Knight (1726), Jortin (1748), Burigny (1752), Durand de Laur (1874), Drummond (1873), and Feugère (Paris, 1874). For studies of Erasmus, see Nisard, *Études sur la Renaissance* (1855); Milman, *Essays* (1870); Seebohm, *Oxford Reformers* (2d ed. 1869).

Erastus, THOMAS (properly *Liebler* or *Lieber*), was born in 1524 at Baden in Switzerland, according to other accounts at Auggen, near Mühlheim in south-west Germany. He studied theology at Basel (where he Grecised his name), and philosophy and medicine at Bologna and Padua. After nine years in Italy, he was appointed physician to the counts of Henneberg; then (from 1558) professor of medicine at Heidelberg, and court-physician to the Elector Palatine. He removed from Heidelberg to fill the chair of Medicine at Basel in 1580, and died there, January 1, 1583. Shortly before his death he had been appointed professor of Ethics. Erastus was a skilful physician and a man of upright character, an equally vigorous writer against 'the new medicine of Philip Paracelsus' (1572) and in favour of the burning of witches (1577 *et seq.*). In theology he was a follower of Zwingli, and represented his view of the Lord's Supper at the conferences at Heidelberg in 1560 and Maulbronn in 1564. The fame of Erastus now rests on his strenuous opposition to Calvinist discipline and Presbyterian order. For ten years (from 1560) he resisted successfully the Calvinist party under Caspar Olevian at Heidelberg; but in 1570 Presbyterianism was introduced by the Elector Frederick III. Erastus was excommunicated on a false suspicion of heresy, founded on a correspondence with Unitarians of Transylvania, but was restored in 1575. He had carried on a private exchange of views on the subject of church discipline with his friend Beza, and after his death his widow's second husband, Castelvetro, published at London (1589), with the concurrence of Archbishop Whitgift and with a fictitious imprint, a treatise on excommunication entitled *Explicatio gravissimæ quæstionis utrum Excommunicatio . . . mandato nitatur divino, an excogitata sit ab hominibus.* This was answered by Beza in his *De verâ Excommunicatione et Christiano Presbyterio* (1590). A translation of Erastus's treatise was published with a preface by Dr Robert Lee (Edin. 1844). Erastus maintained that no member of the church should be excluded from her communion as a punishment for sin. Punishment is 'the special duty and office' of the civil magistrate. He was familiar with the system of Zurich, where the Christian magistrate administered ecclesiastical discipline in the name of the Christian community, and he dreaded that Presbyterianism, unchecked, might exercise a tyranny over men's consciences as absolute as that of the Spanish Inquisition.

In England, the name of Erastians was applied to the party that arose in the 17th century, denying the right of autonomy to the church—a right neither maintained nor denied by Erastus. The Erastian controversy broke out at the time of the Westminster Assembly. The leading Erastians in that assembly were Lightfoot and Coleman, who were supported by Selden and Whitelocke in the House of Commons. Since the time of the Reformation the controversy has been confined chiefly to the church in Scotland.

See on the one side, Gillespie, *Aaron's Rod Blossoming* (1646), Sam. Rutherford, *Divine Right of Church Government* (1646), and Cunningham's *Historical Theology*, vol. ii. chap. xxvii. (1863); and on the other, Selden, *De Synedriis* (1650–53), and Du Moulin, *Of the Right of Churches* (1658).

Erasure, or RAZURE, as it is more commonly called in England, from the Latin *rado*, 'I scrape or shave,' is the scraping or shaving of a deed or other formal writing. In England, except in the case of a will, the presumption, in the absence of rebutting evidence, is that the erasure was made at or before execution. If an alteration or erasure has been made in any instrument subsequent to its execution, that fact ought to be mentioned (in the abstract, or epitome of the evidences of ownership), together with the circumstances under which

it is done. A fraudulent alteration, if made by the person himself taking under it, would vitiate his interest altogether. It was formerly considered that an alteration, erasure, or Interlineation (q.v.) would void the whole instrument, even in those cases where it was made by a stranger; but the law is now otherwise, as it is clearly settled that no alteration made by a stranger will prevent the contents of an instrument from retaining its original effect and operation, where it can be plainly shown what that effect and operation actually was. To accomplish this, the mutilated instrument may be given in evidence as far as its contents appear; and evidence will be admitted to show what portions have been altered or erased, and also the words contained in such altered or erased parts; but if, for want of such evidence, or any deficiency or uncertainty arising out of it, the original contents of the instrument cannot be ascertained, then the old rule would become applicable, or, more correctly speaking, the mutilated instrument would become void for uncertainty. If a will contains any alterations or erasures, the attention of the witnesses ought to be directed to the particular parts in which such alterations occur, and they ought to place their initials in the margin opposite, before the will is executed, and to notice this having been done by a memorandum, added to the attestation clause at the end of the will. For the English law on this subject, see Taylor, *Law of Evidence* (8th ed. 1885).

In Scotland, the rule as to erasure is somewhat stricter than in England—the legal inference being that such alterations were made after execution. As to necessary or *bonâ fide* alterations which may be desired by the parties, corrections of clerical errors, and the like, after the deed is written out, but before signature, the rule in Scotland is that 'the deed must show that they have been advisedly adopted by the party; and this will be effected by mentioning them in the body of the writing. Thus, if some words are erased and others superinduced, you mention that the superinduced words were written on an erasure; if words are simply delete, that fact is noticed; if words are added, it ought to be on the margin, and such additions signed by the party, with his Christian name on one side, and his surname on the other; and such marginal addition must be noticed in the body of the writ, so as to specify the page on which it occurs, the writer of it, and that it is subscribed by the attesting witnesses.' See Menzies's *Lectures on Conveyancing*. The Roman rule was that the alterations should be made by the party himself, and a formal clause was introduced into their deeds to this effect, 'Lituras, inductiones, superinductiones, ipse feci.' As a general rule, alterations with the pen are in all cases to be preferred to erasure; and suspicion will be most effectually removed by not obliterating the words altered so completely as to conceal the nature of the correction. 'The worst kind of deletion,' says Lord Stair, 'is when the words deleted cannot be read (but if they are scored that they can be read, it will appear whether they be *de substantialibus*), for if they cannot be read, they will be esteemed to be such, unless the contrary appear by what precedes and follows, or that there be a marginal note, bearing the deletion, from such a word to such a word, to be of consent.' The law of the United States follows that of England in this matter.

Eratosthenes OF CYRENE, born 276 B.C., was an eminent mathematician, astronomer, and geographer. Among his teachers were Lysanias the grammarian and Callimachus the poet. By Ptolemy Euergetes he was called to Alexandria to superintend his great library. Here he died of voluntary starvation, at the age of eighty, having become blind, and wearied of life. Eratosthenes measured the obliquity of the ecliptic with an accuracy wonderful for his time, drew up a catalogue of the fixed stars, amounting to 675, which is now lost, and made an attempt to measure the magnitude of the earth in the method used at the present day. He found the circumference of the earth to be 252,000 stadia, which, according to Pliny, is 31,500 Roman miles. His most important work was a systematic treatise on geography, which was used by Strabo. He wrote also on moral philosophy, history, and grammar. Such fragments of his writings as are still extant have been collected by Bernhardy in his *Eratosthenica* (Berlin, 1822). See also Berger, *Die geographischen Fragmente des Eratosthenes* (Leip. 1880).

Erbium (sym. Er, eq. 170·5) is a rare metal, the compounds of which are present in the mineral *gadolinite*, found at Ytterby in Sweden. It is also believed to be present in the sun's vapour. It is found along with compounds of yttrium and, it is alleged, of terbium, also rare metals, the existence of one of which, terbium, is still questioned. It is chiefly of interest because the compounds of the three metals mentioned resemble each other so closely, and have such similar properties, that the processes of separation and purification are difficult and tedious in the extreme, a single research with the object of obtaining absolutely pure salts requiring years of patient work.

Ercildoune. See EARLSTON.

Ercilla y Zuñiga, ALONSO, a Spanish poet, was born at Madrid, August 7, 1553. He became page to the Infante Don Philip, son of Charles V., and accompanied him on his early travels, and in 1554 to England, on the occasion of Philip's marriage to Queen Mary. Shortly after he joined the expedition against the Araucanians on the coast of Chili. The arduous difficulties that had to be overcome, and the heroism of the natives, suggested to Ercilla the idea of making it the subject of an epic poem. He began his poem on the spot, about the year 1558, occasionally committing his verses, in the absence of paper, to pieces of leather. An unfounded suspicion of his having plotted an insurrection involved him in a painful trial, and he had actually ascended the scaffold before his innocence was proved. Deeply wounded, the brave poet-soldier turned to Spain, but Philip treating him with great coldness and neglect, he made a tour through France, Italy, Germany, Bohemia, and Hungary. For some time he held the office of chamberlain to the Emperor Rudolf II., but in 1580 returned to Madrid, where he struggled with poverty till his death, about 1595. Cervantes in *Don Quixote* compares the *Araucana* with the best Italian epics, and it has undoubtedly not a little of the epic style and spirit. The first part is the freshest in character, and was published in 1569; the second part followed in 1578, the third in 1597. The most elegant reprint is that published at Madrid in 1776; the most accurate, that issued there in 1828. There is a French translation by Nicolas (1870). See Royer's *Étude* (Dijon, 1880).

Erckmann-Chatrian, the compound name of two French romancists, Lorrainers both, whose stories of Alsatian peasant life are known the whole world over. Émile Erckmann, born 20th May 1822, at Phalsbourg, studied law in Paris from 1842 to 1858; whilst Alexandre Chatrian, born 2d December 1826, in the village of Soldatenthal, from glass-blowing took to teaching in Phalsbourg, and afterwards got a railway clerkship. Their literary partnership dates from 1848; but for ten or eleven

years they had little success beyond getting some of their stories printed in various newspapers and journals. It was not till 1859 that *L'Illustre Docteur Mathéus* (1859) gave a certain éclat to the collective name of Erckmann-Chatrian. *Le Fou Yégof* (1862) is one of a series of novels which give graphic pictures of the invasion of 1813–14, to which series also belong *Histoire d'un Conscrit de 1813* (1864) and *Waterloo* (1865). *Le Joueur de Clarinette* (1863), a simple story of a village musician; *Les Amoureux de Catherine*, another tale of village life in the same volume; *L'Ami Fritz* (1864); *Madame Thérèse, ou les Volontaires de '92* (1863); *Le Blocus* (1867; Eng. trans. *Blockade of Phalsbourg*, 1870); *Histoire d'un Paysan* (1868); and *Contes Populaires*, most of which have been translated into English, count amongst the best they have written. Three plays by them have also achieved success—*Le Juif Polonais* (1869; well known in English as *The Bells*), the dramatic version of *L'Ami Fritz* (1876), and *Les Rantzau* (1882). After the annexation of Alsace-Lorraine to Germany, a strong anti-German feeling was manifested in several of their books—the best of these *L'Histoire d'un Plébiscite* (1872). According to Edmund About (*Athenæum*, October 28, 1876), 'the two friends see one another very rarely, whether at Paris or in the Vosges. When they do meet, they elaborate together the scheme of a work. Then Erckmann writes it, Chatrian corrects it, and sometimes puts it in the fire.' Chatrian died in 1890.

Erdmann, JOHANN EDUARD, German philosopher, was born in 1805 at Wolmar in Livonia (Russia), studied at Dorpat and Berlin, coming, at this last university, under the influence of Hegel, and became professor of Philosophy at Halle (extraordinary 1836) in 1839. His principal work is a *Grundriss der Geschichte der Philosophie* (3d ed. 1877), besides which he also wrote a work on Logic and Metaphysics, two books on Psychology, two collections of essays (one entitled *Ernste Spiele*), and works on *Nature and Creation*, *Body and Soul*, *Belief and Science*, and *The State*. Died in 1892.

Erebus, the name of one of the sons of Chaos, signifies darkness, and is used specially to denote the dark and gloomy cavern beneath the earth, through which the shades pass in going to Hades.

Erebus, MOUNT, an active volcano on Victoria Land, in 78° 10′ S. lat., rising 12,367 feet above the sea. It was discovered in 1841 by Ross, who named it after one of his vessels, and whose further progress south was barred by a wall of ice. See ANTARCTIC OCEAN.

Erechtheus, or ERICHTHONIUS, an Attic hero, is said to have been the son of Hephæstus and Atthis, daughter of Cranaus, the son-in-law and successor of Cecrops. He was brought up by Athena, who placed him in a chest, which was intrusted to Agraulos, Pandrosos, and Herse, the daughters of Cecrops, with the strict charge that it was not to be opened. Unable to restrain their curiosity, they opened the chest, and discovering a child entwined with serpents, were seized with madness, and threw themselves down the most precipitous part of the Acropolis. Afterwards Erechtheus was the chief means of establishing the worship of Athena in Attica. He instituted the Panathenæa, and a temple, the Erechtheum, was erected in his own honour. This original Erechtheum was burned by the Persians, but a new and magnificent Ionic temple was raised on the same site (see ATHENS). Mr Swinburne in 1876 published his tragedy of *Erechtheus*.

Eretria, an ancient Ionic trading and colonising town on the SW. coast of Eubœa, which was destroyed by the Persians in 490 B.C., and, although rebuilt by the Athenians, never afterwards regained its former prosperity and importance. The modern town of Nea Eretria is a small, unwholesome place, surrounded by swamps.

Erfurt, a city of Prussian Saxony, anciently capital of Thuringia, stands in a highly cultivated plain, on the Gera, 13 miles W. of Weimar by rail. Till 1873 it was strongly fortified. Its two citadels, the Petersberg and the Cyriaksburg, were formerly monasteries. Erfurt has several churches, chiefly Gothic, the cathedral and the church of St Severus being the finest. The cathedral, one of the most venerable Gothic buildings in Germany, possesses, besides a very rich portal, sculptures and bronze castings dating from the 13th to the 16th century, especially a Coronation of the Virgin, by Peter Vischer (1521). In the northern tower is the bell called *Maria Gloriosa*, cast in 1497, and weighing 13½ tons. The Regler Church contains an altarpiece by Wohlgemuth. The monastery of St Augustine, famous as the residence of Luther, whose cell was destroyed by fire in 1872, was converted in the year 1819 into an asylum for deserted children. From 1378 to 1816 Erfurt was the seat of a university, of which the academy of sciences and the library (60,000 volumes and 1000 MSS.) alone remain. The growing of flowers and vegetables, and an extensive trade in flower-seeds, are carried on. The principal manufactures are woollen, silk, cotton, and linen goods, lamps, machines, shoes, beer, malt, &c. Pop. (1871) 43,616; (1880) 53,254; (1890) 72,360.

Erfurt, originally called Erpesford or Erpesfurt, was made a bishopric in 741, and in 805 the capital of the Sorbs by Charlemagne. In the 15th century its woollen and linen manufactures raised it to the position of one of the foremost cities of Germany. All through, the town has had a stormy history, being either the bone of contention between the electors of Mainz and of Saxony, or the object of attack by foreign invaders. Since 1803 (except the period from 1806 to 1814) it has belonged to Prussia. At the Congress of Erfurt (September–October 1808) Napoleon met the Emperor of Russia and several of the minor sovereign princes of Germany.

Ergasteria, a mining-town in the Greek nomarchy of Attica and Bœotia, near Cape Colonna, with ancient lead and silver works, reopened in 1864. Pop. 6500.

Ergot, a diseased condition of the ovary of grasses and sedges, due to the presence of species of Claviceps, a Pyrenomycete fungus (see FUNGI), of which the filamentous mycelium of the mould ramifies through the tissue of the flower, causing the outpouring of sugary sap, and bearing a multitude of spores, the ovary meantime becoming deformed and enlarged. In this state the mould was formerly described as a distinct species. This now withers on the surface, but the deeper mycelium within the ovary becomes denser and harder, forming the so-called sclerotium, and lies dormant until the grain is sown in early spring, when it bears globular heads which contain depressions or perithecia, containing

Ergot of Rye.

the ascospores, which again recommence the cycle. The medicinal 'ergot of rye' is that formed by *Claviceps purpurea*. Producing rapid contraction of the uterus, it is often employed in midwifery; but its use in unskilled or unscrupulous hands is attended by the most serious risks. It has also been used in dysentery, epilepsy, whooping-cough, and as a styptic. The continued eating of bread made of ergotised rye produces a specific disease called *Ergotism*. This is a terrible form of poisoning, in which not only convulsions appear, but often also gangrene of the extremities, resulting in mutilation or death, even recovery from less serious doses being slow and difficult. Many dreadful epidemics in rye-consuming countries (as in Lorraine and Burgundy in 1816), the causes of which were not understood, are now supposed to have been due to ergotism. See also RAPHANIA.

Eric, the name of several Danish and Swedish kings.—ERIC VII., king of Denmark, born in 1382, the son of Duke Wratislaw of Pomerania, was selected as her successor by Queen Margaret of Denmark, and in 1412 mounted the throne of Denmark, Norway, and Sweden, united according to the treaty of Calmar. Cruel and cowardly in his character, he lost Sweden in 1437 through a revolt of the peasants of Dalecarlia, and in 1439 was deposed also in Denmark. He died in Rügenwald in 1459.—ERIC VIII., the Saint, became king of Sweden in 1155, did much to extend Christianity in his dominions, and to improve the laws, and fell in battle with the Danes in 1160.—ERIC XIV., the last of the name who reigned in Sweden, succeeded in 1560 to the throne of his father, the great Gustavus Vasa, and at once began to exhibit the folly that disgraced his reign. His flighty matrimonial schemes reached even Elizabeth of England and Mary of Scotland, until at length (1567) his roving fancy found rest in the love of a Swedish peasant-girl, who acquired an influence over him which was ascribed by the superstitious to witchcraft, since she alone was able to control him in the violent paroxysms of blind fury to which he was subject. His capricious cruelties and the disastrous wars that followed on his follies at length alienated the minds of his subjects, who threw off their allegiance in 1568, and solemnly elected his brother John to the throne. Nine years later the unhappy Eric ended his miserable life half voluntarily by a cup of poison. This crazy madman had a genuine love of letters, and solaced his captivity with music and the composition of psalms. His story has been worked into dramatic form by Swedish poets; in German by Kruse in his tragedy, *König Erich* (1871).

Erica'ceæ, or HEATHS, a large, widely distributed order of corollifloral dicotyledons, chiefly small shrubs, frequently evergreen and social in growth, covering large areas, especially in mountainous regions and on tablelands. See HEATH, RHODODENDRON, AZALEA, ANDROMEDA, ARBUTUS, CRANBERRY, KALMIA, &c.

Ericht, LOCH, a lonely lake between Perth and Inverness shires, 1 mile from Dalwhinnie station, and 60 miles NW. of Perth. Lying 1153 feet above sea-level, it stretches 14¾ miles south-south-westward, varies in width between ¼ and 1⅛ mile, is overhung by Ben Alder (3757 feet), abounds in salmo-ferox and trout, and sends off a stream 6 miles to Loch Rannoch.

Ericsson, JOHN, a distinguished engineer, was born at Langbanshyttan, in the Swedish province of Vermland, in 1803. After serving for some time as an officer of engineers in the Swedish army, he removed in 1826 to England, and continued to occupy himself with improvements chiefly on steam machinery and its applications. In 1829, for the Liverpool and Manchester railway race, he built within six weeks (so it is said) the *Novelty*, a steam-engine which, had not the fan broken down at the last moment, might have proved a formidable competitor to Stephenson's *Rocket*. In 1836 he took out a patent for the Screw-propeller (q.v.). In 1839 he went to the United States, where he furnished designs for the warship *Princeton*, the first steamer that had her engines and boilers entirely below the water-line, and brought out his improved caloric engine (see AIR-ENGINE) and numerous other inventions. In 1861, during the civil war, he designed and finished in one hundred days the ironclad *Monitor* (see NAVY, Vol. VII., page 418), and in 1862 built a number of similar vessels for the navy. The *Destroyer*, a vessel with under-water guns, from which projectiles inclosing 300 lb. of gun-cotton were to be fired into an enemy below her armour-plating, was tried in 1881, but failed to satisfy the requirements of the navy board. In 1883 he erected a 'sun motor' in New York: his earlier experiments for developing power from the direct rays of the sun are described in his magnificent volume, *Contributions to the Centennial Exhibition* (1876). He died in New York, 8th March 1889. By his own wish he was buried in the place of his birth, a Swedish man-of-war being sent to convey his body to Langbanshyttan. It was decided to erect his statue in Stockholm, and a bronze statue by Hartley was erected in Battery Park by the municipality of New York. His inventions cover nearly the whole field of mechanical engineering, and have revolutionised both the navigation and the navies of the world. His great services to science have been recognised by several governments, as well as by many learned societies. See his Life by W. C. Church (1890).

Erid'anus. See PO.

Erie, one of the five great lakes which empty themselves by the St Lawrence, separates the province of Ontario, in Canada, on its left, from Michigan, Ohio, Pennsylvania, and New York on its right. It is the most southern of the five, receiving at its western extremity the waters of Lakes Superior, Michigan, and Huron by the river Detroit, and discharging them at its north-east by the Niagara into Lake Ontario. With a length of 240 miles, Erie has a breadth varying from 30 to nearly 60 miles, with an area of 9960 sq. m. It is 8¾ feet below the Huron, and 326 and 573 respectively above the Ontario and the Atlantic. The shores are for the most part low and of a clayey nature. At its south-western extremity are several wooded and partly cultivated islands, the largest of which is about 14 miles in circumference. It is by far the shallowest of the five great lakes. Its mean depth is 70 feet, its maximum 210 feet; and from this comparative shallowness and the consequent liability to a heavy ground-swell, as well as on account of the small number of good harbours, the navigation is peculiarly difficult and dangerous. The chief harbours on the United States shore, besides the natural harbour of Erie itself or Presque Isle, are those of Buffalo, Dunkirk, Cleveland, Sandusky, and Toledo; and on the north or Canadian shore, Ports Dover, Burwell, Colborne, and Stanley. Lake Erie receives no rivers of any consequence, except the Detroit and Maumee. Its commercial importance, however, has been largely increased by art. It is connected by one canal with the Hudson, and by more than one with the Ohio (see CANAL); while, on the British side, it communicates with the Ontario by means of an important work, the ship-channel of the Welland Canal. Its navigation generally closes in the beginning of December, and the lake remains more or less frozen till March or April.

The commercial importance of this lake has been greatly enhanced within recent years by the establishment of numerous lines of railway connecting its ports with the interior. The amount of traffic on the lake and on these railways is enormous. Lake Erie was the scene of a naval engagement between the British and Americans, September 10, 1813, in which the latter were victorious.

Erie, the capital of Erie county, Pennsylvania, on Lake Erie, 88 miles SW. of Buffalo, and 95 NE. of Cleveland, is a port of entry, an important centre of trade, and connected by rail with New York, Philadelphia, Pittsburg, and other cities. Its harbour, one of the largest and best on the lake, is formed by an island of 4 miles in length, which, under the appellation of Presque Isle (Fr., 'peninsula'), still preserves the memory of its having been once connected with the mainland. The belt of water thus sheltered is known as Presque Isle Bay, and forms a natural harbour for the city; it is now protected by a breakwater, is 3 to 4 miles long and 1 mile wide, and varies in depth from 9 to 25 feet. The Erie Extension Canal, connecting the city with the Ohio River, was abandoned in 1871; it had never paid half the interest of its cost, and was operated for some thirty-eight years at a loss. The town's important industrial works include oil-refineries, tanneries, iron-foundries, paper, flouring, and planing mills, factories for railroad cars, engines and boilers, &c. It is a Roman Catholic bishop's see. A natural-gas well was opened here in 1889. Pop. (1870) 19,646; (1880) 27,737; (1890) 40,634.

Erigena, Johannes Scotus, a famous philosopher of the 9th century, according to one account was born at 'Ergene,' in Herefordshire, to another at Ayr, but was more probably a Scot of Ireland, and born there between 800 and 815. His residence at the court of Charles the Bald, in France, where he was from 843 the head of the 'court school' (*schola palatina*), is the only part of his history that is certainly known. He came (851) to the help of Hincmar in the Predestination controversy with the doctrine, hitherto unknown in the West, that evil is simply that which has no existence, and that therefore damnation is not a positive punishment by God, but only consists in the consciousness of having failed to fulfil the divine purpose. The Council of Valence condemned this *pultes Scotorum* ('Scots porridge') as 'an invention of the devil.' The tradition is that, after the death of Charles the Bald (877), Erigena was forced to leave France under the suspicion of heresy, was called to England by Alfred the Great, and died about 880, as abbot of Malmesbury, a violent death at the hands of his scholars. But this tradition seems unsupported, and good authorities have convinced themselves that he never left France, but died there about 877. Erigena translated only too literally, into Latin (860), the writings of the pseudo-Dionysius the Areopagite, and afterwards the Greek scholia of Maximus to the writings of Gregory Nazianzen. His chief work, *De Divisione Naturæ*, lib. v. (854), was condemned by a provincial council at Sens, and by Pope Honorius III. (1225), who described the book as 'swarming with worms of heretical perversity.' It was published by Gale (Oxford, 1681), and by Schlüter (Münster, 1838), and was placed on the *Index librorum prohibitorum* by Gregory XIII. in 1685. (There is a German translation by Noack, 1872–76.) In this work Erigena develops a speculative system on the basis of the gnosis of Origen, the theosophy of the Areopagite, and the dialectic of Maximus Confessor. His aim was to reconcile the fundamental truths of Christianity with human reason, but his system is simply Pantheism, in which God and the world are merged in the higher unity of 'Nature.' Nature—to Erigena the sum of all being and not-being (the necessary complement of being)—has a fourfold form of existence: (1) *Natura creans non creata*—i.e. God, as the uncreated Creator of all things; (2) *Natura creata creans*—i.e. the Word from God, by whom all things are made (the Son); (3) *Natura creata non creans*—i.e. the world, creation, or nature in the narrower sense; (4) *Natura non creans et non creata*—i.e. God, as the final goal of all creation, to whom everything created returns in a universal Apocatastasis (q.v.). Recent writers have shown that Erigena is to be regarded not as an independent thinker, but as a skilful reproducer of Greek speculations.

The complete edition of the works of Erigena, edited by H. T. Floss, forms vol. cxxii. (Paris, 1853) of the *Patrologia* of Migne. His Life has been written by Staudenmaier (1834) and Hermens (1868). See the monographs by St Rémé Taillandier (1843), Christlieb (1860), Huber (1861), Hoffmann (1876), and Buchwald (1884); and the sketch in F. D. Maurice's *Mediæval Philosophy* (1856).

Eri'geron, a genus of composite weeds, allied to Aster. The British *E. acre*, sometimes called Fleabane, has been used as a source of potash, and was formerly in medicinal repute. *E. canadense* has become a common weed in Europe.

Erin. See Ireland.

Erinna, a Greek poetess, the intimate friend of Sappho, born at Rhodes, or on the little island of Telos, to the west of Rhodes. The hypothesis of a second poetess of the same name, in the 4th century B.C., which is based on a statement of Eusebius, is generally rejected. Though she died at the early age of nineteen, Erinna acquired such celebrity by her epics, that her verses were compared with those of Homer. Of her principal poem only four lines are extant; and, of the three epigrams preserved in Schneidewin's *Delectus Poesis Græcæ Elegiacæ* (Göttingen, 1839), two at least are not genuine.

Erinyes. See Eumenides.

Eriobo'trya. See Loquat.

Eriocaula'ceæ, a small order of monocotyledons, allied to Restiaceæ, of grassy or rushy aspect, of marsh or aquatic habit, and unimportant properties. The 300 species are chiefly tropical; the North American *Eriocaulon septangulare* (Pipewort), however, occurs in muddy lake bottoms in West Ireland and the Hebrides.

Eriodendron, a genus of Sterculiaceæ, allied to Bombax, East and West Indian trees with woolly seed; hence often called Wool-trees. The wool is sometimes used for stuffing pillows, &c., and the seeds yield oil, or are sometimes eaten.

Eris, in Greek mythology, the sister of Ares, and personification of strife.

Erith, a town of Kent, on the right bank of the Thames, 15½ miles by rail E. of Charing Cross. A summer-resort for Londoners, a steamboat-station, and the headquarters of several yacht clubs, it has a number of fine villas, and a much-restored church, rich in brasses; whilst in the Erith and Plumstead Marshes are large powder magazines, one of which in October 1864 was the scene of a great explosion. At Erith the *Grace de Dieu* was built in 1515. Pop. of parish (1851) 3231; (1881) 9812; (1891) 13,411. See C. J. Smith's *History of Erith* (1873).

Erivan' (Persian *Rewán*), the fortified capital of the government of the same name in Transcaucasia, is situated on the elevated plain to the north of Ararat, on the river Sanga, 3432 feet above the level of the sea. It has one Russian and six Armenian churches, and five mosques, besides a citadel and a large bazaar. Close by resides the head of the Armenian Church (see Armenia, Vol. I.

p. 425). The town dates probably from the 7th century A.D.; in later years it was held alternately by Persians and Turks. Pop. (1880) 12,449. In 1827 it was stormed by the Russian general, Paskevich, who received the surname of Erivanski; and by the treaty of peace concluded at Turkmanjai, 22d February 1828, both town and province were given up by Persia to Russia. The province has an area of 10,165 sq. m., and a pop. (1885) of 667,464, nearly all Armenians and Tartars, with a small percentage of Kurds, and barely 5000 Russians.

Erlangen, a town of Bavaria, on the Regnitz, 12 miles N. of Nuremberg. As old as the 10th century, it owes its prosperity to the settlement here of French Huguenots after the revocation of the Edict of Nantes (1685), and to its university (1743), which is celebrated as a school of Protestant theology, and attended by from 600 to 900 students. A statue of its founder, the Margrave Frederick of Brandenburg-Baireuth, was erected in the market-place in 1843. Brewing is the staple industry; and besides its extensive stocking and glove manufactories, which provide the greater part of Germany with their goods, Erlangen has great mirror and tobacco factories. Burnt in 1449 and 1632, Erlangen came to Bavaria in 1809. Pop. (1875) 13,597; (1890) 17,559, of whom four-fifths are Protestants.

Erlau (Hung. *Eger*), a city of Hungary, on the river Erlau, 89 miles NE. of Pesth by rail. The archiepiscopal cathedral, built since 1837, at a cost of £67,000, is a domed cruciform building, 328 feet long. The lyceum (1761–99) has a valuable library and an observatory; and there is a richly-endowed hospital (1830). Two warm baths are much resorted to. The Erlau wine is the best red wine of Hungary. Pop. (1870) 19,150; (1880) 20,669; (1890) 22,427. Dating from 1010, Erlau suffered much at the hands of the Turks, who held it from 1596 till 1687.

Erlkönig, a German mistranslation (meaning 'alder king') of the Danish *Ellerkonge* (i.e. *Elverkonge*, 'king of the elves'). It was first used by Herder instead of the corresponding German word *Elfenkönig;* and Goethe followed Herder in his famous ballad (set to remarkable music by Schubert), in which a human child is carried off by the Erlking, and dies in his cold arms. See FAIRIES.

Ermeland, or ERMLAND, one of the eleven districts of the old province of Prussia, extending inland from the Frisches Haff, was created in 1250 one of the four bishoprics of the country of the Teutonic Knights. In 1354 the Bishop of Ermeland, who hitherto had been subject to the Archbishop of Riga, was made directly dependent upon the pope, and elevated to the position of a prince of the empire. When, in 1466, West Prussia was transferred to Poland, the Bishop of Ermeland became a member of the Polish senate, with sundry privileges. Since 1722 Ermeland and its bishop have again been Prussian. The name is still borne by a Prussian district (area, 1640 sq. m.; pop. in 1885, 225,076), with sandy soil, but well wooded, in which a large quantity of flax is grown.

Ermenonville, a village in the French department of Oise, 18 miles NNE. of Paris. It was the death-place of Rousseau (q.v.).

Ermine, or STOAT (*Putorius erminea*), a well-known carnivore in the marten family (Mustelidæ), belonging to the genus which includes pole-cat, weasel, ferret, mink, &c. The body is long and slender, and the legs are short, as in the more familiar weasel. The length of the body is about 10 inches, to which 3 or 4 inches of tail are added. The colour of the stoat is ruddy brown in summer, yellowish beneath; but in winter, in the more northern parts of its distribution, the ermine changes its fur into a beautiful white. That this change occurs in direct association with the lowered temperature seems certain, though the physiology of the process is not understood. Observations seem to show that not only is the new growth of hair at the beginning of winter white, but persistent old

Ermine (*Putorius erminea*): Summer and Winter Fur.

hairs may also change. The end of the tail always remains black, and the change is sometimes only partial. The protective value of the white fur in snowy regions is obvious. Like related species, the ermine is a very lithe, restless, brave, and blood-thirsty animal; it moves rapidly, and can both climb and swim well; it is terrestrial in its general habit, and finds a home among rocks and stones, in walls and the like. It sucks the blood of small mammals and birds, and, while valuable in destroying rats and mice, is sometimes a troublesome poacher on the poultry-yard. It breeds at the end of the winter season.

The ermine occurs in Britain, especially in the north, is generally distributed in the northern parts of Europe, Asia, and America, but is common as far south as the Pyrenees and the Italian Alps. The white fur, which has long been used for trimming or lining the robes of dignitaries, is not so much prized as it used to be. The skins are usually imported from Norway, Lapland, Siberia, and the Hudson Bay Territories. The yellow and black tails are inserted to contrast with the white fur. Ermine is the fur of most frequent use in Heraldry (q.v.). See FERRET, MARTEN, POLE-CAT, WEASEL.

Erne, a river and lake in the south-west of Ulster province, Ireland. The river rises in Lough Gowna, on the borders of Longford and Cavan counties, and flows 72 miles north-west through Loughs Oughter and Erne into Donegal Bay. Lough Erne, one of the finest lochs in the kingdom, extending for 40 miles through Fermanagh county, consists of two lakes, the Upper and Lower, joined by a network of channels 10 miles long. Both divisions are studded with green hilly islands, and contain abundance of salmon, trout, and other fish.

Erne (*Haliaëtus*), one of the 'bare-legged' eagles. The genus includes some seven species, represented apparently in all parts of the world except South America. The Common Erne or White-tailed Sea-eagle (*H. albicilla*) is widely distributed in northern Europe and Asia. It occurs in Britain more commonly than the Golden Eagle (*Aquila chrysaëtus*), but, like the latter, with rapidly increasing rarity. The two cannot be readily confused, for the leg-feathers of the erne do not extend to the toes, the bill is longer, and the habit is different. The erne is rather smaller than

the golden eagle, measuring about 3 feet in length. The general colour is brown, but the head may be paler, and the tail (which only extends very slightly beyond the points of the wings) is white above in the adults. The young erne is a grayer bird. In Britain the erne is now most at home in the remote north—e.g. in the Hebridean and Shetland Islands.

Common Erne (*Haliaëtus albicilla*).

It there builds by the precipices of the coast, but in North Germany it finds a home in wooded inland regions where water is abundant. The same habit has also been noticed in the British Islands—e.g. at Killarney. While continuing the depredations on birds and mammals characteristic of most eagles, the ernes also find in fish a favourite diet.

Another notable species is the White-headed or Bald Eagle (*H. leucocephalus*), the emblem of the United States. In powers of soaring the emblem may be a happy one, but Franklin regrets that the habits and disposition of the bird are not more praiseworthy. This erne is common in North America, both by the coasts and by inland lakes, and also occurs in northern Europe. The general colour is again brown, but the head and neck of the adults are milky-white, and the same is true of the rounded tail. The size is slightly less than that of the British species. It feeds like other eagles, but is very fond of fish, which it gets for itself by wading, or obtains by theft from other birds. The White-bellied Sea-eagle (*H. leucogaster*), found round the Australian coasts, and from Ceylon to Cochin-China; the beautifully marked *H. vocifer* of Africa and Madagascar; and the Asiatic Erne (*H. pelagicus*), are other important species. See EAGLE.

Ernest, the name of several German princes, for whom see HANOVER, SAXONY, SAXE-COBURG, ALTENBURG.

Ernesti, JOHANN AUGUST, a celebrated classical and biblical critic, was born at Tennstädt, in Thuringia, 4th August 1707. He studied (from 1726) at Wittenberg and Leipzig, and, devoting himself to classical studies, became rector of the Thomas School at Leipzig in 1734, a post which he held till 1759, along with first a chair of Humanity (from 1742), and then that of Rhetoric (from 1756) in the university. Becoming professor of Theology in 1759, he resigned the chair of Rhetoric in 1770, and died 11th September 1781. He prepared editions of Homer, Callimachus, Polybius, Suetonius, and Tacitus, and of Xenophon's *Memorabilia* and Aristophanes' *Clouds*, and an excellent edition of Cicero (3d ed. 5 vols. 1776–77), to which he added a valuable *Clavis Ciceroniana* (6th ed. by Rein, Halle, 1831). Ernesti was the chief founder of a correct exegesis of Scripture by the laws of grammar and history, independent of dogmatic prepossessions. Of his numerous theological writings the most notable is his *Institutio Interpretis Novi Testamenti* (1761; 5th ed. 1809), of which there are English translations by Moses Stuart (2d ed. Andover, 1824) and C. H. Terrot (2 vols. Edin. 1832–33). In his *Anti-Muratorius* (1755) he shows that a fair and thorough investigation of the history of doctrines is the best polemic against Roman Catholicism. His Latin speeches gained for him the name of the 'German Cicero.' They are collected under the title *Opuscula oratoria* (2d ed. 1767), with a supplementary volume (1791).

Eros. See CUPID.

Erosion, the influence of rivers or of flowing water in hollowing out their channels, and in wearing down and sculpturing the surface of the earth. See COLORADO, DENUDATION, GEOLOGY, MOUNTAINS, RIVER.

Erostratus, or HEROSTRATUS. See EPHESUS.

Erotic Poetry (from the Greek *erōs*, 'love') comprises poetical pieces of which love is the predominating subject.

Erotomania. See MANIA.

Erpenius (Latinised from Thomas van Erpen), one of the earliest and most eminent of European Orientalists, was born at Gorkum, in Holland, 7th September 1584, studied at Leyden, and at Paris learned Arabic from an Egyptian. In 1613 he became professor of Oriental Languages at Leyden, where he erected an Arabic press in his own house, caused elegant new types to be cut, and not only wrote but printed a great number of important works bearing on his favourite studies. At the time of Erpenius's translation to the university of Leyden, a second Hebrew chair was founded. As oriental interpreter to the government, he read and wrote replies to all official documents coming from the East. Tempting offers of honours and distinction reached him from all parts of Europe; but he was never prevailed upon to leave his native country, where, in the midst of an eminent career, he died of the plague, 13th November 1624. Eastern, and especially Arabic, studies owe much of their development to Erpenius's labours. In spite of his poverty of materials, his famous grammar (*Grammatica Arabica*, Leyden, 1613) enjoyed an undisputed supremacy for two hundred years, till the time of Silvestre de Sacy; and there are many who think his *Rudimenta* (1620) unsurpassed, even at the present day, as a work for beginners. Among his other important works the best known are his *Proverbiorum Arabicorum Centuriæ Duæ* (1614), and his edition and translation of El-Mekîn's *Historia Saracenica* (1625).

Errata, the list of errors with their corrections placed at the end of a book. From greater carefulness in correcting the sheets of a work in passing through the press, errors in sense or typography are now much more rare than formerly; but few books are yet produced without more or less noticeable typographical errors.

Erratics. See BOULDERS, BOULDER-CLAY, GLACIAL PERIOD.

Error, in English law, is any mistake in fact, in law, or in the form of process, requiring to be set right by the court before which an action is tried, or by a court of review. If the error was in fact, the case, under the old system, was heard before the court in which the action was originally tried; if the error was in law, proceedings had to be taken before the Court of Exchequer

Chamber (q.v.). Where a party disputed the ruling of the judge, the form was by Bill of Exceptions (q.v.). According to the former practice, it was necessary, in order to obtain a review on the ground of error, that an original writ, called a Writ of Error, should be issued. The writ, if the error was in fact, was styled *coram nobis*, where the case was in the King's Bench, the sovereign being presumed to preside in that court; if in the other courts, the writ was *coram vobis*. Writ of error in civil cases in the High Court is abolished by the Judicature Acts, and so is Bill of Exceptions. Since 1875 all appeals are to the Court of Appeal by way of rehearing, and are brought by notice of motion in a summary way, and no petition or other formal proceeding other than such notice of motion is now necessary. The appellant may by the notice of motion appeal from the whole or part of any judgment, and this does not usually stay proceedings. Nearly all the judgments of the Divisional Courts of the High Court are subject to appeal to the Court of Appeal and thence to the House of Lords. The jurisdiction was transferred to the High Court of Justice in 1875, which used formerly to be vested in the Common Pleas at Lancaster and at Durham, and which used to be by writ of error to the Queen's Bench. Writs of error used formerly also to be brought on judgments of inferior courts. But since the establishment of County Courts and the changes introduced by the Judicature Acts, the analogous proceeding is an appeal by way of a case stated for opinion of the High Court, and sometimes by motion in a summary way. In criminal cases, error does not now lie for formal defects in the indictment; these should be objected to before the jury is sworn, and may then be amended. A writ of error will lie for a defect in substance appearing in the indictment, as in the case of Bradlaugh *v.* the Queen, where an indictment for publishing an obscene book was held defective because it mentioned the book by title only, instead of setting out the passages alleged to be obscene. A prisoner has therefore three opportunities of taking legal objections; he may demur to the indictment, or move in arrest of judgment, or sue out a writ of error. On the facts in a criminal case there is no appeal from the verdict of the jury. In the United States, the procedure of the State Courts follows the analogy of the English common law; in the Federal Courts the term error is also known; for further details reference may be made to the Acts of Congress and of the several state legislatures.

Errors. In all observations errors must be made. The best instruments have imperfections; and no man, however equable his temperament, can always rely on his making a proper use of his senses. As in astronomy numerical correctness in the results of instrumental measurements is of the first consequence, it is the constant care of the observer to detect and make allowance for errors. The three principal sources from which they may arise are—(1) External or incidental causes, such as fluctuations of weather, which disturb the amount of refraction; changes of temperature, affecting the form and position of instruments, &c.; (2) Errors of observation, being such as arise from inexpertness, defective vision, slowness in seizing the exact instant of an occurrence, atmospheric indistinctness, &c.; and such errors as arise from slips in clamping and momentary derangements of the instrument; (3) Instrumental defects, owing to errors in workmanship, and such as arise from the instrument not being properly placed—called errors of adjustment. The first two classes of errors, so far as they cannot be reduced to known laws, vitiate the results of observations to their full extent; but being accidental, they necessarily sometimes diminish and sometimes increase them. Hence, by taking numerous observations under varied circumstances, and by taking the *mean* or *average* of the results obtained, these errors may be made to destroy one another to a great extent, and so far may be subdued. With regard to the third class, it is the peculiarity of astronomical observations to be the ultimate means of detection of all defects of workmanship and adjustment in instruments, which by their minuteness elude every other mode of detection. It may be mentioned, however, that the method of subduing errors of the first two classes by the law of average is not applicable in all cases. In certain cases recourse must be had to the Method of Least Squares. See SQUARES, and PROBABILITIES.

Ersch, JOHANN SAMUEL, a great German bibliographer, was born at Grossglogau, in Lower Silesia, 23d June 1766; studied theology, next history, at Halle; and after some years of journalism at Jena and Hamburg, became in 1800 librarian to the university of Jena. Three years later, he was called to Halle as professor of Geography and Statistics; and in 1808 was also appointed principal librarian. He died at Halle, 16th January 1818. Ersch was long engaged in miscellaneous bibliographical work for other scholars; but in 1818, along with Gruber, commenced the publication at Leipzig of the famous yet unfinished *Allgemeine Encyklopädie der Wissenschaften und Künste* (see ENCYCLOPÆDIA). By his *Handbuch der Deutschen Litteratur seit der Mitte des 18 Jahrh.* (4 vols. 1812-14) he first established modern German bibliography in the technical sense of the word.

Erse (a corruption of *Irish*), a name given less frequently now than formerly to the Gaelic (q.v.) of both Ireland and the Scottish Highlands.

Erskine, EBENEZER, the founder of the Secession Church in Scotland, was the son of the minister of Chirnside, in Berwickshire, a scion of the noble family of Mar (q.v.), and was born June 22, 1680. He studied at Edinburgh, and, after acting as tutor and chaplain in the family of the Earl of Rothes, was licensed by the presbytery of Kirkcaldy in 1703. His abilities soon brought him into notice, and in the same year he was appointed minister of Portmoak, in Kinross-shire; and here the unction and piety which marked his discourses became exceedingly attractive to the people accustomed to the chilling 'legalism' which then predominated in the Scottish pulpit. He took a deep interest in all public questions, both in church and state, and consequently, on the rise of the Marrow Controversy (q.v.), he was one of the most prominent on the evangelical side. After having discharged the pastoral office in Portmoak for about twenty-eight years, Erskine was in 1731 translated to Stirling. Just then the patronage dispute arose, and Erskine distinguished himself by his powerful advocacy of the right of the people to choose their own pastors. Declining to receive censure for certain statements made by him on this question in a Synod sermon which had given offence to the prevailing party in the church, he, with other three ministers who adhered to him, was in 1733 suspended and then deposed from the ministry. The sentence, however, was recalled in the following year, and Erskine was invited to return. But this he declined to do unless the evils he contended against were removed. The invitation remained open until 1740, when, finding further effort hopeless, the Assembly again deposed Erskine, and ejected him from his church. On the first deposition, Erskine and those adhering to him stated a formal secession from the judicatories of the Established Church, and at Gairney Bridge, near Kinross, erected themselves into the 'Associate Presbytery.' This was

the origin of the Secession Church (see UNITED PRESBYTERIAN CHURCH). In the division in 1747 of the Seceders into Burghers and Anti-burghers, Erskine took the leading part on the side of the Burghers. He was twice married, and had fifteen children. He died 2d June 1754. His *Sermons and Discourses* fill 4 vols. (Glasgow, 1762). See Lives by D. Fraser (1831) and Harper (1849); and *The Erskines: Ebenezer and Ralph*, by John Ker, D.D., and J. L. Watson (Edin. 1882).

Erskine, HENRY, second son of the tenth Earl of Buchan, was born in Edinburgh, 1st November 1746, and was educated at the universities of St Andrews, Glasgow, and Edinburgh. He joined the Scottish bar in 1768. His rise was immediate, and commenced, like that of his rival Henry Dundas, from his appearances in the debates of the General Assembly. Under the short-lived coalition ministry of Fox and North, he became Lord Advocate (1783), an office to which he was again appointed in 1806. In 1785 he was elected Dean of the Faculty of Advocates, but in 1796 was deposed in favour of Robert Dundas of Arniston. This mark of professional censure was intended by the Faculty to stigmatise Erskine's conduct in attending a public meeting and supporting a resolution protesting against the 'Seditious Writings Bill' proposed by the government. Lord Cockburn justly says, 'It was the Faculty of Advocates alone that suffered.' Erskine was elected member for the Haddington burghs in March 1806, and in the following November for the Dumfries burghs. He died at Amondell, his seat near Midcalder, 8th October 1817. During his second tenure of the office of Lord Advocate, Erskine practically carried into effect some of the legal reforms for which a pamphlet, published in London in 1807, and attributed to him on good authority, pleaded forcibly—viz. the introduction of jury trial in civil cases, and the abolition of the rule by which the fifteen judges of the Court of Session sat together. He was the author of several metrical translations from the classics, and other poems, of which the best known is *The Emigrant* (1773), inspired by the depopulation of the Highlands. Erskine's forensic style was the delight of his contemporaries, and the recorded fragments of his speeches justify his high reputation as an orator and a wit, and warrant the conclusion that, had Henry Erskine, in his own witty language, 'played at the guinea tables' in London, instead of 'at the shilling tables' in Edinburgh, he would have been no unworthy rival to his distinguished brother, Lord Erskine. See Colonel Alexander Fergusson's *Henry Erskine* (1882).

Erskine, JOHN, of Dun, Scottish Reformer, was born in 1509. All through the reign of Mary Queen of Scots, and through part of that of her son James, Erskine took an active share in public affairs, lending steadfast support to the reformed preachers, especially to Wishart and Knox, whilst at the same time his moderate and conciliatory temper not only secured him against the enmity of the leaders of the Catholic party, but gave him considerable personal influence in the country. He was frequently chosen to negotiate between the Reformers and the representatives of the sovereign, and to mediate between the different sections amongst the Reformers themselves. From 1560 down to about 1589, two years before his death, he held the office of superintendent for the reformed district of Angus and Mearns. Although a layman, he was elected on at least five separate occasions moderator of the General Assembly, and was one of the compilers of the *Second Book of Discipline* (1578).

Erskine, JOHN, Scottish jurist, was born in 1695, the son of the Hon. Colonel Erskine of Carnock, Fife. He was called to the bar in 1719, but did better as a lecturer than a practitioner, having in 1737 been appointed to the chair of Scots Law in Edinburgh University. He resigned it in 1763, and died on 1st March 1768 at Cardross, near the Lake of Menteith, which estate he had purchased in 1746. His two works are still held in deserved repute—*Principles of the Law of Scotland* (1754; 17th ed. 1886), and the more important *Institutes of the Law of Scotland* (1773; 9th ed. 1871). As a legal writer, indeed, he is second only to Stair, the sterling merits both of the *Principles* and of the *Institutes* being their plainness and sound common sense.

Erskine, JOHN, D.D., son of the preceding, was born June 2, 1721. He studied at the university of Edinburgh, and, licensed to preach in 1743, was appointed minister successively of Kirkintilloch (1744), Culross (1753), New Greyfriars Church, Edinburgh (1758), and the collegiate charge of Old Greyfriars (1767), where he had for his colleague Dr Robertson. In 1766 the university of Glasgow conferred on him the honorary degree of D.D. In the General Assembly he was for many years the leader of the popular or evangelical party; and between him and Principal Robertson, the leader of the Moderate party, there was a courteous and honourable friendship. Erskine's twenty-five publications are of a high order of ability. They consist of essays, letters, sermons, dissertations, and pamphlets, &c., mainly of a religious character, even when dealing with the political American controversy, on which he wrote largely. He also edited a number of British editions of works of American divines. Sir Walter Scott, in his *Guy Mannering*, gives a graphic description of his powers as a preacher. See the Life by Sir Henry Moncrieff Wellwood (1818).

Erskine, RALPH, brother of Ebenezer, was born at Monilaws, in Northumberland, March 18, 1685, and, after studying at Edinburgh, was ordained to the parish church of Dunfermline in 1711. Like his brother, he took part on the evangelical side in the Marrow Controversy (q.v.); and, after the formation of the Associate Presbytery, he withdrew from the communion of the Established Church, and joined the former in 1737. In the controversy concerning the burgess oath he also took part with the Burghers, and wrote several pamphlets in defence of their position. He was, however, less a controversial than a practical writer. Being a very popular preacher while he lived, his sermons were greatly prized after his death, and many of them were translated into Dutch and widely circulated in Holland. His *Gospel Sonnets* and *Scripture Songs* are well known. He died November 6, 1752. See the Life by James Fisher, prefixed to his *Practical Works* (2 vols. 1764).

Erskine, THOMAS, LORD ERSKINE, the youngest son of Henry David, tenth Earl of Buchan, was born in Edinburgh, 21st January 1750, and was educated at St Andrews. In 1764, much against his will, he was sent to sea in the *Tartar* man-of-war, under Sir David Lindsay. After cruising about for four years in the West Indies and on the coast of America, he obtained an ensign's commission in the 1st Royals, at a price which absorbed his whole patrimony (1768), and was for some time stationed at Minorca, where he employed his leisure time in a minute and devoted study of Shakespeare, Milton, Dryden, Pope, and other masters of English literature. On his return to London in 1772, Erskine mingled freely with the best social and literary circles, and acquired a distaste for military life, which an accidental visit to an assize court, and an interview with Lord Mansfield, turned into a determination to

prosecute the study of law. He was admitted to Lincoln's Inn, 26th April 1775; and in 1776 entered Trinity College, Cambridge, where he took an honorary M.A. in 1778, just before being called to the bar. His professional career was one of immediate and unprecedented success. Accident threw in his way a retainer in the case of Captain Baillie, lieutenant-governor of Greenwich Hospital, who was threatened with a criminal prosecution for libel, at the instance of Lord Sandwich, the First Lord of the Admiralty. Erskine's advocacy secured the discharge of the rule for leave to file an information (24th November 1778), and as he left Westminster Hall from the scene of this signal victory the attorneys flocked round him with their retainers to the number, as he afterwards used to tell, of sixty-five. The next year saw an equally successful defence of Admiral Lord Keppel against charges of professional misconduct and incompetence. In 1781 Erskine secured the acquittal of Lord George Gordon, indicted for high-treason in connection with his conduct during the notorious riots, and on this occasion delivered his first assault upon the doctrine of *constructive* treason, by which it was sought to make persons who aimed at effecting a change in the sovereign's constitutional character and position guilty of the capital offence of 'compassing the king's death.' In 1783 Erskine was appointed a King's Counsel on the special recommendation of Lord Mansfield, and at the same time was returned as member of parliament for Portsmouth. The high expectations of his friends were rudely disappointed by his first political appearance in the House of Commons, and, although he subsequently made effective and eloquent speeches, he never became a parliamentary orator. 'I'll tell you how it happens, Erskine,' said Sheridan, 'you're afraid of Pitt; and that is the flabby part of your character.' Erskine's sympathy with the French Revolution, aroused by a visit to Paris in 1791, led him to join the 'Society of the Friends of the People'—whose object was to bring about parliamentary reform—and to undertake the defence in the principal political prosecutions of 1793–94. His courageous acceptance of a retainer from Tom Paine resulted in his removal from the office of Attorney-general to the Prince of Wales, to which he had been appointed in 1786. But his speeches for this unpopular defendant, and for Frost (1793), Hardy (1794), and Horne Tooke (1794), are among the finest specimens of forensic skill, and, in the language of Hardy, 'will live for ever.' Erskine's defence of Hadfield (April 26, 1800), indicted for shooting at George III. in Drury Lane Theatre, was a powerful and logical analysis of a theory of criminal responsibility in mental disease, which had hitherto done bloody duty in English courts of law. In 1802 Erskine was appointed Chancellor to the Prince of Wales, an office which had lain dormant since the time of James I., but was now revived in his favour. In 1806 he was raised to the peerage and the woolsack, but soon retired into private life. He died at Amondell, Linlithgowshire, 17th November 1823.

Erskine had married first, in 1770, Frances, daughter of Daniel Moore, M.P. for Marlow; and secondly, at Gretna Green, when he must have been about seventy, a Miss Mary Buck. He published a pamphlet on the abuses of the army in 1772; a view of the causes and consequences of the war with France in 1797; a political romance, *Armata;* a pamphlet in favour of the Greeks; and some poems.

Erskine's decisions as Lord Chancellor were styled by his contemporaries the 'Apocrypha,' and have added nothing to his permanent fame. His reputation is purely forensic, and in this respect is unrivalled in the history of the English bar. The charm of voice and presence and gesture may have contributed something to his unique influence over judges and jurymen; but the careful student will not fail to note in his speeches the enduring qualities of genuine sentiment, profound acquaintance with life and character, singular fertility in illustration, and powers of exposition and reasoning to which the history of advocacy hardly offers a parallel. See Campbell's *Lives of the Chancellors*, vol. viii.; Fergusson's *Henry Erskine* (1882); and Duméril's *Lord Erskine, a Study* (Paris, 1883).

Erskine, THOMAS, of Linlathen, was born in 1788, and educated at Edinburgh High School, at Durham, and at the university of Edinburgh. He was admitted advocate in 1810, but ceased to practise after his elder brother's death gave him the family estate of Linlathen, near Dundee, and devoted himself for the remainder of his uneventful life to his favourite theological studies. He never married, but his devoted sister helped him to make his house at Linlathen a hospitable centre of Christian culture. Among his intimate friends were such spiritual leaders as M'Leod Campbell, Maurice, Stanley, Ewing, Vinet, as well as Carlyle and Prévost-Paradol. He died 20th March 1870. Erskine was brought up an Episcopalian, but in later life was at least nominally a member of the Church of Scotland. His theological opinions and religious sympathies hardly fell within the lines of the usual creed definitions, while a belief in the ultimate universal salvation of mankind and the worthlessness of miracles as evidence for inspiration were scarcely consistent with formal citizenship within any church so recently as fifty years ago. His books were *Remarks on the Internal Evidence for the Truth of Revealed Religion* (1820); *An Essay on Faith* (1822); *The Unconditional Freeness of the Gospel* (1828); *The Brazen Serpent, or Life coming through Death* (1831); *The Doctrine of Election* (1837); and *The Spiritual Order*, a posthumous work (1871). See his Letters, edited by Dr W. Hanna (1877–78).

Eruptive Rocks. See IGNEOUS ROCKS.

Eryngo (*Eryngium*), a genus of Umbelliferæ, but of curiously thistle-like aspect, since the sessile flowers of the umbel form what is practically a capitulum. The large, spiny leaves recall those of holly, but have a glaucous bloom, which in some species gives the foliage an opalescent blue colour. These especially are cultivated in flower-gardens, but the young leaves of *E. maritimum* (Sea-holly) are occasionally eaten as a salad; the Mediterranean species were also valued by the ancients. Falstaff mentions the use of the candied root. An American species is also used in domestic medicine.

Sea-holly (*Eryngium maritimum*).

Ery'simum, a genus of Cruciferæ allied to Hedge-mustard (Sisymbrium) and Dame's Violet

(Hesperis). The seeds of *E. cheiranthoides* were formerly employed as an anthelmintic, hence the name of Worm-seed. It is also called Treacle Mustard, because an ingredient in the famous *Venice Treacle*. The seeds of *E. perfoliatum* are used as a source of oil in Japan.

Erysipelas (Gr., 'red skin'), an inflammatory and febrile disease of the skin, attended by diffused redness, pain, and swelling of the part affected, and in the end by either desquamation or vesication of the cuticle, or scarf-skin, in the milder forms, and by suppuration of the deeper parts in the severer varieties of the disease (*phlegmonous* erysipelas). It is characterised by a marked tendency to spread over the skin from the place where it arises. Erysipelas affects, in a large proportion of instances, the face and head; it is apt to be attended with severe fever, and often with great disorder of the nervous system, arising in some instances from inflammation of the membranes of the brain. In other parts of the body, severe or phlegmonous erysipelas is apt to be succeeded by protracted and exhausting suppurations, and sometimes by diseases of the bones, or inflammations of the internal organs. Erysipelas in its severer forms usually commences in a wound or sore, and is extremely apt to be communicated to any one with a breach in the continuity of the skin who comes in contact with a case of the disease. Epidemic outbreaks of erysipelas used therefore to be common and disastrous in surgical hospitals; but since the general introduction of antiseptic treatment they have almost disappeared. Erysipelas is very apt to recur in a person who has been attacked once or oftener; and this is especially true of the form which affects the face. It is believed to be due to the presence of a micrococcus in the affected tissues. It is seldom that depletion is allowable in erysipelas, but the bowels should be well cleared out in most cases, and Diuretics (q.v.) given, after which the treatment consists for the most part in watching narrowly the progress of the case, keeping up the strength as well as possible, and obviating special dangers as they occur. In some cases iron is used as a specific remedy in the form of large doses of steel drops. It is of course important that no one liable to the disease should be exposed to the infection. St Antony's Fire (see ANTONY) and Rose are common names for erysipelas.

Erythema (Gr. *eruthainō*, 'I redden'), a name applied to certain skin diseases, but scarcely used by any two writers on the subject in exactly the same sense. It is used, generally speaking, of eruptions where there is circumscribed or diffuse redness, without any break in the skin surface, with or without elevation of the affected part. The chief forms described under the name are rashes like a persistent blush occurring in the course of some fevers, in consequence of drugs, or without ascertainable cause, but usually of short duration: *E. multiforme*, where the eruption is raised, and generally in the form of papules, rings, or irregular lines; *E. nodosum*, consisting of dark-red, painful swellings, usually on the front of the leg, and believed to be connected with the rheumatic diathesis; and cases closely resembling erysipelas, except that the symptoms, both local and constitutional, are very much less severe. The cause, if known, should be treated; but no general rules for treatment can be laid down.

Erythræa. See CENTAURY.

Erythrina. See CORAL FLOWER.

Erythronium, a genus of Liliaceæ. *E. dens canis*, the Dog-tooth Violet, so called because of the resemblance of its little white bulbs to dogs' teeth, is a well-known ornament of English flower-borders in spring. It is a native of southern Europe and Siberia, where it is used as a source of food, and also medicinally.

Erythrophlæum, a genus of leguminous trees (sub-order Mimoseæ). The red juice of the bark of *E. guineense* is administered in ordeals and used for arrow-poisoning by the natives of Guinea and the Gold Coast.

Erythroxylaceæ, a small order of dicotyledonous trees or shrubs, chiefly South American, allied to Malpighiaceæ. *Erythroxylon suberosum* is a red dye-wood of Brazil. That of *E. hypericifolium* is the *Bois d'huile* (Oil-wood) of Mauritius. The most important member of the order is, however, *E. coca*. See COCA.

Eryx, the ancient name of a mountain in the NW. of Sicily, near Drepanum (mod. Trapani), on which stood a famous temple of Venus, who was thence called *Erycina*.

Erzberg. See EISENERZ.

Erzerûm, an important town in Turkish Armenia, in 39° 55′ N. lat., and 41° 20′ E. long., not far from the Kara-Su, or western source of the Euphrates. It is situated on a high but tolerably well cultivated plain, 6200 feet above the level of the sea, surrounded by mountains. The climate is cold in winter, but hot and dry in summer. Erzerûm is the residence of English, Russian, German, and French consular agents; and its population is estimated at 40,000, consisting of 30,000 Turks, 8000 Armenians, and 2000 Persians, who carry on a brisk trade, and have thus attained to a degree of prosperity unusual in the East. The copper and iron wares of Erzerûm have acquired a wide celebrity. Situated at the junction of the important highways leading from Trebizond, Transcaucasia, Persia, Kurdistan, Mesopotamia, and Anatolia, Erzerûm forms an entrepôt of commerce between Europe on the one hand and the interior of Asia, and particularly Persia, on the other. The streets, the houses of which are built chiefly of volcanic stone cemented with mud, are narrow, crooked, and filthy; and ruins of fortifications and of buildings formerly magnificent everywhere meet the eye. The town consists of the fortress, strictly so called, and four suburbs. The fortress, which is inclosed by a high wall, has, on the west, a citadel (El-Kal'a), with many curious monuments, and a mosque of Christian origin. The fortress also contains fifteen other mosques, the residence of the chief-magistrate, some caravanserais, and a few elegant houses belonging to the higher order of officials and Mohammedan merchants. The suburbs boast twenty-four mosques, several Armenian churches, and a number of large bazaars and caravanserais. Erzerûm imports shawls, silk goods, cotton, tobacco, rice, indigo, &c., and exports corn, sheep and cattle, horses, mules, and gall-nuts. The principal trades carried on are tanning, dyeing morocco leather, and blacksmiths' and coppersmiths' work. But since Russian Transcaucasia has provided a safe trade-route to Persia, the prosperity of Erzerûm has greatly suffered. It was first conquered by the Arabs in 700, but retaken by the Byzantines fifty years later. After various vicissitudes, it fell into the hands of the Seljuks; the Mongols took it in 1241; and finally, in 1517, it passed into the possession of the Turks. It still, however, continued to be the most important city in the country, and at the commencement of the 19th century had a population of 100,000 inhabitants. In the war of 1829, between the Turks and Russians, the taking of Erzerûm by Paskievich decided the campaign in Asia. Erzerûm was an important military centre during the wars of 1854–55 and 1877–78, and much hard fighting was done in its neighbourhood. In December 1877 the

Russians closed round the city, already hard pressed, and reduced its defenders to the utmost distress; in February 1878 it was surrendered to Russia, who held it till October, when it was restored to the Turks. See Curzon, *Armenia* (1854); Norman, *Armenia and the 1877 Campaign* (1878).

Erzgebirge ('Ore Mountains'), the name given to the chain of mountains, rich in metals, stretching SW. and NE. for 96 miles on the confines of Saxony and Bohemia, from the valley of the Elbe to the Fichtelgebirge. In the south it rises to a height of from 2500 to 3300 feet, forming a steep wall of rock; in the north it forms broad, slaty plateaus, broken by deep valleys, and gradually slopes down towards the level districts of Altenburg and Leipzig. Many of these valleys are well wooded and romantic, and occasionally fertile and thickly peopled, being watered by the Mulde, the Pleisse, and their numerous tributaries. The chain rises to its highest elevations in the so-called 'Saxon Siberia,' over against Zwickau. Here, in 12° 54′ E. long., stands the town of Gottesgabe, the highest in Germany, at an altitude of 3363 feet; and here, too, are the loftiest peaks of the range (Keilberg, 4052 feet; Fichtelberg, 3980; Spitzberg, 3675). The Erzgebirge is chiefly of the gneiss-granite formation, with argillaceous and micaceous slates, porphyry, and basalt. Silver and lead are the principal metals; next come tin, iron, cobalt.

Esaias. See ISAIAH.

Esarhaddon. See ASSYRIA.

Esau, the eldest son of Isaac, and twin-brother of Jacob. See JACOB, EDOM, JEWS.

Esbjerg, a port of Denmark, 56 miles W. of Fredericia by rail, with a large export trade in cattle, &c., mostly to England. Its harbour, the only one of importance on the west coast of Jutland, was constructed by the state at great expense in 1868–74; and in 1887 an annual subsidy of about £7000 was granted by government for steamship communication with Britain. Pop. (1890) 4111.

Escalade (Lat. *scala*, 'ladder'), in siege operations, a method of gaining access to the enemy's works; passing ditch, curtain, bastions, by means of ladders. See FORTIFICATION, SIEGE.

Escarp'. See FORTIFICATION.

Escarpment, a long line of cliff, formed by the outcrop of a relatively hard stratum of rock interbedded amongst more yielding strata, the dip or inclination of which is generally gentle. This structure is the result of denudation—the hard rock projects simply because it has yielded less readily to the agents of erosion. In a country composed of an alternation of such relatively hard and soft rocks, dipping in one and the same direction, we usually meet with a succession of escarpments, with their steep faces all turned towards the direction to which the strata rise, while the ground falls away with a gentle slope in the direction of the dip or inclination of the beds.

Escars. See ÅSAR.

Eschar (Gr. *eschara*), a slough or portion of dead or disorganised tissue, is commonly applied to artificial sloughs produced by the application of caustics. *Escharotic* means causing an eschar.

Eschatology (Gr. *eschatos*, 'last,' and *logos*, 'a discourse'), the doctrine of the last things, a theological term for what Scripture reveals and Christian speculation has concluded about a future state. But although the term is thus limited, an eschatology existed among all the great nations of antiquity, dark and ill defined as in the Greek, or elaborate as in the Egyptian religion. Together with it grows up more or less definitely the idea of retribution. For an account of the more elementary forms of this conception, see TRANSMIGRATION. Protestant eschatology is generally confined in practical discourses to a consideration of these four last things—Death, Judgment, Heaven, and Hell (see IMMORTALITY, RESURRECTION, DEVIL, and HELL). The principal religious parties which do not recognise eternal punishment as a Scriptural doctrine are treated at UNIVERSALISTS and CONDITIONAL IMMORTALITY; the question of an intermediate state, at PURGATORY. See also MILLENNIUM.

Escheat (Fr. *échoir*, from Lat. *cadere*, 'to fall or happen'), an incident of the feudal law whereby, when there was no tenant qualified to perform the services, land reverted to the lord. In England, escheat took place *per delictum tenentis*, as e.g. when the tenant was convicted of a capital felony; this kind of escheat 'with attainder' was abolished in 1870, as also the Forfeiture (q.v.) of land to the crown for high-treason (see ATTAINDER). According to the existing law, a criminal's property is forfeited only in so far as may be necessary for the purpose of making compensation; but the old doctrine of 'corruption of blood' is now entirely done away; no person is barred by the crime of his ancestor from succeeding to property. Escheat still takes place *per defectum sanguinis*, for want of heirs, when the owner (the feudal tenant) of land dies intestate, leaving no heir; in such case the feudal superior (usually the crown) may claim the land. When land falls to the crown, the 'prerogative of grace and bounty' is sometimes exercised in favour of persons having claims on the deceased; subject to this prerogative the land becomes part of the crown-lands, and the profits are carried to public revenue.

Escheat in Scotland is of two kinds: (1) The total forfeiture to the crown of all property heritable and movable belonging to a person who has been convicted of treason. (2) It signifies the forfeiture of goods by a debtor who has failed to make payment of debt in obedience to legal Diligence (q.v.). This species of escheat for debt was abolished by 20 Geo. II. chap. 50. It was of two kinds: single escheat, and liferent escheat. By the former, all the debtor's movables were forfeited to the crown; by the latter, the annual profits of the debtor's estate were forfeited to the superior. Single escheat still exists in Scotland as a punishment of crime. In all capital convictions it is ordered that the prisoner's 'whole movable goods and gear be escheat and inbrought to his majesty's use.' In cases of deforcement, bigamy, perjury, and some others, single escheat is imposed by statute as a portion of the penalty on conviction. Single escheat also falls upon denunciation for outlawry; and, if the rebel continues for a year under denunciation, his liferent escheat falls to his superior.

In the United States, the rules of feudal tenure are, for the most part, obsolete; but all property, real or personal, which is left without a legal owner, is claimed by the state in which it is situated.

Eschenbach, WOLFRAM VON. See WOLFRAM VON ESCHENBACH.

Eschscholtz Bay, the innermost part of Kotzebue Sound, in Alaska, barely outside the polar circle. It was named after the naturalist Johann Friedrich Eschscholtz (1793–1834), who sailed as surveyor with Otto von Kotzebue.

Eschscholtzia, a genus of Papaveraceæ, of which *E. californica* and other species are common as showy garden annuals.

Eschwege, a town in the Prussian province of Hesse-Nassau, on the Werra, 40 miles ESE. of Cassel by rail. It has manufactures of woollen, cotton, and linen fabrics, of machines, and of

tobacco; also tanneries, and some trade in fruit and pork, and agricultural produce. Pop. 9492. The town was twice plundered and once burned during the Thirty Years' War.

Eschweiler, an industrial town of Rhenish Prussia, 8 miles ENE. of Aix-la-Chapelle, has important iron, zinc, and tin works, machine-shops, manufactories for making copper plates, needles, wire, gas-pipes, and firebricks, besides tanneries and breweries. In the vicinity are productive coal-mines. Pop. (1875) 15,540; (1885) 16,889.

Escobar y Mendoza, ANTONIO, Spanish casuist, was born at Valladolid in 1589. Entering the order of the Jesuits in 1604, he became celebrated as a preacher and writer. At his death in 1669 he left more than 40 vols. in folio, mostly in theology and morality, the principal being the casuistical *Liber Theologiæ Moralis* (1646), which has several times been printed.

Escorial, or, less correctly, ESCURIAL, a royal palace, mausoleum, and monastery of Spain, 31 miles NW. of Madrid, on the south-eastern slope of the Sierra Guadarrama, at an altitude of 3700 feet. This immense pile of buildings, built of dark-gray granite, has a stern, austere, forbidding appearance, which is not at all relieved by the bleak, wind-swept, mountainous region in which it stands. It owes its existence to Philip II., who erected it partly to provide a royal burying-place for the kings of Spain, partly to commemorate his victory over the French at St Quentin on St Lawrence's day, 10th August 1557. Its general shape is that of a quadrangular parallelogram, 706 feet long by 550 broad, with a smaller square projecting from the east side. The current belief is that it was planned to represent a gridiron, the object upon which St Lawrence was martyred; but this has been questioned. At anyrate, each corner of the parallelogram is fenced with a tower, about 200 feet high; and above the church, in the centre of the pile, rises a cupola, its summit 312 feet from the floor. The first stone of the edifice was laid in 1563, the architect being Toledo, after whose death in 1567 his pupil Herrera carried on the work to its completion in 1584. The finest individual building is the church, a square basilica, in the shape of a Greek cross, and in the Doric order of architecture. It was formerly rich in paintings; and, although in 1837 a hundred of the best were removed to Madrid, there still remain specimens by Coello, Carbajal, Tibaldi, Zuccaro, Luca Giordano, Trezzo, Zurbaran, Ribera, Tintoretto, Titian, and Veronese. The Pantheon, or royal mausoleum, an octagonal chamber beneath the church, contains the bones of the kings of Spain from Charles V., father of Philip II., onwards (except Philip V. and Ferdinand VI.) to Alfonso XII., with queens, regents, and mothers of kings; the rest of the royal family, with Don John of Austria, are buried in the 'Panteon de los Infantes.' The library, once one of the richest in Europe, but greatly diminished by a fire in 1691, and by thefts by the French soldiery in 1808, still contains 32,143 vols. and 4611 valuable MSS., including 1905 written in Arabic. In the palace the most interesting apartment is the cell of Philip II., in which he spent his last days. The Escorial was again greatly injured by fire in 1872.

Escort. See CONVOY.

Escrow. See DEED.

Escutcheon (Fr. *écusson*, in contradistinction to *écu*, an ordinary shield), in Heraldry, the shield on which arms are painted; also a small representation of the knightly shield used as an armorial charge, and generally reckoned among the subordinaries. The name inescutcheon in modern heraldry is used where there is more than one such charge. From the escutcheon as a charge must be distinguished the escutcheon *en surtout*, charged with some particular coat, and placed in the centre of a heraldic shield, which is much used in marshalling of arms in regal, continental, and Scottish heraldry. Such an escutcheon, placed with the arms of an heiress in the centre of her husband's coat, is known under the name of an escutcheon of pretence. The escutcheon of pretence used in this way is unknown out of Britain.

Esdraelon, or PLAIN OF JEZREEL, a broad valley of Palestine, constituting the basin of the Kishon, extends westwards from Mount Hermon to the slopes of the Carmel range. Although it was a flourishing and fertile region in antiquity, it fell in modern times out of cultivation, and so recently as 1867 was annually harried by Bedouins; now, however, it is once more in the highest state of cultivation. Here Gideon defeated the Midianites, and here in 1799 the Turks were defeated by the French. See Laurence Oliphant's *Haifa* (1887).

Esdras, BOOKS OF. The word *Esdras* is the Greek form of Ezra, and indicates that the books so named do not exist in Hebrew or Chaldee. What is now usually called 1st Esdras is in the oldest Greek texts also called 1st Esdras; what is there 2d Esdras being our canonical Ezra. The oldest form of our 2d Esdras, though originally written in Greek, is in Latin only. Hence it has been proposed to call our 1st Esdras the *Greek* Esdras, and our 2d the *Latin* Esdras. The Council of Trent, though recognising most of the Apocrypha as canonical, did not so regard either 1st or 2d Esdras of the Apocrypha (their 1st Esdras being Ezra, and their 2d, Nehemiah). Yet in the authoritative Roman Septuagint of 1587 1st Esdras stands *before* the canonical Ezra; and modern Vulgates print 1st and 2d Esdras along with the Prayer of Manasseh as a kind of separate appendix. In all the earlier editions of the English Bible the order of the Vulgate is followed. The Geneva Bible was the first to adopt the classification now used, according to which Ezra and Nehemiah give their names to two canonical books, and the two apocryphal become 1st and 2d Esdras; and in the sixth article of the Church of England 1st Esdras is called the 3d book of Esdras. As regards the *first* book of Esdras, it is for the most part a transcript —and not a very accurate one—of Ezra and a portion of Nehemiah, together with the last two chapters of 2d Chronicles. Josephus quotes it extensively in his *Antiquities*, even when it contradicts *Ezra* proper, a fact which indicates that it was highly valued by the Jews. The book seems to have been written rather with a hortatory than a purely historical aim, in order to stimulate to the more zealous keeping of the law. The author was probably a Jew, writing in Egypt possibly as early as 146 B.C., and certainly a century before Christ. The familiar phrase, *Magna est veritas et prævalebit* ('Truth is great, and will prevail'), is taken from the 41st verse of the 4th chapter of this book, where, however, the text reads *prævalet*. The *second* book of Esdras, or Revelation of Esdras, is wholly different in character from the first. It consists of a series of angelic visions and revelations made to Ezra regarding the mysteries of the moral world and the final triumph of the righteous. It might fairly be called the apocalypse of Ezra, had not Tischendorf published a later and inferior work under this title in 1866. The book is not all by one hand. The oldest part—chaps. iii.–xiv.—seems to have been written by a non-Christian Jew of Alexandria about 81–96 A.D.; while chaps. i. ii. xv. xvi. are the work of a Christian Jew of

Alexandria as late as 263 A.D. See Fritzsche's *Handbuch* to the Apocrypha; and Lupton in the *Speaker's Commentary* (1888).

Esenbeckia, a genus of Rutaceæ. The bark of *E. febrifuga* of Brazil was formerly used as a substitute for Cinchona.

Eserin, the alkaloid of the Calabar Bean (q.v.).

Esher, a pretty village of Surrey, on the Mole, 15 miles SW. of London by rail. Here are Esher Place, a brick gate-tower of Wolsey's palace, and Claremont (q.v.). Pop. of parish, 1993.

Esk (Cymric *wysg*, Gael. *uisge*, 'water,' akin to *Exe*), the name of several small Scotch rivers. The Dumfriesshire Esk, formed by the Black and White Esks (12 and 14 miles long), runs 22 miles south-south-eastward, next 5 furlongs along the Border, and lastly 8 miles south-south-westward through Cumberland, till it falls into the head of the Solway Firth. It passes Langholm and Longtown, receives the Tarras, Liddel, &c., and affords capital fishing.—The Edinburghshire Esk, formed by the North and South Esks (17 and 19 miles long), flows 4 miles northward to the Firth of Forth at Musselburgh. Its scenery is very pretty, the northern branch passing Habbie's Howe, Roslin, Hawthornden, and Melville Castle; the southern branch Dalhousie Castle and Newbattle Abbey; and the two uniting in Dalkeith Park. The fishing is recovering from the injurious effects of the paper-mills.—Of the two Forfarshire rivers, the South Esk runs 49 miles south-eastward and eastward to the North Sea at Montrose, and the North Esk 29 miles south-eastward (over the last 15 along the Kincardineshire boundary), until at a point 4 miles N. of Montrose it likewise falls into the North Sea. Both traverse fine scenery; both afford first-rate sport; and both give earl's titles to branches of the Carnegie family—Southesk (1633) and Northesk (1662).

Esker. See ÅSAR, and GLACIAL PERIOD.

Eski-Djumna, a town of Bulgaria, 20 miles WSW. of Shumla, with a noted fair in May. Pop. 10,038.

Eskimo, the name of a nation which constitutes the aboriginal inhabitants of the whole northern coast of the American continent down to 60° N. lat. on the west, and 55° on the east, and is spread over the Arctic Islands, Greenland, and about 400 miles of the nearest Asiatic coast. Only in the southern limits of the American Eskimo region do their abodes touch the northern limit of wooded land, while on the other side their tracks have been met with as far as Arctic discoverers have hitherto advanced towards the pole. They prefer, however, the vicinity of the seashore, from which they rarely withdraw more than 20, and hardly ever 80 miles. Their number is not ascertained with exactness, but it scarcely amounts to 40,000. Nevertheless they are scattered as the sole native occupants of regions stretching from east to west as far as 3200 miles in a straight line, to travel between the extreme points of which would necessitate a journey of no less than 5000 miles. This distance, taken in connection with their homogeneous nature and manners, makes their small bands the most thinly scattered people of the globe. Their extraordinary persistency in maintaining their language and habits must be due to the difficulties they have had to face in procuring subsistence where no other nation can live, and to the consequent obligation of preserving as a precious inheritance all the contrivances, and of maintaining the hardiness, developed by their ancestors during their first settling on the Arctic shores.

Eskimo Winter Station, Greenland.
(From a Drawing by the Author.)

As to their bodily form, they used to be classed most generally among nations of the Mongolian stock, but now they are considered by some almost as much akin to the American Indians, the coast tribes serving as an intermediate link. Their height nearly equals the average of the North-west Indians. They appear comparatively taller sitting than standing. Their hands and feet are small, their faces oval, but rather broad in the lower part; their skin is only slightly brown; they have coarse black hair and very little beard. The skull is high and mesaticephalic, with a tendency in some individuals to the dolichocephalic type.

Though occasionally they find food by pursuing the chase on land, and by fishing, the Eskimos get their subsistence mostly from hunting by sea, using for this purpose their skin-boats where the sea is open, and their dog-sledges on the ice. From the skin, blubber, and flesh of the seal and the cetaceous animals, they procure clothes, fuel, light, and food. Their most interesting as well as important invention for hunting is the well-known small skin-boat for one man, called a *kayak*. It is formed of a framework covered with skin, and, together with his waterproof jacket, it completely protects the man against the waves, so that he is able to rise unhurt by means of his paddle, even should he capsize. A Greenlander's kayak is almost 18 feet long and 2 feet broad, and can carry 200 lb. besides the man. The special weapon of the kayak is the large harpoon, connected by a line with an inflated bladder. The hunter throws it when but 25 feet from the seal, and at once drops the bladder overboard, thus retarding the speed of the wounded animal, which runs off with it until finally killed by a lance-thrust.

In winter the Eskimos are undoubtedly stationary in their habits. But during the summer, when sufficient open water is found, they roam about in their large skin-boats, the *umiaks*, which are from 25 to 37 feet long, 5 feet broad, and 2½ feet deep, and are capable of carrying from 1½ to 3 tons—

the tent, with all the necessary implements for the summer household.

The winter dwellings vary with regard to the materials of which they are built, as well as in their form. In the farthest west they are constructed mostly of planks, covered only with a layer of turf or sod; in Greenland the walls consist of stones and sod; in the central regions the houses are formed merely out of snow. In Alaska the interior is a square room, surrounded by the sleeping-places, with the entrance on one side, while a hearth with wood as fuel occupies the middle of the floor. In Greenland the room is heated only by lamps, and the sleeping-places or family stalls are arranged in a row occupying one of its sides. The house for this reason is lengthened proportionally to the number of its inhabitants. Nowadays, however, the houses are not made so long as formerly—a curious fact corresponding to the disuse of the Indian 'long houses,' and like it a result of contact with civilisation. In East Greenland, in the autumn of 1884, the isolated pagan tribe of Angmagsalik numbered 413 individuals, inhabiting thirteen houses, of which one had fifty-eight inmates; while on the semi-civilised west side, where formerly houses with fifty persons also were frequent, the average number has now sunk to ten persons per house. In Alaska, on the other hand, the wintering stations have communal buildings for common use and public assemblies, the so-called *kagses* and *kashim*. In East Greenland a house of ordinary size accommodated thirty-eight persons, divided into eight families, each having its part of the sleeping-bench assigned and separated from the next by a low curtain, but all comprised in the same one room of the whole dwelling, which was 28 feet long, 15 feet broad, and 6½ feet high along the ridge line. The number of inhabitants at an Eskimo station is most frequently under forty, but in rare cases more than two hundred are found. A funnel-shaped, half-underground passage forms the entrance of the narrow dwellings.

The *dress* is almost the same for women as for men, consisting of trousers or breeches and a tunic or coat fitting close to the body, and covering also the head by a prolongation that forms the hood. For women with children to carry, this hood is widened so as to make it an excellent cradle, the *amaut*. Tattooing has been general among all the tribes, but only in the west is found the curious custom of wearing labrets, or lip-ornaments of bone or stone, inserted in holes of the lip, pierced for the purpose. The ordinary materials of which clothes are made are the skins of seals, land animals, and birds. Besides these, the intestines of seals are utilised in manufacturing an outer clothing used for waterproof coats.

The Eskimo *language* exhibits in a high degree the polysynthetic structure of the American tongues, characterised by the power of expressing in one word a whole sentence in which are embodied a number of ideas which in other languages require separate words. This is effected by means of radical words, to which affixes or imperfect words are attached. The Greenland dictionary contains 1370 such radicals and about 200 affixes, of which from one to ten, rarely more, can be appended to one of the former. As far as a rough estimate seems to prove, in many cases a radical may in this way be made the foundation of, strange to say, many thousands of derivatives, and a word can be composed which expresses with perfect distinctness what in our civilised languages might require twenty words. In Greenland and Labrador the missionaries have adapted the Roman letters for reducing the native language to writing. The *printed* Greenland *literature*, including what has been published by the Moravian Brethren, amounts with pamphlets and the like to what might make seventy to eighty ordinary volumes. About half of it is of a religious character. A sort of journal has been published annually since 1861, containing many articles by native writers. The Labrador literature, as far as we know, contains about ten books. The two dialects, of course, show some difference, but probably less than, for instance, Danish and Swedish. A similar difference may prevail between the idioms of Greenland and Alaska, without rendering them mutually unintelligible. Works in which the Eskimo language is occasionally treated are numerous.

As to *sociology*, it is doubtful whether an organisation like that of the Indian 'families,' in a stricter sense, has been discovered among the Eskimos, although a tendency to it certainly may be traced. Its maintenance must probably have been found incompatible with the extraordinary dispersion and isolation of the race. But a division into tribes, each with their separate territories, is ascertained as actually existing. The tribe again is divided into groups constituting the inhabitants of the different wintering-places. Finally, in the same station, the inhabitants of the same house are closely united with regard to common housekeeping. In this, and perhaps similar ways, their general communism in living, characteristic of their stage of culture, is governed by rules for partnership in householding, for distribution of the daily game during the winter, and for the possessions of the individual, the family, the housemates, and the place-fellows. One of the oldest and most respectable men, called in Greenland *itok*, in Labrador *angajorkak*, is obeyed as chief of a house or wintering-place, although his authority, perhaps, may rest on tacit agreement only. In a similar way, more or less public assemblies constitute councils, and may be considered the courts of justice. Social organisation has been more highly developed in Alaska than in Greenland, altogether apart from the later European influence.

The inhabitants of Danish West Greenland, numbering about 10,000, the greater part of the Labradorians, and the Southern Alaska Eskimos are Christianised. As for the rest, the *religion* of the Eskimos is what is generally designated as Shamanism. According to the traditions of the Greenlanders, their heathen ancestors had a very distinct belief in the existence of the soul as independent of the body, and able to continue its existence after death. The souls of the deceased were venerated as guardian spirits of their surviving offspring, but besides them numbers of invisible rulers, called *inue*, or owners of things, filled the universe. The religious observances, with the aim of propitiating or calling for assistance on these supernatural powers, consisted of *serranek* ('prayer'), *kernainek* ('invoking'), and the use of amulets. Moreover, many regulations were observed concerning modes of life, fasting, abstinence, and sacrifices (*aitsuinek*). Some people were endowed with a peculiar skill (*nalussaerunek*, 'clairvoyance') in discerning the spiritual beings and influencing them. The highest stage of this kind of knowledge was that of the *Angakoks*, or Shamans, who invoked their guardian spirits (*tornat*) by means of *torninek* ('conjuring'). A supreme being, *tornarsuk*, ruler of the *tornat*, is also spoken of, but in very indistinct terms. In Alaska religious festivals, performed by large assemblies, and with the use of masks, were held in high esteem as a means of propitiating the invisible powers. The opposite of religious actions and angakok wisdom was *iliseenek* ('witchcraft'), also consisting without doubt in an application to

supernatural powers, but that secretly, for selfish purposes, to the detriment of others.

The Christianised natives still preserve their ancient folklore. It represents at the same time their original poetry, religious ideas, and history, praising the deeds of their great men in braving the dangers to which their race has been continually subjected. The *Tales and Traditions of the Eskimo* (Edin. 1875), collected and translated by the writer of this article, comprise a collection of 150 tales founded on versions supplied by about fifty narrators from different parts of Greenland, and a few from Labrador. A valuable collection has since been acquired from East Greenland, some tales from Baffin Land, and a number of the simplest fragments of the same from Behring Strait.

The name Eskimo is said to be formed by corruption out of an Indian word signifying 'eaters of raw meat.' They call themselves *Inuit*, in Greenland partly *Kaladlit*. Their origin most generally has been derived from Asia, but now they are believed by some to have come from the interior of America, and, following the river-courses, to have arrived at the Arctic Sea, where they have developed their abilities as an Arctic coast people. The writer is inclined to believe that this development has issued from the north-western corner of America, while others suggest that the same process has been going on around Hudson Bay too. In Alaska they almost appear to form a continuation of the North-west Indians—a gradual one, as towards the north and east they have become a more exclusively maritime and Arctic people; their relation to the inland people takes a decidedly hostile character, and murderous fights have been frequent on the borders of the Mackenzie and the Coppermine rivers. The Eskimos may now be divided into the following groups with a roughly estimated census: (1) The Western Eskimos, inhabiting the Alaska Territory and the Asiatic side of Behring Strait, rated at 13,200 souls; (2) the Mackenzie Eskimos, or Tchiglits, from Barter Island to Cape Bathurst, 2000; (3) the inhabitants of the central regions, including the Arctic Archipelago, 4000 (?); (4) the Labradorians, 2200; (5) the Greenlanders, upwards of 11,000. A side branch, moreover, inhabits the Aleutian Islands, numbering 2400; their habits and mode of life are almost like those of their Inuit neighbours, but their language, except its grammatical system, differs widely from the Eskimo.

As to the influence of the Europeans, the missionary work is mentioned above. In Greenland much care has been bestowed by the Danish government to avert the hurtful influence of contact with civilised strangers. But communism forms as essential an element in the native life as does even hunting, and, since the traditional obligations which counterbalanced its ill effects have fallen gradually into desuetude, the general result has been impoverishment. The curtailment of the houses mentioned above is owing to a rather ineffectual attempt by the natives themselves to escape this calamity.

See the article GREENLAND; also, for the books upon the Eskimo, Pilling's 116-page *Bibliography of the Eskimo Language* (Washington: Government Printing Office, 1888). Among the books enumerated therein may be selected those by Beachy, Craws. Dall, H. Egede, C. F. Hall, Parry, Petitot, Ray, J. Richardson, H. Rink, and J. Ross. Besides these may be mentioned two, not in Pilling, *Memoirs of Hans Hendrik, the Arctic Traveller*, translated from the Eskimo original by Dr H. Rink (Lond. 1878); also Dr H. Rink, *The Eskimo Tribes* (in English, Copenhagen and London, 1887).

Eskimo Dog, a half-tamed variety widely distributed in the Arctic regions, and indispensable for drawing the sledges. They are strong and powerful, like shepherds' dogs in form, with long black and white, brown, or dingy white hair.

Eskimo Dog.

Often ill fed and overworked, they retain much of the original wildness of their wolf ancestry, and are subject to an epidemic which kills them in large numbers, to the serious impoverishing of their owners.

Eski-Sagra, a town of South Bulgaria [Eastern Roumelia], at the southern base of the Balkans, 70 miles NNW. of Adrianople. It was almost destroyed during the Russo-Turkish war of 1877–78, and the population has dwindled from 20,000 to 10,000.

Esla, a river of Spain which rises in the Cantabrian Mountains, and flows SSW. through Leon, joining the Douro near the frontier, after a course of 150 miles.

Esmeraldas (Span., 'Emeralds'), the most northerly maritime province of Ecuador, with a climate hot, moist, and on the coast unhealthy, and still largely covered with dense forest. Area, 5200 sq. m.; pop. (1885) 11,146.—The capital, Esmeraldas (pop. 3000), stands 10 miles from the mouth of the river of the same name, which is navigable to this point for ships drawing 16 feet of water.

Esné (hieroglyphic *Sne*, Gr. *Latopolis*—'the city of the *Latus nobilis*'—the fish there worshipped) is a considerable town of Upper Egypt, and is situated on the left bank of the Nile, in 25° 15′ N. lat., 36 miles above Luxor. It contains about 7000 inhabitants, including many Copts and a large colony of dancing-girls, and has manufactories of fine cotton, shawls, and pottery. Indigo dyeing is a staple industry, and until the Egyptian troubles of 1881 and following years there was a considerable trade with the Soudan. The climate is considered particularly healthy, and invalids are frequently ordered there by the native doctors. The ancient temple, dedicated to the god Khnum, is buried beneath the accretions of the modern houses, except the noble portico or hypostyle hall, of 24 columns, four deep, which was excavated to the pavement by Mohammed Ali, to serve as a gunpowder cellar. Of the older temple behind nothing is known, but Champollion ascribed it to Thothmes III. The back of the portico of the temple of Khnum presents the name of Ptolemy Philometer; but the rest is more modern, and belongs to the time of the Cæsars. The sculptures are poor in design and execution. It has a Roman zodiac like that of Dendera, formerly thought to be of the most remote antiquity. A smaller temple, with a zodiac, erected in the reign of Ptolemy Euergetes, formerly stood at Ed-Deyr, 2½ miles N. of Esné, but has been destroyed. At Esné is also a stone quay bearing the name of M. Aurelius. This city

was the capital of a nome, and the coins struck in it in the reign of Hadrian, 127–128 A.D., represent the fish latus.—Champollion, *Not. Descr.*; Wilkinson, *Anc. Egyptians*; Mariette, *Mon. of Upper Egypt*; Lane-Poole, *Egypt*.

Esocidæ. See PIKE.

Esote'ric (Gr.) is a term derived from the ancient mysteries, in which it was applied to those doctrines that were designed for the initiated, in contradistinction to those that were imparted to the uninitiated, which were termed *exoteric*. It is now used in various relations of an analogous kind. For Esoteric Buddhism, see THEOSOPHY.

Espalier, a term borrowed from the French, and signifying a railing on which fruit-trees are trained as on a wall. Such railings are very variously constructed—sometimes of wood, sometimes of iron, sometimes of upright rails held together by a horizontal rail at top, sometimes chiefly of horizontal rails with upright posts for their support. Espaliers may be very conveniently and cheaply made of strong iron wire, sustained by upright iron or wooden posts, as in ordinary wire-fences. They vary in height from 4 to about 8 feet, according to situation and the size of the garden. On the Continent they are often constructed horizontally or at a more or less oblique angle to the sun at a few feet above the ground; but, although their introduction in this form into British gardens has been recommended by some writers, they have only been adopted here and there experimentally and with no satisfactory result. They have the advantage of securing the fruit in a great measure from the effect of winds, which often shake off great part of the crop of standard trees whilst still unripe; and owing to the full exposure to sun and air excellent fruit is produced, although there is no reflected heat as from a wall, which is therefore still superior. Espaliers are very common in gardens in Britain, and add at once to the beauty and the productiveness of a garden, the ground not being overshadowed as by standard trees, although, of course, the roots of the trees render it unsuitable for many crops to some distance on both sides of the espalier. Espaliers are often used to separate flower-borders from plots occupied by culinary vegetables. Apples and pears are considered more suitable for espaliers than any other kinds of fruit-trees commonly cultivated in Britain. The treatment is generally similar to that of wall trees, but the training is usually by horizontal branches. It is not unusual, when trees have become old and their branches thick and firm, to dispense with great part of the rails necessary in their earlier training.

Espartero, BALDOMERO, Duke of Vittoria, was born 27th February 1792, the son of a cartwright at Granatula, in La Mancha. He was intended for the priesthood, but in 1808, on the invasion of Spain by the French, he volunteered into the *Batallon Sagrado* ('Sacred Battalion') of students, and after the close of the war of independence in 1814 went to South America, where he fought against the insurgents, until Bolivar's great victory at Ayacucho in 1824 put an end to the Spanish rule on the American continent. In 1833 he declared for the succession of the daughter of Ferdinand VII., became in 1836 general-in-chief of the army in the north, viceroy of Navarre, and captain-general of the Basque provinces. Next year he drove the Carlists from before Madrid across the Ebro, defeated their forces at Lluchana and Burgos, and drove Don Carlos across the frontier into France. For his success Espartero was made Grandee of Spain and Duke of Vittoria. In 1840 the queen-mother Christina was compelled to resign her office of regent, and next year Espartero was appointed by the Cortes to supply her place until the queen (Isabella) should have reached her majority. He guided the helm of the state through socialist and Carlist troubles with energy, firmness, and ability, until a combination of the Republicans and the Moderados brought about his fall in 1843. He resided for four years in England, then, returning to Spain, lived quietly at Logroño from 1847 till 1854, when they again called Espartero to the head of the government. For two years he conducted the affairs of the nation; but in 1856 was supplanted by O'Donnell, and in 1857 resigned his dignity as senator. After the revolution of 1868, which resulted in the expulsion of Queen Isabella, Espartero gave his full and hearty support to the provisional government, though he took no part in their proceedings. In 1870 his name was put forward for the throne of Spain; but he soon withdrew it, and in 1875 tendered his adhesion to Alfonso. He died at Logroño, 9th January 1879. There is an elaborate Life by Florez (Madrid, 1843–45).

Esparto (*Stipa tenacissima*), a grass nearly allied to the well-known and beautiful Feather-grass (q.v.), a native of the south of Europe (especially Spain, between Alicante and Malaga) and North Africa (between Oran and Tripoli). From very ancient times it was used on both sides of the Mediterranean for the making of carpets, sandals, ropes, baskets, nets, and sacks, and as a substitute for horse-hair; but its chief application is now as a material in paper-making (see PAPER), for which it is mostly exported to Britain, which from all parts receives about 150,000 tons of esparto annually. The grass grows wild, requires little rain, and is pulled once a year; but two crops are taken in some parts of Spain, where it has also been the practice to pluck, not cut, the plant. It covers large areas from the seashore up to a considerable altitude, and accustoms itself to the poorest rocky and sandy soils. Its reckless and excessive exploitation, with the resultant injury alike to the supply and to the soil itself, has recently led to official inquiry and governmental regulation in Algeria, as already in Spain, and has also induced the extension of our knowledge of the whole life-history and relations, biological and economic, of this important plant. See Trabut, *Étude sur l'Halfa* (Algiers, 1889).

Esparto Grass (*Stipa tenacissima*).

The name esparto, the Spanish form of the Latin *Spartium*, as well as the Arabic name *halfa* now naturalised in French, is also applied, especially in Tunis and Tripoli, to another somewhat similar and related grass, *Lygium spartium*, more accurately known, however, in French as *Albardine* and in Arabic as *Sennoc*. A third grass, also of similar habit, uses, and distribution, is the Byss (*Ampelodesmos tenax*). In Egypt the name halfa is applied to *Eragrostis cynosuroides*, and in Fezzan to

Imperata cylindrica. Esparto is sometimes even confusedly applied to *Spartium junceum* and other leguminous plants. See BROOM.

Espinasse. See L'ESPINASSE.

Espinel, VINCENT DE, a Spanish poet and musician, was born at Ronda in Granada, 28th December 1551. He studied at Salamanca, and afterwards served as a soldier in Flanders, meeting with some of the adventures which he relates in his *Vida y Aventuras del Escudero Marcos de Obregon* (Madrid, 1618 and 1804; Eng. trans. by Langton, 1816), a book that was largely drawn upon by Lesage for his *Gil Blas*. Espinel afterwards returned to his native country, and took holy orders. Although holding the office of chaplain to the hospital at Ronda, he spent most of his time in Madrid, where he died in 1634. He was a friend of Lope de Vega. He also published a volume of poems (1591), chiefly lyrics, and a translation of the *Ars Poetica* of Horace. He was, if not the inventor, the improver of the ten-line octosyllabic stanza. Verses written in this form have, since his day, been called in Spain *espinelas*. Espinel was a performer on the guitar, to which he added the fifth string.

Espirito Santo, a small maritime state of Brazil, lying immediately to the north of the state of Rio Janeiro. Area, 17,312 sq. m.; pop. 121,562. The surface is mostly flat and swampy, the climate moist and hot, and the vegetation luxuriant. Sugar, coffee, cotton, and timber are exported, but the trade is not of much importance. The former capital, Espirito Santo, founded in 1535 on a bay of the same name, has sunk to a fishing-village; the present capital is Victoria, on the same bay.

Espiritu Santo (Span., 'Holy Spirit'), the largest and most westerly island of the New Hebrides, with an area of 1868 sq. m., and a pop. of 20,000. The soil is fertile, but the climate is unhealthy.—Espiritu Santo is also the name of an island in the Gulf of California, 30 miles N. of La Paz; of a cape of Tierra del Fuego, near the entrance to the Strait of Magellan; of the mountains separating Honduras and Guatemala; and of several other places in the old Spanish colonies.

Espy, JAMES POLLARD, meteorologist, born in Pennsylvania in 1785, practised law in Ohio, and was afterwards a classical teacher in the Franklin Institute of Pennsylvania. His theory of storms excited considerable attention at the time (see STORMS); and his work on the *Philosophy of Storms* (1841) was highly praised by the French Académie des Sciences. Appointed in 1843 to the Washington observatory, Espy there laid the basis of the Weather Bureau, which has since become an important branch of the War Department. He died 24th January 1860.

Esquimalt, a small port at the south end of Vancouver Island, on Juan de Fuca Strait. It is used as a British naval depôt. Pop. 614.

Esquimaux. See ESKIMO.

Esquire (Old Fr. *escuier*, 'a shield-bearer'), originally the shield-bearer or armour-bearer of a knight. A knight fully equipped was in the days of chivalry attended by two esquires, whose spurs were of silver, not of gold, like the knight's. And when the sovereign created esquires, silver spurs were placed on their heels, and collars of SS round their necks. It is difficult to define exactly who in strict law is now entitled to the designation esquire. A Gentleman (q.v.) is one who bears coat-armour (*insignia gentilitia*), but not every gentleman is an esquire. Blackstone quotes with approval Camden's definition of four classes of esquires: (1) 'The eldest sons of knights, and their eldest sons in perpetual succession. (2) The eldest sons of younger sons of peers, and their eldest sons in like perpetual succession; both which species of esquires Sir Henry Spelman entitles *armigeri natalitii*. (3) Esquires created by the king's letters-patent or other investiture, and their eldest sons. (4) Esquires by virtue of their offices, as justices of the peace, and others who bear any office of trust under the crown.' 'To these,' continues Blackstone, 'may be added the esquires of Knights of the Bath, each of whom constitutes three at his installation, and all foreign, nay Irish peers.' The mention by Blackstone of Irish peers arises from the fact that peers of Ireland were before the Union legally foreigners. Camden's third class no longer exists, creation by letters-patent or investiture having long ago ceased. Christian, in his notes to Blackstone, would limit the holders of 'offices of trust under the crown' to those who are styled esquires by the king in their commissions, and he remarks the omission in Blackstone's enumeration of barristers, who have been decided by the Court of King's Bench to be esquires by office. No esquires to Knights of the Bath have been appointed since 1812, and by the statutes of 1847 these knights have no longer the power to nominate them. It is needless to add that in common usage the designation of esquire is loosely given in the present day, both in Britain with its colonies and in the United States, to all persons supposed to be in comfortable circumstances.

Esquirol, JEAN ÉTIENNE DOMINIQUE, one of the greatest physicians for the insane, was born at Toulouse, 4th January 1772. He served in the military lazaretto at Narbonne in 1794, and was appointed physician to the Salpétrière at Paris in 1811. After 1817 he delivered clinical lectures on the diseases of the brain, and their cures; in 1818 his exertions secured the appointment of a commission, of which he became a member, for the remedy of abuses in mad-houses; in 1823 he became inspector-general of the University, and in 1825 first physician to the *Maison des Aliénés*, while managing his private asylum at Charenton. The July revolution deprived him of all his public offices, and he withdrew into private life. He died 12th December 1840. Esquirol's writings embrace all the questions connected with the treatment of insanity; his influence on the treatment of the insane has been very powerful for good, and most of the modern lunatic asylums in France have been built according to his advice. He published *Des Illusions chez les Aliénés* (1832) and *Des Maladies Mentales* (1838).

Esquiros, HENRI ALPHONSE, a French poet and politician, was born at Paris, 24th May 1814. At twenty he made his début with a volume of poems, which was followed by two romances, *Le Magicien* (1837) and *Charlotte Corday* (1840). His *Évangile du Peuple* (1840), a democratic commentary on the life of Jesus, cost him eight months' imprisonment and a fine of 500 francs, but gave him leisure and inspiration for his *Chants d'un Prisonnier*. His *Vierges Folles, Vierges Martyrs*, and *Vierges Sages* (1841–42) showed further his socialistic sympathies. After the revolution of February 1848, Esquiros was elected a member of the Legislative Assembly, but the *coup d'état* of 1851 drove him to England, where he gathered the materials for his *English at Home, Cornwall and its Coasts*, and *Religious Life in England*. Permitted by the amnesty of Napoleon III. to return to France, he was appointed supreme administrator of Bouches-du-Rhône by the government of the National Defence in 1870, next year was returned to the National Assembly, and in January 1875 was made a member of the senate, but died at Marseilles, 12th May 1876.

'Essays and Reviews,' the title of a remarkable volume published in 1860, containing the following seven papers: (1) 'The Education of the World,' by Dr Temple; (2) 'Bunsen's Biblical Researches,' by Dr Rowland Williams; (3) 'On the Study of the Evidences of Christianity,' by Professor Baden Powell; (4) 'The National Church,' by H. B. Wilson; (5) 'The Mosaic Cosmogony,' by C. W. Goodwin; (6) 'Tendencies of Religious Thought in England, 1688–1750,' by Mark Pattison; (7) 'The Interpretation of Scripture,' by Professor B. Jowett. All the writers, except Mr Goodwin, were clergymen of the Church of England, and their work, which was censured for its heterodox views by nearly all the bishops, and formally condemned by convocation in 1864, caused much excitement and controversy. Dr Williams and Mr Wilson were sentenced by the ecclesiastical courts to suspension for a year, but on appeal the sentence was reversed by the Privy-council; and Dr Temple's election to the see of Exeter in 1869 was also ineffectually opposed. The most important replies to the *Essays and Reviews* were those edited by Bishop Thomson (afterwards Archbishop of York) and by Bishop Wilberforce.

Essek, the capital of Slavonia, on the right bank of the Drave, 12 miles above its confluence with the Danube, and 189 S. of Pesth by rail. The Roman *Mursia*, and the seat of a bishopric since 335 A.D., it has a prosperous trade in corn, live-stock, wood, &c. Pop. (1890) 19,778.

Essen, a town in Rhenish Prussia, 22 miles by rail NE. of Düsseldorf, stands in the midst of a rich coal and iron district. It possesses numerous establishments for manufacturing iron, chief among them being the celebrated Krupp works and cannon-foundries, which employed 74 men in 1848, and 20,960 in 1888; in the same year there were in the Krupp works 1195 furnaces, 92 steam-hammers—some of great size—286 boilers, and 370 steam-engines, 2735 tons of coal and coke being used, and nearly 600 tons of iron produced in the works daily. Besides this great establishment, there are also manufactures of tobacco, walking-sticks, and vinegar, with dye-works and breweries. Pop. (1885) 65,074; (1890) 78,706. Although the industrial activity of Essen is recent, the town itself dates from the foundation of the Benedictine nunnery in 873. One of the churches of the place, also founded in the same year, presents several architectural features of interest.

Essence (Lat. *essentia*, from *esse*, 'to be'), as a philosophical term, the equivalent of the Greek *ousia*, was originally used in the same sense as *Substance* (q.v.). Later, substance came to be used for the undetermined substratum of a thing, essence for the qualities expressed in the definition of a thing; or, as Locke put it, 'Essence may be taken for the very being of a thing, whereby it is what it is.'—In Chemistry, and in popular parlance, essences are solutions of the essential oils in alcohol, and may be prepared (1) by adding rectified spirit to the odoriferous parts of plants, or to the essential oils, and distilling; or (2) simply by adding the essential oil to the rectified spirit, and agitating till a uniform mixture is obtained. Thus the essence of lemons is merely a solution of the volatile oil of lemons in rectified spirit. The term has, however, received a wider significance, and is applied to any liquid possessing the properties of the substance of which it professes to be the essence. Thus essences of coffee, beef, and rennet contain in a concentrated form the virtues of coffee, beef, and rennet, and in some circumstances may be substituted for them.

Essenes (*Essēnoi*, *Essaioi*), a small religious fraternity among the Jews, whose name and origin, as well as character and history, are alike involved in obscurity. The Essenes bore one of the most momentous parts in the development of Judaism. Christianity stands in so close connection with them that John the Baptist and Christ himself have by some been pronounced to have issued from their ranks; and Islam still bears traces of an original connection. Josephus, Philo, Pliny, Eusebius, and the Fathers generally were long considered the sources, and the only sources, from which the genuine history of this fraternity could be deduced. Strange that for so many centuries the real and genuine sources—the Talmudical writings—should never have been thought of. These, together with Josephus and Philo, Pliny, Makrisi, and Abulfaraj, better enable us to form an idea of the real state of this community. Exception must be taken to the opening statement of Josephus, that there were three different 'sects' among the Jews—the Pharisees, the Sadducees, and the Essenes. The Sadducees were a political party, nothing more or less; and the Pharisees, forming as they did the bulk of the nation, cannot rightly be called a *sect*. Least of all were the Essenes such. They were Pharisees of stronger convictions, and carried out the Pharisaic views with a consistency which made them ridiculous even in the eyes of their own mother-party. The comparatively modern name of Essenes may be derived either from a Chaldee word *sacha*, meaning 'bathers' or 'baptists,' or from *asa*, meaning 'healers.' The Mishna, Beraitha, and Talmud speak of these advanced Pharisees in general as Chasidim (*Asidaioi*, 'pious men'), Nazirim ('abstinents'), and Toblé Shachārith ('hemerobaptists').

The Nazirim, a kind of voluntary priesthood, enjoining abstinence from wine, flesh, and other sensual enjoyments, had in the troublous times of anti-Syrian agitation, and the general upheaving of society, found numerous adherents; and gradually there sprang up a host of men calling themselves 'Nazirs for ever' (*Nazire olam*). Pharisees of a spiritual and contemplative bias took this vow of Nazirship for life, and constituted themselves into a sort of religious club. Levitical purity in its strictest and highest sense made them draw closer and closer the innumerable 'fences' which the traditional law had erected round the Biblical law. Thus it became necessary, or at least expedient, that those among them who could break all ties of friendship and family should retire into a solitude not easily approachable by a stranger to their community. Food, again, could not be prepared save by those of the brethren who knew and strictly obeyed the hyper-traditional injunctions. Their dress, every implement of daily use, had to be made under similarly stringent laws of purity. A natural consequence of this their exalted notion of outward priesthood was their general celibacy. In this state of voluntary isolation, trading was out of the question: they tilled the ground, and lived on the fruits of the earth. Taking their meals, and these of the coarsest and plainest description, in common, they idealised the table into an altar, and, prayer having been said, they remained standing silently round it during the repast. That they had no individual property follows of course, and their communistic motto, which the Mishna (Aboth) has preserved to us—'Mine is thine, and thine is mine'—explains itself. We need not enlarge further on their small eccentricities—on the white linen garment, the apron, the scoop or shovel; they are one and all signs and symbols of Levitical purity. Every morning they bathed, like the priests who ministered in the temple, in pure spring-water. They abhorred blood as a source of impurity, and for this reason, probably, some of them abstained

also from going up to the temple, where sacrifices were daily offered; others we find present at a festival in the temple (Succah, 51, 53). But these were but outward signs of purity, stepping-stones to inner piety, to communion with God, which was only to be acquired, according to their notion, by solitude and an ascetic life. The belief in the efficacy of the most rigid simplicity and willing self-sacrifice they held in common with the Pharisees; their horror of oaths, their frequent prayers, their occupation with mystical doctrine were their own. Untroubled by the noise of war or the strife of parties, leading a life divided between ablutions, contemplation, and prayer, despising the body and bodily wants—what more natural than that by degrees they should be led into a kind of mystical enthusiasm and fanaticism? They allegorised, they symbolised; and their efforts culminated in seeing the unseen.

Angelology, derived from the Magi, formed a prominent feature of their creed. In course of time, they were looked upon by the vulgar as saints and workers of miracles: they cast out demons, and healed the sick. Jehovah is the original light; from him proceed a number of spirits, and at their head stands the Wisdom, or *Logos*, into which, after death, the soul is again absorbed. Their code of ethics was threefold—the love of God, of virtue, and of man, their scale of perfectibility reaching its acme in the communion with the Holy Spirit—*Ruach Hakodesh* (Mishn. Sota, 99). In fine, mixing up, in the strangest manner, the most exalted and the most puerile notions, they became the forerunners of the Christian Gnostics and of the Jewish Cabbalists. One fragment of their literature alone remains; it is quoted in the Talmud (Jerusch. Berachoth) in the following words: 'It is written in the book of the *Chasidim*, If thou leavest it (the divine law) for one day, it will leave thee for two.'

They seem never to have numbered more than four thousand, including even those Nazirs or Essenes who remained in their own families. Their colony appears to have been established chiefly near the Dead Sea, and it is undoubtedly this colony which has served Josephus as a basis for his romantic Essene republic. But, however distant from each other they might be, a constant intercommunication was kept up through a body of delegates, or angels (Malachim). As they had sprung from the Pharisees, so they again merged into them; the remaining part became Therapeutæ, or Christians. The Talmud gives a distinct account of their ceasing to exist as a separate community (Bechorot, 27).

See the Talmud, the Midrash, Josephus, Philo; the histories of the Jews by Ewald and Grätz; Sprenger, *Leben Mohammads* (1861); Reuss, *La Théologie Chrétienne;* Keim, *Jesus of Nazara;* Lightfoot on the Colossians; Zeller, who, in his *Philosophie der Griechen*, makes them indirectly influenced by non-Jewish, neo-Pythagorean doctrines; Lucius, *Der Essenismus* (Strasburg, 1881).

Essential Oils. See OILS.

Essequi'bo, the most westerly of the great rivers of British Guiana, rises in the Acarai Mountains, 46 miles N. of the equator, and after a course of 620 miles enters the Atlantic, forming an estuary 15 miles wide, in which lie numerous fertile islands. The entrance to the river is rendered difficult owing to the sand and mud collected at its mouth; its course, which is through magnificent forest scenery, is much broken by cataracts, and it is navigable for 35 miles only. It receives a number of large tributaries, as the Rupununi, and the united Cuyuni and Mazaruni; on the Potaro, another affluent, is the grand Kaieteur Fall, 741 feet in sheer descent, discovered in 1870. The county of Essequibo, lying to the west of the river, has a coast-line of about 120 miles, nearly to the mouth of the Orinoco.

Essex, a maritime county in the east of England, washed by the North Sea, and separated from Kent by the Thames estuary, from Suffolk by the Stour. Measuring 57 miles from east to west, and 44 from north to south, it has an area of 1657 sq. m. The low flat sea-board is close on 100 miles long, deeply indented by shallow creeks, and much of it fringed by the desolate salt-marshes described so well in Baring-Gould's *Mehalah*. Inland the surface becomes gently undulating or even hilly, the principal eminences being Danbury Hill (600 feet), Laindon Hill (620), and High Beech (759). The rivers are the Thames, Stour, Lea, Stort, Colne, Blackwater, Crouch, Roding, and Chelmer —rivers that sometimes flood the low-lying lands, as notably in the summer of 1888. Four years before, an earthquake, proceeding from north-east to south-west, did almost £10,000 damage. Chiefly occupied by the stiff London clay, but with chalk in the north-west, and crag near Harwich, Essex offers a great variety of soil. Nearly 79 per cent. of the entire area is in cultivation; and as Essex is more than most counties purely agricultural, so it has suffered more than most through the agricultural depression, 21,472 acres being thrown on the landlords' hands in 1887. Epping Forest (q.v.) is a mere remnant of the once wide woodlands, whose total area throughout the whole county is now reduced to less than 44 sq. m. Fishing is prosecuted, though not very actively; and the Colne has long been famous for its oysters. Brewing is an important industry, especially at Romford; but outside of the metropolitan area there are no great manufactures. Essex since 1877 has been included in the new diocese of St Albans, and since 1885 has returned one member to parliament for each of its eight divisions—South-west or Walthamstow, South or Romford, West or Epping, North or Saffron Walden, North-east or Harwich, East or Maldon, South-east, and Mid or Chelmsford. The County Council consists of eighty-four members. Chelmsford is the county town; and towns other than the above are Colchester, Stratford, Barking, Braintree, Brentwood, Coggeshall, Dunmow, Halstead, Harlow, Ilford, Ongar, Witham. Pop. (1801) 227,682; (1841) 344,979; (1881) 576,434; (1891) 785,399. Essex, named after the East Saxons, has little history apart from Colchester (q.v.); its only battlefield is Ashingdon (Assandun). The palaces of Havering and Theobalds are no more; but the Norman keep of Castle Hedingham still stands, and Audley End, a splendid Jacobean mansion. Old halls too are plentiful; and there are ruins of more than a dozen monastic houses. Of Essex worthies the chief have been Tusser, John Ray, Quarles, Sydney Smith, and Isaac Taylor. See the county histories of Morant (2 vols. 1768) and Suckling (1845); also E. Walford's *Guide to Essex* (1882).

Essex, EARL OF, a title conferred in 1572 on Walter Devereux (1541–76), scion of a very old Herefordshire house, the daring but luckless coloniser of Ulster. The title had been previously borne by the Mandevilles, the Bohuns, the Bourchiers (Devereux's ancestors), and by Thomas Cromwell (q.v.).

ROBERT DEVEREUX, Walter's eldest son and successor, was born at Netherwood, near Bromyard, on 10th November 1567, at nine was sent by Burghley, his guardian, to Trinity College, Cambridge, and at thirteen got his M.A. He had been taken to court the Christmas of 1577; in 1580 Leicester had become his step-father; and under Leicester he first saw service in the Netherlands (1585-86), for his valour at Zutphen being made a

knight-banneret. Back at court, the young gallant quickly won the 'singular countenance' of the elderly queen. In the words of his college-friend Bagot, 'when she is abroad, nobody near her but my L. of Essex; and at night my Lord is at cards or one game or another with her, that he cometh not to his own lodging till birds sing in the morning.' There were tiffs between them, over his bickerings with Raleigh, his duel with Blount, his stealing off to fight in Portugal, moneys lent by Elizabeth, his favouring of Puritanism, and, worst of all, his clandestine marriage in 1590 with Walsingham's daughter, Sir Philip Sidney's widow. Ere long, however, he was once more 'in very good favour,' and in 1591 commanded the forces despatched to help Henry IV. in Normandy against the League; in 1593 was sworn a privy-councillor; and by 1594, thanks to Bacon, who made him his stalking-horse, was acting as a sort of foreign secretary. His was the principal glory of the brilliant capture of Cadiz (1596); but his, too, largely the failure next year of the 'Islands Voyage' (see RALEIGH). In 1597 Essex became Earl Marshal, in 1598 Chancellor of Cambridge; but meanwhile occurred his great quarrel with Elizabeth, when he turned his back on her, exclaiming that her conditions were as crooked as her carcass. A box on the ear and 'Go and be hanged' was her answer; and, clapping hand to sword, Essex vowed he would never put up with so great an indignity. They never were properly reconciled. His six months' lord-lieutenancy of Ireland proved an utter fiasco; his army of sixteen thousand dwindled to barely four; and, concluding a truce with the arch-rebel Tyrone, he hurried back to England, and burst into Elizabeth's bedchamber. She received him not ungraciously at first; still, imprisonment followed, and deprivation of all his dignities. And now he formed the mad plot for removing Elizabeth's counsellors, in pursuance of which, on Sunday, 8th February 1601, he attempted vainly to raise the city of London. On the 19th he was found guilty of high-treason, on the 25th beheaded in the Tower. Elizabeth signed his death-warrant reluctantly; but the story of the ring, given him by the queen for a safeguard, but kept back by the Countess of Nottingham, is an invention of fifty years afterwards. A patron of letters, Essex was himself a sonneteer; and Cooper's *Athenæ Cantabrigienses* (1861) gives a longish list of his writings. See the authorities cited there and in our articles BACON and ELIZABETH.

ROBERT DEVEREUX, eldest son of the preceding, was born in January 1591, and in 1604, soon after James I.'s accession, was restored in blood as third Earl of Essex. When just fifteen, he was married to a daughter of the Earl of Suffolk, but during his two years' travels on the Continent (1607–9) she and Carr fell in love with each other, and Carr, on getting a divorce, she married (1613). Essex's own second marriage (1631) was almost as unhappy as the first. From 1626 he had attached himself to the popular party, and the Long Parliament brought him to the front; in July 1642, withstanding all Charles's blandishments, he received the command of the parliamentary army. A dull, worthy soul, a striking contrast to his brilliant sire, he was brave enough personally, but a very poor general; and to his hesitancy and inactivity the prolongation of the war was largely due. The drawn battle of Edgehill, the capture of Reading, and the relief of Gloucester were followed by his blundering march into Cornwall, whence he himself fled by sea. On 2d April 1646 he resigned the command, and on 14th September he died. The title died with him; but in 1661 it was revived in favour of Arthur, second Lord Capell (1635–83), the ancestor of the present earl. See works cited at CHARLES I., and Walter Bourchier Devereux's *Lives of the Devereux, Earls of Essex* (2 vols. 1853).

Esslingen, a manufacturing town of Würtemberg, on the Neckar, in the centre of a pleasing and fertile district, 9 miles by rail ESE. of Stuttgart. It consists of the inner town, which retains much of its old walls and towers, and of several suburbs, embosomed in gardens and vineyards. The chief buildings are the old citadel, the Liebfrauen Church (1440)—a splendid Gothic edifice, with a beautiful spire 246 feet high—the old (1430) town-house, and the new (1742). It has the greatest machine-shops in the kingdom, a lithographic establishment, and manufactures of a wine called Esslingen champagne, of woollens, of cotton and woollen yarns, lackered iron, silver-plate, and tin wares, with a good trade in wine and fruit. Pop. (1875) 19,602; (1890) 22,134. Esslingen was founded in the 8th century, and received in 1209 the rights of a free city of the German empire. During the 15th century it was engaged in a bitter contest with the counts and dukes of Würtemberg. In 1802 the town, with its territory, was assigned to the duchy of Würtemberg.

Essouan. See ASSOUAN.

Established Church. See ENGLAND (CHURCH OF); SCOTLAND (CHURCH HISTORY); and for the question of the duty of the state towards religion, see STATE RELIGION, VOLUNTARYISM, &c.

Estaing, CHARLES HECTOR THÉODAT, COMTE D', naval officer, was born in Auvergne in 1729, became brigadier in 1756, and afterwards served in the East Indies with Lally. In 1778, as vice-admiral, he sailed with sixteen vessels to co-operate with the colonists against the British. He captured St Vincent and Grenada in 1779, but his efforts on the mainland were uniformly unfortunate; and in 1780 he returned, severely wounded, to France, where he persuaded the ministry to send 6000 men to the colonists' aid. His loyalty to the royal family, and especially to the queen, outweighed his services to his country, and he was guillotined in Paris, 28th April 1794.

Estate, in the law of England, is the state or legal relation in which a person stands to his property, or, in other words, the quantity of interest he has in it. The first division of estates is into legal and equitable. By the former is signified the estate which a man has by the common law; by the latter, the interest which has been created by the operation of a court of equity (see EQUITY, USES, TRUST). Estates in land may be considered with reference to the quantity of the estate, the time of enjoyment, and the number of persons who may unite in the enjoyment. Under the first head, estates are either freehold or less than freehold. Freehold estates, again, are divided into freeholds of inheritance, or Fees (q.v.), and freeholds not of inheritance, or for life. An estate for life may be for the life of the person to whom it is granted, or for that of another person, or for more than one life. A person holding an estate for the life of another is called tenant *pur autre vie*. An estate *pur autre vie* granted to a man and his heirs descends, in case of the death of the tenant intestate, during the life for which he holds to his heir. An estate by the courtesy of England, and an estate in dower, are estates for life. A conveyance by deed to A. B., without words giving him an estate of inheritance, makes the grantee tenant for life. An estate to a woman during her widowhood, or to a man until the occurrence of a specified event, as till he receive a benefice, will be construed to be an estate for life, but the estate is determinable on the event happening. Tenants for life are entitled to take Estovers (q.v.), but

they must not commit Waste (q.v.). The representatives of a tenant for life are also usually entitled to take the emblements on the expiry of the term. Estates less than freehold are called also chattels real. This species of estate, on the death of the tenant, passes, like other Chattels (q.v.), to the executor, and not to the heir. They are divided into estates for years, estates at will, and estates on sufferance (see LEASES). Estates, with reference to the time of their enjoyment, may be either in possession or in expectancy. An estate in possession comprehends not only an estate in the actual occupation of the tenant, but one from which he has been wrongfully ousted. In this latter case the law regards the rightful tenant as having the actual estate, to which is attached the right of entry. An estate in expectancy may be either in Reversion (q.v.) or Remainder (q.v.). Estates of this character form a large portion of the rights to land in England, and are the subject of some of the most subtle learning of the English law. With reference to the number of persons entitled to the enjoyment, estates may be in severalty, in joint-tenancy, in co-parcenary, or in common. An estate in severalty is where the sole right to the estate is in a single person. See CO-PARCENARY, LAND-LAWS, REAL, SEVERALTY, TENURE.

Estates of the Realm. The three estates of the realm are not King, Lords, and Commons, as is popularly believed, but the Lords, the Clergy or Spiritualty, and the Commons, which estates, together with the king or queen, form the parliament of the United Kingdom of Great Britain and Ireland. (For an apology for the common error, see Lister's *Life of Clarendon*, vol. i. p. 190–196; see also the article PARLIAMENT.) The ancient parliament of Scotland consisted of the king and the three estates of the kingdom, by which latter was meant—(1) the archbishops, bishops, abbots, and mitred priors; (2) the barons, under which head were comprehended not only the nobility, but the commissioners of shires and stewartries; and (3) the commissioners from the royal burghs. In Sir David Lindsay's *Satire of the Thrie Estaitis*, it is before Spiritualitie, Temporalitie (landholders), and Burgesses that Johne the Common Weile makes his complaint. The expression *Fourth Estate* for the newspapers is ascribed by Carlyle to Edmund Burke, who said that in the reporters' gallery there was a fourth estate more powerful than any of the other three. In France the nobles, the clergy, and the third estate (*tiers état*) remained separate down to 1789 (see FRANCE); in England the greater clergy became Lords Spiritual, the lesser clergy became, for political purposes, part of the Commons, and parliament was organised in two houses. In Sweden there were, till 1866, four estates or houses—nobles, clergy, citizens, and peasants.

Estate Tail. See ENTAIL.

Es'te (ancient *Ateste*), a town of Italy, on the southern slope of the Euganean Hills, 17 miles SSW. of Padua. It is an old place, with a decidedly Lombard appearance, many of the houses being supported by arches. Its most interesting buildings are the *Rocca*, or castle, overhanging the town, and a Romanesque church, surmounted by a leaning campanile. Este has some manufactures of porcelain and faience wares. Pop. 5979.

Es'te, one of the oldest and most illustrious families of Italy, possibly of Langobard origin, whose heads from an early date ranked as keepers of the marches of upper Italy, and afterwards received from the emperors several districts and counties, to be held as fiefs of the empire. In 1097 the family divided into two branches, the German and Italian. The former was founded by Welf IV., who had received the investiture of the duchy of Bavaria from the Emperor Henry IV. in 1070. From him are descended the Houses of Brunswick and Hanover, and consequently the sovereigns of Great Britain, also called Este-Guelphs (see GUELPHS). The Italian branch was founded by Welf's brother, Fulco I.; and for several centuries the history of the Este family as heads of the Guelph party is interwoven with the destinies of the other ruling families and small republics of Northern Italy. During this period they first gained possession of Ferrara and the march of Ancona, and afterwards of Modena and Reggio, and were widely celebrated as the patrons of art and literature. Among the most illustrious members of the family was Alfonso I. (died 1535), equally distinguished as a soldier and a statesman, and celebrated by all the poets of his time, particularly by Ariosto. His second wife was the notorious Lucrezia Borgia. A quarrel with the Popes Julius II. and Leo X. brought about the forfeiture of his papal fiefs, which were restored by Charles V. after the siege of Rome in 1527. His successor, Ercole II., who married Renate, daughter of Louis XII. of France and Anne of Brittany, attached himself to Charles V. His brother, a dignitary of the Catholic Church, erected the magnificent Villa d'Este at Tivoli. The next prince, Alfonso II. (died 1597), would have been noways inferior to the preceding but for his immoderate love of splendour, his inordinate ambition, and the cruelty he displayed towards the poet Tasso. Rinaldo (died 1737), by his marriage with Charlotte of Brunswick, united the German and Italian houses, separated since 1070. The male line of the House of Este became extinct on the death of Ercole III. in 1803, whose only daughter married the Archduke Ferdinand, third son of Francis I. of Austria. Their eldest son, Francis IV., by the treaty of 1814–15, was restored to the duchy of Modena, and on his mother's death obtained the duchies of Massa and Carrara. He was succeeded in 1846 by his son, Francis V., who in 1859 was obliged to resign his territories to Victor Emmanuel. With the death of Francis V. in 1871 the Austrian branch also became extinct.

Estella, an ancient city of Spain, in the province of Navarre, on the Ega, 27 miles SW. of Pamplona. Pop. 6749. Here Don Carlos was proclaimed king in 1833; and Estella was again the Carlist headquarters from 1871 to 1876.

Estepa, a town of Spain, 60 miles ESE. of Seville. Pop. 8190.

Estepona, a maritime town of Spain, 26 miles NNE. of Gibraltar. It supplies Gibraltar with fruits and vegetables. Pop. 9994.

Esterházy de Galantha, one of the most powerful families of Hungary, raised in the 17th century to the rank of princes of the empire, the representative of which is at present one of the greatest landed proprietors in Austria. The family divided into three main branches—the Csesznek, Altsohl or Zolyom, and Fraknó or Forchtenstein lines. Count Paul Esterházy of Fraknó (1635–1713) served in the Austrian army with such distinction as to gain a field-marshal's baton at the age of thirty, and for his successes against the Turks, and still more for his support of the House of Hapsburg, was made a prince of the empire in 1687. A descendant, Prince Nicholas IV. (1765–1833), founded the splendid collection of pictures at Vienna, and by this and other expenses brought his vast estates into sequestration. When Napoleon, in 1809, entertained the notion of weakening Austria by the separation of Hungary, he made overtures to Prince Esterházy respecting the crown of Hungary, which, however, were declined. His son, Prince

Paul Anton (1786–1866), entered at an early age on a diplomatic career, and represented the Austrian government at London until 1842. In 1848 he was for some time Minister of Foreign Affairs under Batthyanyi. He added greatly, by his profusion, to the burdens imposed on the family property. The Esterházy estates include 29 lordships, with 21 castles, 60 market-towns, and 414 villages in Hungary, besides lordships in Lower Austria, and a county in Bavaria; but until its liabilities have been met, the family receives from its vast possessions only a limited yearly rental.

Esther, THE BOOK OF, relates how a Jewish virgin Hadassah (Heb. 'myrtle'), or Esther (Pers. 'star'), who was a foster-daughter of Mordecai, was chosen by the Persian king Ahasuerus (Xerxes) as his wife in room of the disgraced queen Vashti, and brought about the great deliverance of her people which is commemorated in the Feast of Purim ('lots'). Haman, the king's prime-minister, had issued a decree for the extirpation of all the Jews, and had prepared to hang Mordecai; but Mordecai, who had formerly detected a conspiracy against the king's life, was raised to great honour, and Haman was hanged on the gallows 50 cubits high that he had prepared for Mordecai. After this Esther, at Mordecai's instance, revealed her Hebrew lineage, and prevailed upon the king to counteract the former edict by another permitting the Jews everywhere to destroy their enemies. The Book of Esther stands alone among the Hebrew Scriptures as an expression of the uncompromising spirit of Hebrew nationality, containing hardly a trace of religious feeling. The name of God is not once mentioned, while the great king of Persia is referred to nearly 200 times. A possible explanation is the fact that the book was meant to be read at the merry revels of the Purim festival. It has continued in constant use and favour among the Jews, and of the five Hagiographical rolls it is called emphatically 'The Roll' (*Megillah*). The author is quite unknown, and the date is probably the latest Persian or the earliest Greek period. It has been much disputed whether the Book of Esther contains authentic history, or only 'the Legend of the Feast of Purim' (Reuss). It was discredited by such early Christian writers as Melito of Sardis in the 2d century, and Athanasius, Gregory of Nazianzus, and Amphilochius of Iconium in the 4th century. Luther, in his *De Servo Arbitrio*, says: 'Though they have this book in the canon, in my judgment it deserves more than all to be excluded from the canon;' and in his *Table-talk* he says: 'I am so hostile to the book that I would it were not in existence, for it Judaises too much, and hath a great deal of heathenish naughtiness.' There are two Greek versions of the Book of Esther, containing a multitude of interpolations and additions, the earlier of which, it is clear, was known to Josephus. They are printed together in Usher's *De Græca LXX. Interpretum versione* (Lond. 1655), and in O. F. Fritzsche's *Libri Estheræ græci textus duplex* (Zurich, 1848), and *Libri Apocryphi Veteris Testamenti græce* (1871). In Jerome's translation all the Greek additions are placed at the end, and marked with an *obelus*. Hence in our Bibles they do not appear, being relegated to the Apocrypha. The story of Esther afforded a subject for the genius of Handel and of Racine.

See Zunz, *Die Gottesdienstliche Vorträge der Juden* (1832); Fritzsche, *Exegetisches Handbuch zu den Apokryphen* (1851); Oppert, *Commentaire du Livre d'Esther* (1864); Langen, *Die deuterokanonischen Stücke des Buches Esther* (1862); and the commentaries by Bertheau (1862), Keil (1878), F. W. Schultz (1876), and Cassel (1878 *et seq.*). See ARABIAN NIGHTS; and the too ingenious *Hellenistische Bestandteile im biblischum Schriftum* (Vienna, 1882), by J. S. Bloch.

Esthonia, called by the natives Wiroma, the most northerly of the Baltic provinces of Russia, is bounded E. by the river Narova, S. by Livonia, W. and N. by the Baltic, with an area of 7818 sq. m. It constitutes a broad flat ridge extending from west to east, with a very gentle slope towards Livonia, but a terrace-like steeper declivity next the Gulf of Finland. A large part of the surface is covered with forests, moors, and small lakes; rivers are numerous, but mostly small and sluggish in flow; erratic boulders of granite are common everywhere. The climate is changeable, and often very hot in summer and very cold in winter. Agriculture is the chief occupation of the people, the principal crops being rye, oats, barley, and potatoes. The coastal waters are rich in fish, especially anchovies. A large quantity of brandy is made, and some cotton spun and wool woven. The chief town is Revel (q.v.), the principal port. The population (387,085 in 1885) consists of two divisions, the Esths and the Esthlanders. The latter are a mixed race of immigrants, the German element strongly preponderating. German, which was until quite recently the official language and the language of the educated classes, is now being superseded by Russian, the use of the latter tongue having been made compulsory in all places of instruction by a decree of May 1887. The Esths, a people of Finnish race, constitute the peasantry, some 290,000 in number, and the original possessors of the soil. About 440,000 of this people are also found in Livonia, and 11,500 more in the governments of St Petersburg, Pskov, and Vitebsk. In spite of six centuries of slavery to their German lords, the Esths have preserved their national characteristics almost unaltered—language, customs, clothing, dwelling, physical attributes. There are two principal dialects, Dorpat and Revel Esthonian, which differ considerably. The people have a well-supported newspaper press, and excellent national songs, closely resembling those of the *Kalevala*. See Neuss, *Esthnische Volkslieder* (Revel, 1850–52, and St Petersburg, 1854); *Kalewi Poëg*, edited by Kreutzwald (Dorpat, 1857); and Jannsen's *Estnische Märchen* (1881–88). In religion they are mostly Lutherans, though the Russians are making strenuous efforts to bring them over to the Greek Church; superstitious beliefs are widely prevalent. Esthonia was conquered by Waldemar II. of Denmark in 1219; but in 1346 it was sold to the Teutonic Knights, and incorporated with Livonia. From 1561 it belonged to Sweden, until in 1710 it was seized by Peter the Great, who definitively united it to his own dominions by the treaty of Nystad in 1721. Serfdom was abolished in Livonia in 1816, and in Esthonia in 1819.

Estienne. See STEPHENS.

Estoile, or STAR, in Heraldry, is distinguished from the Mullet (q.v.) by having six waved points, while the latter consists of five plain points.

Estoppel, a conclusive admission, which cannot be denied or controverted by the party whom it affects. Coke says that it is so called 'because a man's own act or acceptance stoppeth or closeth up his mouth to allege or plead the truth.' Estoppels are usually divided into three kinds—(1) By matter of record, where any judgment has been given in a court of record, the parties to the suit are estopped from afterwards alleging such matters as would be contradictory to the record. Where the judgment is wrongfully signed, the remedy is to apply to the court to set it aside. (2) By matter in writing. Thus, a party who has executed a deed will be precluded from afterwards denying, in any action brought upon that instrument, the fact of which it is evidence. (3) By matter in *pays*, as by acceptance of an estate, where e.g. a tenant cannot

dispute his landlord's title, or, a licensee of a patent is estopped from denying the patentee's right to the patent. Besides these, some other modern rules are referred to the doctrine of estoppel. Where a man's misrepresentation or negligence induces in another a belief in the existence of a certain state of facts, and action is taken upon that belief, the person guilty of misrepresentation or negligence is estopped or barred from denying the existence of that state of facts. Thus, the acceptor of a bill of exchange is barred from denying the handwriting of the drawer; and, where a person draws a cheque in so careless a way that the amount may be easily changed, he is estopped by his own negligence from suing his banker for paying any so increased amount. There is, further, equitable estoppel, or estoppel by acquiescence, where a person, by tacitly representing his own position to be more favourable to another than it is, has induced that other to act on the belief that the representation is true. The doctrine of estoppel prevails in America as well as in England. In Scotland, also, the same principle is recognised, under the name of Personal Exception (q.v.). See Michael Cababé, *The Principles of Estoppel* (1889).

Esto'ver, the right which a tenant has to take a reasonable portion of the wood on an estate for certain definite purposes. Estovers, or *botes* (Saxon), are of three kinds—housebote, which is twofold—viz. *estoverium œdificandi et ardendi*, a right to wood for fuel and repairs of the house; ploughbote, *estoverium arandi*, wood for repairing instruments of husbandry; and haybote, *estoverium claudendi*, wood for repairing hedges and fences.

Estrays. See POUND.

Estreat (Lat. *extractum*), in English law, a true extract copy or note of some original writing or record, and specially of fines or amercements, as entered in the rolls of a court, to be levied by bailiffs or other officers. When, however, it is applied to a Recognisance (q.v.), it signifies that the recognisance itself is estreated for execution. If the condition of a recognisance be broken, the recognisance is forfeited; and on its being estreated the parties become debtors to the crown for the sums in which they are bound.

Estrées, GABRIELLE D', mistress of Henry IV. of France, was born about 1571. She had already parted with her virtue before she became acquainted with Henry, in 1590. For the sake of appearances, she was married to a gentleman of Picardy, named Liancourt, from whom, however, she soon separated. The king was so fond of her that, in spite of the opposition of Sully, he was about to divorce his consort, Marguérite de Valois, in order to marry Mme. de Liancourt, when the latter died suddenly at Paris on 10th April 1599.

Estremadu'ra, a district of Spain, lying between Portugal and New Castile, and watered by the Tagus and the Guadiana. It is bounded on the N. by Leon, on the S. by Andalusia, and since 1833 has been divided into the two provinces of Badajoz (q.v.) and Cáceres (q.v.). Area, 16,701 sq. m.; pop. (1886) 799,659. Like the New Castilians, the inhabitants present a mixture of Moz-arabic and Spanish blood, but are still graver and more taciturn than the former. The lower classes are rough and uncivilised, but honest and hospitable, modest, good-tempered, and brave.

Estremadura, a coast-province of Portugal, south of Beira, with an area of 6850 sq. m., divided into nearly equal portions by the river Tagus. The northern section is mountainous, with bare but picturesque continuations of the Castilian ranges; south of the river and along parts of the coast the country is hilly and better wooded. Many districts are extremely fertile, others utterly barren; scarcely half the province is under cultivation, but in the most favoured localities all the vegetation of middle and southern Europe flourishes. The silk-culture has greatly increased of late years; manufactures are confined to Lisbon, and this city, with Setubal, monopolises also nearly all the trade. Sea-salt, soda, and fruits are the chief exports. The other principal products of the country are wine, oil, corn, and cork; but even the sandy plains are covered with cistus, rosemary, myrtles, and other flowering and fragrant plants. Pop. (1881) 946,472, over a fourth of the whole belonging to Lisbon and its suburbs.

Estremoz, a town of Portugal in the province of Alemtejo, 23 miles NE. of Evora. It is built round the base of a hill which is crowned by a once formidable castle, erected in 1360. Estremoz is famous for its jars of red porous earthenware for keeping water cool. Pop. 7575.

Eszek. See ESSEK.

Étampes, a town in the French department of Seine-et-Oise, 35 miles SSW. of Paris by rail. An ancient place, with a street 4 miles long, it has a fragment of a royal castle, the 'Tour de Guinette' (*circa* 1160), three interesting churches, a statue of the naturalist Geoffroy Saint-Hilaire, a medieval hôtel-de-ville, large flour-mills, market-gardens, &c. Pop. 8197.

Étang (Lat. *stagnum*) is the name given (*Etangs salés*) to large lagoons along the French coast, frequently salt, and generally communicating with the sea by channels. See BERRE.

Eta'wah, a town of the Doab, picturesquely situated among the ravines near the left bank of the Jumna, about 70 miles SE. of Agra, is on the East Indian Railway, and at the junction of the Agra-Mainpuri and Gwalior-Farukhabad roads. Half-hidden among trees, the town contains some handsome streets, and carries on a considerable trade. A native cloth, horn combs, and sweetmeats are manufactured. Close by are some famous Hindu places of worship, and the *ghats*, or flights of stairs leading to the river for the purpose of ritual ablution, are lined with handsome shrines. Pop. (1891) 38,793. The district of Etawah, lying entirely in the basin of the Jumna, and almost exclusively within the Doab, has an area of 1693 sq. m., and a pop. (1881) of 722,371; (1891) 727,629, nearly all Hindus.

Etching. See ENGRAVING.

Etchmiadzin. See ARMENIA.

Eternal Punishment. See HELL, CONDITIONAL IMMORTALITY, UNIVERSALISTS.

Ethelbert, king of Kent, and third in direct descent from Hengist, was born in 552, and succeeded to the throne about the ninth year of his age. In a contest with Ceawlin, king of Wessex, for the title of Bretwalda, in 568, he was defeated at Wibbandune, now Wimbledon, in Surrey. About the year 590, however, he was acknowledged as Bretwalda of the Saxon octarchy. The most important events of his reign were his own conversion to Christianity, and the formal introduction of that religion into his kingdom, by St Augustine in 597. Ethelbert was also the author of the first written Saxon laws, the collection called *Dooms*, by Bede, 'which he established with the consent of his Witan in the days of St Augustine.' Ethelbert died in 616.

Etheldreda, ST, a daughter of the king of East Anglia, was born about 630, and was twice married, her second husband being Oswy, king of Northumbria. To escape, however, from the married state, she withdrew first to the monastery founded by her aunt, Ebba, on St Abb's Head, and then to the Isle

of Ely (q.v.), where, in 673, she herself founded a monastic house. She died on 23d June 679, and was canonised, her festival falling on 17th October, the day of the translation of her body to its shrine in 695. Her name was popularly abbreviated or corrupted into St Audrey; and at a fair in the Isle of Ely, a common kind of lace was sold, which came to be known as St Audrey's lace. Hence *tawdry*, applied to any kind of frippery.

Ethelred I., elder brother and predecessor of Alfred the Great, was king of Wessex and Kent from 866 till his death on 23d April 871, shortly after his great victory over the Danes at Æscesdune or Ashdown, a victory supposed to be commemorated by the White Horse (q.v.).—ETHELRED II., the 'Unready,' was only seven at the death of his father, King Edgar, and ten when in 978 the murder of his half-brother, Edward the Martyr, placed him on the English throne, and brought about Dunstan's fall. From boyhood he was swayed by unworthy and traitorous favourites, and his reign, 'the worst,' says Freeman, 'and most shameful in our annals,' was a series of raids and invasions by the Northmen, and endeavours to buy them off with ever-increasing bribes. Still, 'Unready,' his nickname, stands for 'redeless,' deficient in counsel; of misplaced energy he had more than enough. This showed itself in his treacherous massacre of the Danish settlers on St Brice's Day (13th November), 1002, a crime that was punished by fierce invasions, until in 1014 he was forced to take refuge in Normandy. In 1002 he had married Duke Richard's daughter, Emma; the marriage was fraught with important consequences, as the earliest link between England and Normandy. Sweyn's death soon allowed his recall, but on 23d April 1016 he himself died in London. He was succeeded by Edmund Ironside, third of seven sons by a first marriage; by Emma he was the father of Edward the Confessor.

Ether, or ÆTHER. Many physical phenomena are supposed to be due to the propagation of a state of stress or motion through a medium filling all space. Such a medium is called an ether. The theory of propagation through an ether is the exact opposite of the theory of direct action at a distance. Newton said that it was inconceivable to him that any one who was capable of thinking correctly in such matters could admit that direct action at a distance was possible. He suggested that Gravitation (q.v.) might be due to diminution of pressure in a fluid filling space in the neighbourhood of material bodies. Sir W. Thomson has shown that this diminution of pressure would be accounted for if we suppose that each particle of matter is a source at which an incompressible fluid is being constantly created at a rate proportional to the mass of the particle, the fluid being also constantly annihilated at an infinite distance. Or, conversely, we might suppose that the fluid is created at infinity, and absorbed and annihilated at each particle, at a rate proportional to its mass. In either case the motion of the fluid would be greatest in the neighbourhood of material bodies; but it is a known fact in hydrodynamics that, in a fluid, the pressure is least where the speed of motion is greatest. Thus the state of stress assumed by Newton would be accounted for.

Light and the so-called radiant heat are supposed to consist in waves of transverse vibrations which are propagated through the ether. Indeed, the phenomena of interference (see LIGHT) cannot be explained in any other way. Similarly, electric and magnetic effects are supposed to be due to the propagation of some state of stress through an ether. But it would be utterly unscientific to fill space over and over again with a new medium for every special phenomenon which has to be explained in this way, and it seems probable that one medium can explain all. Maxwell has assumed the existence of, and has investigated the state of stress in, a medium through which electromagnetic action is propagated. The equations which he obtains are identical in form with the equations of motion of an elastic solid, and the rate of propagation of an undulation is, in his theory, numerically equal to the ratio of the electromagnetic and electrostatic units. This ratio is found by experiment to be numerically equal to the speed of propagation of light. Thus the medium which Maxwell assumed in order to explain electrodynamic phenomena is identical, in his electromagnetic theory of light, with the luminiferous medium; and the theory gives an explanation of reflection, refraction (single and double), and various other phenomena. Additional support has lately been given to the theory by the experiments of Hertz and others, which prove the existence of these electro-magnetic undulations, and show that they have properties identical with those of light. See ELECTRICITY, and LIGHT.

The ether seems to be of the nature of an elastic solid; and, in order to account for the immense rapidity of its vibrations when radiation passes through it, its rigidity must be excessively large compared with its density. It may be asked how, if this be so, the earth can move through the ether at the rate of nearly a million miles per day. But, if we consider that shoemaker's wax is so brittle a solid that it splinters under the blow of a hammer, and that it yet flows slowly like a liquid into the crevices of a vessel in which it is placed, and that bullets sink slowly down through it, and corks float slowly up through it, the motion of the earth through the ether does not seem so incomprehensible. The bullet moving through the wax experiences great resistance to its motion when it has to move, say, an inch in some weeks; but if we give it some years to move an inch, the resistance would be very small. So it may be that the motion of planets through the ether is relatively much the same as that of the bullet moving with excessive slowness through the wax. From magneto-optic phenomena it seems certain that something of the nature of molecular rotation is going on in the ether (see MATTER, and VORTEX).

There is no evidence of the existence of a condensational-rarefactional wave (as in the case of sound in air) in the ether. In the electro-magnetic theory it is got rid of from its velocity being infinite. In a theory of the ether recently advanced by Thomson, in which it is supposed to have negative compressibility, and to be made stable by being infinite or having rigid boundaries, the speed of propagation of the condensational-rarefactional wave is zero. The question of a contractile ether had been previously considered by Green, but was dismissed by him with the statement (erroneous, as Thomson has shown) that it is essentially unstable. The theories of an ether of zero or positive compressibility lead to results which are inconsistent with experiment. On the other hand, Thomson's theory leads to the known experimental results, as also does the electro-magnetic theory.

Ether, $(C_2H_5)_2O$, otherwise called ETHYLIC ETHER, VINIC ETHER, and SULPHURIC ETHER, is prepared from alcohol by the action of sulphuric acid at an elevated temperature. Alcohol is placed in a retort or still, and about an equal volume of sulphuric acid is added. Heat is at once developed by the mixing of the liquids, and on raising the temperature ether vapour passes over along with a proportion of alcohol. At the same time a stream of alcohol is allowed to pass into the still, and the heat is so regulated that a constant

temperature of about 266° (130° C.) is maintained. When five volumes of alcohol in all have been added, the temperature is allowed to rise to 286° (141° C.), at which point impurities commence to pass over. The ether so obtained contains alcohol, sulphurous acid, and water, and these may be removed by treatment with solution of chloride of calcium, &c., and subsequent redistillation.

The chemical reactions which take place in this process are of great interest, and may be divided into two stages. (1) The sulphuric acid acts on alcohol, forming ethyl-sulphuric acid and water.

Sulphuric Acid. Alcohol. Ethyl-sulphuric Acid. Water.

$$H_2SO_4 + C_2H_5OH = C_2H_5HSO_4 + H_2O.$$

(2) This acid again is acted on by alcohol, with the re-formation of sulphuric acid and the production of ether.

Ethyl-sulphuric Acid. Alcohol. Ether. Sulphuric Acid.

$$C_2H_5HSO_4 + C_2H_5OH = (C_2H_5)_2O + H_2SO_4.$$

From this it will be plain that the sulphuric acid is restored again, and is ready to attack alcohol anew, so as to form more ether. This process would go on indefinitely, were it not that the water liberated in the first reaction dilutes the sulphuric acid, and ultimately renders it too weak for further action.

Ether is a colourless, transparent, volatile liquid of great mobility and high refractive power, and possessing a fragrant odour and a fiery, passing to a cooling, taste. It has a specific gravity of ·720 at 60° (15·5° C.), and boils at 96° (35·6° C.), forming a vapour more than two and a half times as dense as air. When reduced to a temperature of − 24° (− 31° C.), ether freezes. It volatilises spontaneously when placed in an unconfined position, as in the palm of the hand, and vaporises so quickly as to produce intense cold. Indeed, when water is covered with ether, and the latter assisted in its evaporation by being blown upon, it escapes so readily as to reduce the temperature of the water to the freezing-point. It is very inflammable, burning with a yellow-white flame; and mixed with air or oxygen, it gives rise to a dangerous explosive mixture, and hence great care requires to be taken in its distillation to keep all lights and fires out of the room where the vapours are condensing. When ether is added to its own bulk of water, briskly agitated, and allowed to settle, the two liquids appear to separate again; but it is found that the ether has taken up one-eighth of its volume of the water, whilst the latter has dissolved the same quantity of ether. It is readily miscible with alcohol in all proportions. Ether is one of the best solvents for the oils and fats, and hence is employed in analysis for the solution and separation of the oils from other organic matters, as in the analysis of oil-cakes, &c. It is also a good solvent of iodine, sulphur, phosphorus, and of strychnine and other alkaloids, as well as of corrosive sublimate and other salts.

Ether enters into combination with many acids, forming compound ethers possessing great fragrancy, such as

Acetic Ether.....	$C_2H_5C_2H_3O_2$.	
Butyric Ether.....	$C_2H_5C_4H_7O_2$,	Pine-apple Oil.
Pelargonic Ether..	$C_2H_5C_9H_{17}O_2$,	Essence of Quinces.

Œnanthic ether, on which the flavour and smell of wines, brandy, &c. so much depend, originally supposed to be a distinct ether, has been proved to be a mixture of various ethyl ethers, chiefly ethyl caprate.

Ether is useful in the preparation of freezing mixtures, the mixture of ether and solid carbonic acid giving rise to a very low temperature indeed. When inhaled by man and the lower animals, ether first produces stimulating and intoxicating effects, but afterwards it gives rise to drowsiness, accompanied by complete insensibility, which entitles ether to be regarded as an important anæsthetic agent; and, indeed, for some time it was the only agent used for producing Anæsthesia (q.v.) in operations, but in many places it has been entirely superseded by the employment of chloroform.

Etheredge, Sir George, a Restoration dramatist, was born most probably in London about 1636. Almost nothing is known of his personal history save that he must have lived much in his early life at Paris, that he studied law, was 'gentle George' and 'easy Etheredge' in the circle of Sedley and Rochester, the most brilliant young reprobates of their time, that he had an intrigue with the famous actress, Mrs Barry, afterwards settling £6000 on her daughter, was knighted and married, not with his entire good-will, to a wealthy widow, and in 1686 was sent to be Resident at the Imperial court at Ratisbon. This banishment he found intolerably tedious, but he contrived to vary its monotony with coursing, moderate drinking, sometimes immoderate play, and flirtation with passing actresses, as well as with correspondence with Middleton, Dryden, Betterton, and others. Fortunately, drafts of some hundred of his letters (many of these official), along with poems and other papers, have been preserved in a letter-book acquired by the British Museum in 1837, and help to reveal to us a man of whom our knowledge otherwise would have been singularly scanty. It is not true that Etheredge broke his neck at Ratisbon in 1689, by falling down-stairs after a banquet; he seems to have died in Paris, most likely about the close of 1690. In English literature Etheredge holds a place securely as the founder of the comedy of intrigue, which reached its perfection in the masterpieces of Congreve and Wycherley. He himself had found his inspiration in Molière, and out of him grew that great master of comedy's English counterpart, the legitimate comedy of manners, and the dramatic triumphs of Sheridan and Goldsmith. Etheredge was more important in the impulse he gave the drama than in the magnitude of his own performance. His habitual indolence hindered him from producing more than three plays, *The Comical Revenge; or Love in a Tub*, the earliest play of which any large part was written in rhymed heroics (1664); *She Would if She Could* (1668); and *The Man of Mode; or Sir Fopling Flutter* (1676). These were all highly popular in their day, and it may be said that we have no better helps to an understanding of the time. The figures we meet are real creations, instinct with life, and some, as Dorimant and Sir Fopling Flutter, possess the supreme merit of having gone into literature as concrete types of the qualities they were meant to represent. See the fine essay on Etheredge in Edmund Gosse's *Seventeenth-century Studies* (1883), and the admirable complete edition of his works, with Introduction, by A. Wilson Verity (1888).

Ethics is that branch of philosophy which is concerned with human character and conduct. It deals with man as a source of action, and not merely as the subject of knowledge. It is thus brought into the closest relation with psychology, which explains the nature and origin of the mental processes of the individual, and with the investigations into the development of human customs and institutions made by the new science of sociology. In this way a number of questions arise which are in their terms psychological or sociological, although they have nearly always been discussed with a view to their ethical bearing. Such are (1) the psychological question concerning the way in which ethical or moral principles are apprehended—the question of Conscience or the moral faculty; (2) a series of inter-connected psychological questions concerning

the motives to action, or the way in which morality is realised in conduct—e.g. (*a*) whether reason can be a motive to action—the question of the relation of Reason to Sentiment, (*b*) whether motives can be reduced to a common formula in terms of pleasure and pain—the question of the relation of Pleasure to Desire, (*c*) whether and how far spontaneity is involved in voluntary action—the time-honoured question of Free-will; (3) a psychological question as to the way in which character is moralised—the question of the nature and relation of the Virtues. Besides these, there is (4) the historical question of the connection of moral ideas and practice with the social customs of the time, and its political, religious, and other institutions.

The preceding questions all deal with the actual facts of conduct and character—their order and historical connection. But it is characteristic of properly ethical inquiry to seek to determine the principles or end by which conduct is to be regulated. Ethics thus looks at things from a point of view foreign to the theoretical sciences. It has to do not merely with what is, but with what ought to be. This is indicated by the familiar opposition between Right and Wrong in conduct, Virtuous and Vicious in character, and in the notion of Duty, in which the human will is conceived as under an obligation to obey a certain law, or follow a certain end, which obligation, however, may or may not be fulfilled in actual conduct. This notion of moral obligation or Duty does not come to the front in the Greek philosophers, to whom the origin of our philosophical conceptions of morality is mainly due. Its present fullness of signification is largely due to legal and to religious modes of thought; and, owing to its influence, modern ethics has frequently received a distinctly legal or theological stamp—being represented as a system of duties, prescribed by God, or by Conscience, in which certain kinds of action are enjoined and others forbidden. But, underlying this notion, there is the conception of certain kinds of conduct, or certain types of character, as better than others, or preferable to them. This, at least, is involved in all ethical thought. And the attempt to reach a synthesis of what is called morally good, or to give a reason for preferring certain objects to others, necessarily leads to the inquiry after an ultimate end, which is not desired as a means to anything else, but is held to be good in itself. This is the ethical end, or Chief Good, which formed the leading subject of discussion in Greek ethics, and to the explicit investigation of which modern ethical speculation has to a large extent returned.

The nature of this chief good has been differently defined by different schools. But it was remarked by Aristotle, at a time when ethical terminology was less complex than it is now, that, in spite of their different views as to the nature of this good, all men are agreed as to its name: calling it *eudaimonia*—a term equivalent to 'well-being,' but unfortunately rendered, according to the universal tradition of translators, by the English word *happiness*. The word happiness in modern ethical discussions signifies a maximum of pleasures, or an experience in which the pleasures greatly exceed the pains. In this sense of the word, however, the assertion that the good is happiness would have been denied by Aristotle, as well as by Plato. While arguing that the good for man must be something obtainable by man, Aristotle did not find the end in pleasure, but rather in the perfect development of a man's self, in moral and intellectual excellence. But the doctrine that pleasure is the highest good was held by predecessors and contemporaries of Aristotle, and was afterwards formulated by Epicurus into an ethical theory.

This view that pleasure or happiness is the chief good has been held in two very different forms. According to the one view, the chief good and moral end for each individual is his own happiness or pleasure; according to the other view, it is the happiness or pleasure of the community, or of mankind, or even of sentient creatures generally. The former was the doctrine of Epicurus, and has been called Egoistic Hedonism. The latter view—called Universalistic Hedonism or Utilitarianism—owes its development to modern and especially to English writers. A principle similar to that of modern utilitarianism was laid down very early in the history of English ethics. Thus, it has been pointed out that Richard Cumberland, in his treatise *De legibus Naturæ* (1672), put forward the 'common good of all' as the supreme end to which all rules of conduct are subordinate, though, according to him, this good includes perfection as well as happiness. In a similar way, Shaftesbury (*Inquiry concerning Virtue and Merit*, 1699), Joseph Butler (in his *Sermons*, 1726), and Francis Hutcheson (*System of Moral Philosophy*, 1755) speak of the 'good of society' as equivalent to virtue. But the real founder of modern utilitarianism was David Hume (*Treatise of Human Nature*, 1739; *Inquiry into the Principles of Morals*, 1751). He defined Virtue as a quality approved by the spectator, and Vice as a quality blamed or censured by the spectator, and endeavoured to show, by a review of the virtues, that the qualities approved are either immediately agreeable or useful (i.e. indirectly agreeable) to ourselves or to others. In this way, utility is made the ground of the distinction between Virtue and Vice. The *Moral Philosophy* of Paley (1785) contributed largely to define and render applicable to practice the utilitarian criterion of morality; though, in his system, the utilitarian principle is based upon an 'other-worldly' selfishness. Subsequently, utilitarianism was defended and applied to morals, politics, and law by Jeremy Bentham (1748–1832), who was surrounded by an energetic school of writers, including Ricardo, James Mill, J. S. Mill, Austin, and George Grote. J. S. Mill's remarkable essay on *Utilitarianism* (1861) is chiefly occupied with defending the theory against the popular objections to it, which had been increased rather than obviated by Bentham's uncompromising polemics. He especially contended against the representation of utilitarianism as a selfish and a sensual theory. It is not selfish (he argued), for it requires that a man should be impartial in deciding between his own interests and those of others. It is not sensual, for man possesses faculties of a kind which sensual pleasures cannot satisfy. The being of lower faculties may have more contentment, because without the desire for anything further, but has not more pleasure or happiness. In defending this position Mill does not rely merely on the greater permanence, purity, and fruitfulness of the intellectual and social pleasures as compared with the pleasures of sense. He asserts that pleasures differ from one another in kind as well as in degree or intensity, and that the pleasure of higher quality or kind is to be preferred to one of lower quality, even although the intensity of the latter be greater than that of the former. It is now, however, generally admitted that this distinction is inconsistent with the hedonistic basis of utilitarian ethics, seeing that it makes not the pleasure itself, but that which distinguishes one pleasure from another, the real ground of moral preference.

Owing to the definiteness of its principle, and the facility (within a certain range) with which it can be applied, the utilitarian maxim admitted, in the hands of Bentham and his school, of fruitful application to political and legal questions. The proof, or philosophical basis, of the theory presents greater difficulty. Pleasure, indeed, may be obviously

desirable, though it is not so obvious that it is the ultimate or highest moral end. But it is plainly due to confusion of thought that this desirableness of pleasure is given (by J. S. Mill) as a sufficient reason for holding that the general happiness is the ethical end for the individual. The gulf between egoistic hedonism and utilitarianism requires to be bridged over. The transition from one position to the other has frequently been made by the help of religious or of political considerations. Thus the utilitarianism of Paley was founded on the belief that the happiness of mankind was the ethical end prescribed by God; that of Bentham resulted from looking at action from the point of view of the community and its interests rather than from that of the interests of the individual. In this connection, consideration is given to the sanctions of morality, or pains following the breach of moral law. These sanctions are enumerated as religious, political, social, and internal. The religious sanction is that relied on by Paley. Bentham and Mill lay greater stress on the others. But it is admitted that the political sanction does not exact from an individual beneficence, or active regard to his neighbour's happiness, but only probity, or non-interference with that happiness. The social sanctions, again, are incomplete and variable, and have no exact correspondence with the utilitarian principle; while the internal sanctions depend on the individual conscience, which utilitarian writers commonly hold to be a growth in the individual mind, due to and imitating the social sanctions. The unsatisfactoriness of the proof of utilitarianism is recognised in the chief recent exposition of the theory—that in Sidgwick's *Methods of Ethics* (1874). The utilitarian theory of the moral end or standard is there associated with an intuitive theory of knowledge not usually held by utilitarians: the justification of the theory is based on the axioms of justice and benevolence, which the exhaustive examination of intuitive ethics carried out in the same work has left standing as formal axioms of the practical reason. Owing to the influence of the doctrine of evolution as applied to character, a still more radical transformation has been effected in the utilitarian theory (Spencer's *Data of Ethics*, 1879; L. Stephen's *Science of Ethics*, 1882). Applied only to the method of utilitarianism in Spencer's hands, the evolution-theory has been used by other writers to show the inadequacy of the utilitarian principle; but few attempts have been made to substitute for the latter an ideal in better correspondence with the facts and laws of moral development.

Utilitarianism is a morality of consequences: finding the moral quality of conduct and character in the kind of feeling actions tend to produce in sentient beings. As this pleasant or painful feeling can only be ascertained by experience, the theory is nearly always associated with an empirical theory of the origin of our knowledge of morality. The controversies, especially of English ethics, have been largely occupied with the debate on this question between the Empirical and Intuitive schools of ethics. The latter school lays stress on the immediateness and universality of the moral judgments passed by each man's conscience. A doctrine of the Moral Sense, as a feeling, or perception, by which actions or motives were morally distinguished apart from their consequences, was developed by Shaftesbury and Hutcheson; and Butler formulated the doctrine that conscience is the supreme authority as to what is right or wrong. It is true that in Butler's *Sermons* Self-love, or a calm regard to one's interests on the whole, is frequently spoken of as co-ordinate with, and indeed, in one place, as superior to Conscience. But this is inconsistent with Butler's explicit statements even in that work, and the view does not reappear in the *Dissertation on Virtue* appended to the *Analogy* (1736). In the latter work, also, the virtuous action which conscience prescribes is no longer asserted to be conterminous with action aiming at the good or happiness of society. In this way Butler's severance from utilitarianism is complete, and he may be fitly regarded as the head of the modern intuitive school. Of this school Dr Martineau (*Types of Ethical Theory*, 1885) is a prominent representative; differing, however, from the majority of the school in holding that moral quality belongs primarily to motives, not to action. The weakness of the intuitive position, as stated by Butler and many of his successors, lies in the fact that the source of ethical principles, conscience, is not brought into intelligible relation with the rational or spiritual nature of man. Hence the force of the objection urged against Butler—that he moves in a circle, defining the right as what conscience approves, and conscience as what approves the right. The doctrine of Conscience holds an insecure position in his system, because it is unrelated to reason, because, in a word, his ethics is without foundation in metaphysics. On this account, the position has been peculiarly liable to be undermined by empirical analyses, such as Bain's attempt (*The Emotions and the Will*, 1859; *Mental and Moral Science*, 1868) to trace the growth of conscience in the individual from fear and love with a perception of utility added, or the more elaborate efforts of evolutionist writers, by whom it is represented as the result of countless experiences of the effects of action transmitted from individual to individual, until, in the form of a moral sense or conscience, they have become part of the common mental inheritance of the race. A further difficulty connected with the view of conscience held by Intuitionists is the mutual relation of the kinds of actions it approves, or of the laws for action laid down by it. Justice, veracity, beneficence, &c. are said to be its laws; but the attempt is seldom made to show how these are connected with one another.

These obvious difficulties meet at least with an attempted solution in the ethical system of Kant (*Groundwork of the Metaphysic of Morals*, 1785; *Critique of Practical Reason*, 1788). For Kant, conscience is simply practical reason; and its laws are reduced to unity. Reason, although limited in its knowledge of objects to the phenomena of sense, is yet in the practical sphere capable of laying down absolute or unconditional laws. This is shown by the moral law, with its categorical 'thou shalt,' prescribing a principle of conduct irrespective of desire or any ulterior end. Only the action which proceeds from a good will (that is, a will in accordance with moral law) is completely good. External conformity to the law gives legality; morality requires that the law, or respect for it, should be the moving principle of action. This, according to Kant, may prove to us that the will is free: 'thou shalt' implies 'thou canst.' Thus, in the order of our knowledge, it is the moral law that convinces us of freedom. But in reality the moral law is simply the law of the will itself, and the will is free when acting under its own law; it is under constraint only when influenced by the sensuous nature with which it is connected in man. The 'categorical imperative' of the moral law is expressed by Kant in the phrase, 'Act according to that maxim (or subjective principle) alone which thou canst at the same time will to be a universal law.' Reason is one in all men, and action to be rational must thus admit of being universalised. In this way reason gives a form for action. It also gives its end; for reason is an end in itself, and humanity, as rational, must therefore always be treated as an end, never as a mere means. Kant's

ethical principle remains, however, a formal principle, not admitting of the connection he sought to give it with the content of practical life. Its formality or emptiness is due to his purely formal conception of reason itself. To get rid of this formality has been the effort of the later ethical systems which have been most influenced by Kant. They base morality, as he did, on the reason or spiritual principle; but, with a less restricted view of this principle, they seek its content and realisation in practical life and its institutions. This position, largely due to Hegel, has been worked out independently in the most important recent English work of speculative ethics—T. H. Green's *Prolegomena to Ethics* (1883). 'The ultimate standard of worth is,' according to Green, 'an ideal of personal worth,' while, at the same time, 'it is equally true that the human spirit can only realise itself, or fulfil its idea, in persons, and that it can only do this through society, since society is the condition of the development of a personality.' It thus appears that at the present time the two leading ethical schools in Britain may both be called evolutionist—the one, that just described, looking upon morality as the gradual realisation of a spiritual principle in the forms and institutions of domestic, civic, and political life; the other holding that the evolution is a merely natural one, and giving the name morality to those habits of acting which have contributed to the preservation and development of the race. The former theory is connected historically with intuitionism, the latter with utilitarianism. Neither is able to give so precise a definition of the moral ideal as was attempted by the older theories; and it may be admitted, perhaps consistently, by both sides (though with some difference of meaning under the similarity of phrase), that no such precise definition is possible, but that our apprehension of the ideal itself becomes clearer and fuller as it is progressively realised in the individnal life and in society.

Some of the more important ethical writings, of different schools, have been already mentioned. The best introduction to the history of the subject is Sidgwick's *Outlines of the History of Ethics for English Readers* (1886). See articles on the great ethical thinkers, ARISTOTLE, EPICURUS, BUTLER, KANT, &c.; also EVOLUTION, STOICISM.

Ethiopia, the biblical *Kush*. Originally, all the nations inhabiting the southern part of the globe, as known to the ancients, or rather all men of dark-brown or black colour, were called Ethiopians (assumed by the Greeks to be from the two Greek words *aithō—ōps*, and to mean 'sunburned;' but it may be possibly a form of an unknown Egyptian word). Later, this name was given more particularly to the inhabitants of the countries south of Libya and Egypt, on the Upper Nile, extending from 10° to 25° N. lat., 28° to 40° E. long.—the present Nubia, Sennaar, Kordofan, Abyssinia. The accounts which the ancients have left us with respect to this people are, even where they are not of an entirely fabulous nature, extremely scanty and untrustworthy, as both Greeks and Romans never got beyond Napata, 19° N. lat. From the Homeric age down to Ptolemy, these regions were understood to be peopled by Pygmies, Troglodytes ('dwellers in caverns'), Blemmyes ('hideous men'), Macrobii ('long-lived men'), &c., besides being divided into the lands of cinnamon, myrrh, of elephant-eaters, fish-eaters, tortoise-eaters, serpent-eaters, &c. Homer frequently refers to the 'blameless Ethiopians.' The only portion of ancient records which does contain something akin to historical accounts is that which refers to Meroë, an island formed by the rivers Astaphus and Astaboras, tributaries of the Nile. There stood, from time immemorial, an oracle of Jupiter Ammon. This and the central portion of the island, together with the extraordinary fertility of its soil, the abundance of animals, metals, &c., made it not only the chief place of resort for all the inhabitants of the adjacent parts, especially the numerous nomad tribes, but also the emporium for India, Arabia, Ethiopia, Egypt, Libya, and Carthage. Thus it grew so rapidly that about 1000 B.C. it counted among the most powerful states of the ancient world; and about 760, having ever since Sesostris been tributary to Egypt, it succeeded, under Sabacus, in shaking off the Egyptian yoke, and continued, in its turn, to hold Egypt for about sixty years. During the reign of Psammetichus, 240,000 Egyptians settled in Meroë, which, the greater part of the immigrants being artisans, traders, &c., rose still higher. Many new cities were built, and the state was in the most flourishing condition when it was conquered by Cambyses, about 530 B.C. He fortified the capital town, and called it Meroë. After the destruction of Thebes by Cambyses, most of the inhabitants of that city took refuge there, and made the country still more Egyptian. Ergamenes transformed its theocracy into a military monarchy in the 3d century. Under Augustus, Meroë was conquered, and a Queen Candace is mentioned as his vassal. Under Nero nothing but ruins marked the place of this once powerful and highly civilised state. Up to this day remnants of mighty buildings, covered with sculptures—representations of priestly ceremonies, battles, &c.—and half-defaced inscriptions hewn in rocks, besides rows of broken sphinxes and colossi, are frequently met with in those parts.

According to the scanty native chronicles, the son of Solomon and the Queen of Sheba (Makeda as they, Balkis as the Arabian historians call her), named Menilehek, was the first king of the Ethiopians. Few kings' names occur up to the time of Christ, when Bazen occupied the throne. The missionary Frumentius (330) found two brothers (Christians) reigning—Abreha and Azbeha. During the time of the Greek emperor Justin (522), King Elezbaas destroyed the state of the Homerites in Asia, in order to revenge their persecutions of Christians, and was canonised. From 960 to 1300 another dynasty, the Zagœan, held the chief power, all the members of the Solomonic dynasty, save one, having been murdered by Esal, who made her son king. In 1300 Ikon-Amlak, a descendant of this one scion of the house of David, regained possession of the throne. The history of the country, down to the reign of the Negus John (killed near Galabat in May 1889, in battle with the dervishes), is given under ABYSSINIA.

Emigrants from the other side of the Arabian isthmus, as were, beyond doubt, the earliest settlers in Ethiopia, it is but natural that the structure of their language, as well as that of their own bodies, should bear traces of their Semitic origin. The fact of this emigration is expressed in the very name of this language, which is called *Ge'ëz*—possibly 'free,' affording a parallel to the designation *Franc*—French, though more probably the word means 'migration,' hence 'emigrants.' The name Ethiopia, or, as they call it, Ityōpyā (adj. Ityōpyāwī), they adopted from the Greeks at a very late period. This their oldest language, *Lesāna Ge'ëz*, was suppressed by a royal decree of Ikon-Amlak, in the 14th century, and the Amharic adopted as the court language. Ever since, it has, with exception of the province of Tigré, where it is still spoken (with slight idiomatic changes), remained the *Lesāna Mazhaf*, the language of books and of the church. It is exclusively used in writing, even of ordinary letters, and the educated alone understand it. Its general structure comes as close to that of the Arabic as a sister-dialect can

and must. A great many of its words are still classical Arabic; others resemble more the Hebrew and the Aramaic; others, again, belong to African dialects; and many, as the names of the months,

ኣስመ : ከመዝ : ኣፈቀር : ኣግዚኣ
ብሔር : ለዓለም : ኣስከ : ወልዲ :
ቀሕደ : ወሀበ : ቢዛ : ከመ : ኩሉ :
ዘየኣምን : ቦቱ : ኢይትሐጐል : ኣላ :
ደረክብ : ሕይወተ : ዘለዓለም ::

The text John, iii. 16, in Ethiopic, as printed by the British and Foreign Bible Society.

are Greek. It has twenty-six letters, twenty-two of which bear the ancient Semitic stamp, and exhibit the greatest likeness to the Phœnician—the common original alphabet—though no doubt derived immediately from the Sabean or South Arabic alphabet (see ALPHABET). There are seven vowels, including a very short *e*, which sounds precisely like the Hebrew Shĕva, when open, and like *e* in 'men,' when shut. These vowels are represented by little hooks, and remain inseparably attached to their respective letters; and as the Ge'ëz, unlike all its sister-languages, is never written without vowels, the alphabet becomes a syllabary with 182 characters. In addition to this, four consonants (*g*, *k*, and *h* sounds) interject a *u* sound before the principal vowel, *gua*, *guī*, *guē*, &c. Another difference exists in its being written from left to right—a circumstance from which some have concluded that the Greeks introduced writing in Ethiopia; forgetting, in the first place, that Greek itself was frequently written from right to left, and that Zend, certain cuneiforms, hieroglyphs, &c. are likewise written from left to right. As was to be expected among emigrants from South Arabia, the verbal system has most resemblances to the Arabic, although it differs from this, and agrees with Aramaic, in discarding the passive and using for it the reflexive; there is a double infinitive, only a passive participle and participial words formed by *m* prefixed; traces of a dual remain, though it is no more in use; the formation of the so-called broken plural, and of declension generally, a special accusative termination, the distinction of the subjunctive from the imperfect, and other peculiarities distinguish the Ge'ëz from the Northern Semitic, while the want of the article distinguishes it from Arabic; and in power to subordinate clauses by means of particles and form a concatenated sentence it is superior to all other Semitic dialects. There are no diacritical marks employed in writing; the letters are not combined, and the words are separated by two dots.

Although there may have been some literature in a flourishing country like Ethiopia anterior to Christ, still, owing both to frequent internal convulsions and other causes, no traces of it remain, even the few inscriptions that have been found being of the Christian age. The earliest existing document of post-Christian literature is a complete translation of the Bible, according to tradition by Frumentius, most probably by missionaries from the north, whose native language was Aramean (see FRUMENTIUS). The Old Testament, a translation from the Alexandrine version, or LXX., consists of four parts: (1) the Law or Octateuchos (five books of Moses, Joshua, Judges, Ruth); (2) Kings; (3) Solomon; (4) Prophets, and two books of the Maccabees. The New Testament consists of: (1) Gospels; (2) Acts; (3) Paulus; (4) Apostolus. The Book of Enoch belongs also to the literature of the Old Testament (see ENOCH), besides the Book of Jubilees, the Ascension of Isaiah, and some others. The New Testament comprises the Shepherd of Hermas, and likewise another book, Synodos, containing the pseudo-Clementine or Apostolical Constitutions, in two recensions, with the Apostolic Canons, the canons of various councils, and much other matter. The Ethiopians have a liturgy (*Kanon Kedāsē*—'Holy Canon'), and a symbolico-dogmatical work (*Haimanōta Abau*—'Belief of the Fathers'), containing portions of homilies of the Greek Fathers, Athanasius, Basil the Great, Chrysostom, Cyril, Gregory of Nyssa, and Gregory Nazianzen. Besides these they have martyrologies, called Seneksār (Synaxaria). They employ in this their sacred literature a peculiar kind of rhythm without a distinct metre. Any number of rhyming lines forms a stanza, without reference to the number of words constituting the verse, or of verses constituting the stanza. They also use certain phrases as a refrain. Ethiopic literature consists chiefly of translations, in earlier times from the Greek, and more recently from the Arabic. In the translations from Greek some interesting works have been preserved which had otherwise disappeared—e.g. the Book of Enoch. Among the translations from the Arabic are books of philosophy, medicine, jurisprudence, and history. The native literature consists chiefly of sacred poetry and chronicles, among the last the *Gloria Regum* (*Kebra Nagast*), a work in praise of Axum and the royal family of Ethiopia (*Chronicle of Axum*). They are very fond, however, of riddles, wise saws, and the like, so fascinating to the Eastern mind. They have native vocabularies, Ethiopic and Amharic, though not of great value to the modern lexicographer. No wonder the learned in Europe should have been sorely puzzled by such a language, and that they should, after long consideration, have pronounced it to be either 'Chaldee' or 'Indian,' while Bruce held it to be the language of Adam and Eve. Potken, a Cologne church-dignitary, happening to be at Rome at the beginning of the 16th century, there made the acquaintance of native Ethiopians, and became the first to enlighten the world on the nature of this occult language. After him came the Carmelite Jacob Marianus Victorius from Reate, who wrote *Institutiones Linguæ Chaldææ seu Æthiop.* (Rome, 1548), an entirely worthless book; then Wemmers, who in 1683 published an Ethiopian grammar and dictionary. The principal investigator, however, was Job Ludolf from Gotha, who, aided by the Abba Gregorius, and supported by his own extraordinary linguistic talents and indomitable energy, acquired such a power over this language that, notwithstanding the number of eminent Orientalists, such as Platt, Lawrence, Dorn, Hupfeld, Hoffmann, Roediger, Ewald, Isenberg, Blumenbach, Dillmann, &c., who have since worked in this field, his books still hold their own place. It is hardly necessary to add that the Ethiopic is one of the most important and indispensable languages to the Semitic scholar.

The great advances made in Ethiopic studies in recent years have greatly superseded earlier works. (1) Texts: *The Psalter*, by Potken (Rome, 1513, 1518); by Ludolf (Frank. 1701, and often). *The Gospels* (Lond. 1826); *New Testament* (Lond. 1830), both by T. Pell Platt (already in Walton's Polyglott); *Jonah* in 4 oriental versions, by W. Wright (Lond. 1857); *Joel*, by Dillmann (in Merx, *Comm. on Joel*) (1879); *The Old Testament* (vol. i. 1853; vol. ii. 1861–71), by Dillmann. Dillmann has also edited the following: The *Book of Enoch* (1851; previously by Lawrence, Oxford, 1838; recent Eng. trans. by G. H. Schodde); the *Ascension of Isaiah* (1877; previously by Lawrence, Oxford, 1819); the *Book of Jubilees*, or *Little Genesis* (1859). The *Pastor of Hermas*, by D'Abbadie

(1860); the *Ethiopian Didascalia*, or *Apost. Constitutions*, by T. Pell Platt (1834). Besides these, various texts have been edited, including some parts of the secular literature. (2) Grammars and Dictionaries: Ludolf, *Gramm. Æth.* (Frank. 1702); Dillmann, *Gramm. d. Aeth. Sprache* (Leip. 1857); good small grammar by Prætorius (Leip. 1886); Ludolf, *Lex. Æth.-Lat.* (Frank. 1699); Dillmann, *Lex. Ling. Æth* (Leip. 1865); *Chrestomathy*, by same (Leip. 1856). The ancient Ge'ĕz is now represented by various dialects: (1) by the Tigrē, which has best preserved the features of the original language, spoken in the north-east of Abyssinia, and particularly by populations just outside the north border of the kingdom; vocabulary by Munzinger in Dillmann's *Lexicon*; (2) by the Tigriña, or, more properly, Tigraï, spoken about Axum, the ancient seat of the kingdom, which, however, has suffered more from the influence of Amharic (Prætorius, *Gramm. d. Tigriña Sprache*, Halle, 1871; Schreiber, *Manuel de la langue Tigraï*, Vienna, 1887); (3) by the Amharic, the state language since end of 13th century, and extending far to the south, which has drawn into itself a multitude of elements from the African languages, and developed many forms altogether alien to Semitic (*Grammar and Dictionary* by Isenberg, Lond. 1841; Prætorius, *Gramm. d. Amh. Sprache*, Halle, 1879; *Dictionnaire de la langue Amariña*, par D'Abbadie, Paris, 1881). Since the English expedition to Abyssinia, the British Museum possesses a larger number of Ethiopic MSS. than any other library. Catalogue of Ethiopic MSS. in British Museum (Lond. 1847); Catalogue of Ethiopic MSS. in Bodleian, (Oxford, 1848), both by Dillmann; Catalogue of Ethiopic MSS. in British Museum, acquired since 1847, by W. Wright (Lond. 1877), including the Magdala Collection.

Ethiops, or ÆTHIOPS (Gr. *aithō*, 'I burn,' and *ops*, 'countenance'), is a term applied by the ancient chemists to certain oxides and sulphides of the metals which possessed a dull, dingy, or black appearance. Thus, *Ethiops Martialis* was the mixture of protoxide and peroxide of iron known as the black oxide.

Ethmoid Bone, THE (so called from *ēthmos*, 'a sieve'), is one of the eight bones which collectively form the cranial box. It is of a somewhat cubical form, and enters into the formation of the cranium, the orbits, and the nasal fossæ. See NOSE.

Ethnology, one of the numerous sciences, such as Anthropology, Philology, Psychology, and Sociology, which collectively constitute the complete study of man. But, owing to its comparatively recent origin, much diversity of opinion continues to prevail regarding the proper scope and limits of this branch of the subject. Thus, while Powell declares that 'there is no science of ethnology,' Adolf Bastian regards it as the 'sister' of anthropology, the latter dealing with the physical, the former with the psychic element in man. Between these extremes lie the more moderate and now largely accepted views of those who, with Broca, Latham, Topinard, Littré, De Quatrefages, and many others, regard anthropology as the science of man as distinguished from his nearest congeners in the animal kingdom—the bimanus as opposed to the quadrumana—and ethnology as the science of man as a genus in relation to its more or less numerous species, or as a species in relation to its more or less numerous varieties. Thus, '*anthropology* determines the relations of man to the other mammalia; *ethnology*, the relations of the different varieties of mankind to each other. . . . The simple record of facts constitutes *ethnography*, or descriptive ethnology' (Latham). 'Ethnology treats of the origin and distribution of peoples, ethnography of their description' (Littré). 'Medicine studies individuals; ethnography, peoples; ethnology, races; and general anthropology, man as a whole and in his relations to animals' (Broca).

As thus defined, and as also understood by this writer, ethnology embraces a comparative study of the various *races* of mankind, their origin, physical and mental differences, dispersion, geographical distribution and interminglings, leaving human speech to *philology*, human culture (political and social institutions, usages, traditions, folk-lore, religion) to *sociology*—i.e. the science of man as a *zōon politikon* (Aristotle). These limitations have been necessitated by the continuous tendency of the sciences, as well as of the arts, to 'division of labour,' as here shown by the entirely independent development of philology, and by the recent creation of sociology, for which Herbert Spencer already claims the rank of a science. Nevertheless, such limitations cannot be always rigidly adhered to, and in dealing with such a complex theme as the human family there must necessarily arise certain collusions, so to say, certain overlappings in the direction of all the allied sciences. Thus, to give one instance, the important and much agitated question of language as a racial test could not be at all discussed without some reference to such strictly philological subjects as the origin and growth of articulate speech.

In accordance with the foregoing statement, the main points with which we are here concerned are the origin, nature, number, and distribution of the present human races, where the first question that presents itself is the specific unity or diversity of mankind. From the very nature of the case, this is a question that can never be decided one way or the other with absolute certainty. But the general tendency of modern inquiry points to the conclusion that the poet's 'one touch of nature,' which 'makes the whole world kin,' was not merely inspired by a vague sentiment, but rests on a solid foundation of fact. The physical and mental qualities characteristic of the leading types are not considered as sufficiently marked to constitute so many distinct species, while the now fairly established fact that all are mutually fertile between themselves is held to be all but conclusive of their primordial unity (Flower, Tylor). Hence the monogenist doctrine, which otherwise accords with orthodox belief, is daily gaining ground on the polygenist views, which were based partly on the erroneous assumption of the permanency of types (fixity of species), partly on the brief record of the Mosaic cosmogony, which certainly did not allow sufficient time for the differentiation of the existing human varieties. But this difficulty is now removed by the results of recent research, which place beyond all doubt the existence of Linnæus's *homo sapiens* in early quaternary, if not even in late tertiary times (see MAN). Since then there has been ample time for the upward evolution even of the semi-simian pre-glacial 'men of Spy,' contemporaries of *Rhinoceros tichorinus*, and of *Elephas primigenius*. (Their remains were discovered in 1886 by MM. Lohest and De Puydt in a cave on the banks of the Orneau, commune of Spy, Namur, Belgium).

Apparently a more serious objection to the monogenist theory is based by Friedrich Müller, Professor Sayce, and others on the admittedly fundamental diversity of linguistic families. Thus is again raised the whole question of the relations of language to ethnology, a question by which this science has been from the first and still is unreasonably beset. It is argued that, if the languages of primitive peoples are radically distinct, the peoples themselves must have different origins; and, while some suggest twelve or more independent physical and linguistic groups, others attempt to avoid the seeming difficulty by supposing that, if originally one, the chief physical groups were differentiated before the evolution of speech, which was consequently independently evolved after dispersion of

homo alalus in so many independent geographical centres. But it is obvious, in the first place, that neither of these assumptions removes the difficulty; for if every fundamentally distinct linguistic presupposes a fundamentally distinct physical stock, then these latter must be reckoned not by units or tens, but by many hundreds, philology having clearly shown that, even excluding many extinct tongues, the radically different existing stock languages do not fall far short of a thousand. We have here therefore a *reductio ad absurdum*, and the assumption that physical and linguistic types coincide must be absolutely rejected. With its rejection is cleared away a fruitful source of endless confusion in ethnological studies. It follows, in the second place, that the difficulty itself is purely fanciful; for, if physical and linguistic types need not coincide, it is evident that within a given physical group we may have an indefinite number of independent linguistic groups. The further consideration that language changes much more rapidly than physique, a proposition that has become a commonplace with all anthropologists, leads us to expect that the relation must in fact be as here stated. Since the remote epoch when Haeckel's *homo primigenius alalus* ('speechless man') became Linnæus's *homo sapiens* endowed with speech and reason, there has been time for the development of several more or less marked physical varieties. Consequently, there has been also time for the more complete development of a much larger number of linguistic forms, the existence of which is thus no longer antagonistic to the primordial unity of mankind.

How this unity became diversified within certain relatively narrow limits is a question which, strictly speaking, belongs to the domain of Evolution (q.v.). It is the province of ethnology to study the varieties as they are, to determine their number, character, and mutual relations, with a view to an ultimate classification of all existing human groups. Here one point, that of mixture, requires to be all the more specially emphasised, as it is usually the less attended to by writers on this difficult branch of the subject. It may be stated broadly that, after the first more or less marked differentiations, whether due to the outward influences of the environment, to natural selection, the struggle for existence, the correlation of parts, or all these combined, all subsequent modifications have been mainly caused by incessant intermingling, and consequently that there are no longer any pure races in existence. (One may perhaps except a few isolated groups, such as the Andamanese Islanders, the Kai Colos of Fiji, the Ainos of Yesso, the Fuegian Kahgans, and till recently the Tasmanians, completely extinct since 1876; but the statement may be accepted as substantially true.) Long isolation in new centres exposed to new conditions of life would undoubtedly tend to fix changes gradually brought about by natural causes. But, as the earth became more densely peopled, fresh shiftings necessarily arose, colonies were thrown off, contact and collision between the earliest evolved varieties became inevitable. To the influences of the surroundings were thus added the far more potent effects of crossings, and the development of fresh types and sub-varieties of all sorts proceeded at an accelerated rate. This process was necessarily continued down to the present time, resulting in ever-increasing confusion of fundamental elements, and blurring of primordial types.

To this confusion and blurring must be attributed the great difficulty now felt in determining the number and the distinctive characteristics of the original human stocks, and the amazing diversity of views that has always prevailed on this subject. It cannot even be asserted that what we call the main divisions, the primary groups, are themselves original even in their ideal conception, and not the outcome of still more remote and earlier fusions. Who shall say that the dirty yellow tinge, for instance, of the average Chinese is not the result of a blend, as the light brown of the eastern Polynesians certainly appears to be?

This brings us to the consideration of the so-called 'ethnical criteria'—i.e. the various factors on which ethnologists rely in their different schemes of classification. These criteria are partly internal or anatomical—the skeleton in general, and particularly the cranium; partly external—colour of skin, colour and texture of hair, and such other determining elements, whether physical or mental, as may be studied on the living subject. Although opinion varies considerably as to the value of these several characteristics, there is a general consensus in attaching special, if not permanent, importance to the three elements of colour, hair, and form of the skull. Of these colour, probably because the most conspicuous feature, was the first to be considered, and formed the basis of all the early classifications, such as those of F. Bernier (1672), who distinguished four radical types—European White, African Black, Asiatic Yellow, and Northern Lapp; of Linnæus (1738–83), whose *homo sapiens* comprised four species—the light-skinned European, the yellow Asiatic, the black African, and brown or tawny American; and of Blumenbach (1752–1840), whose groupings fluctuated, but whose terminology (Caucasic, Mongolic, &c.) has been largely retained.

Then followed a chaotic interval, during which almost every writer proposed with equal confidence a fresh division of the primary human groups. During this period, ethnology, in common with other studies affording large scope for the exercise of the imaginative faculties, became the battle-ground rather of partisans than of men of science. The wildest theories on the specific unity or disparity of mankind, the permanence or evanescence of types, the innate capacity or incapacity for progress, and so forth, were advocated, often with much erudition, but little common sense, by Nott and Gliddon, Morton, Knox, even Cuvier and Agassiz, apparently more eager to further their peculiar political and religious views than to promote the cause of truth. Some of these theories were even self-destructive, as for instance those of Agassiz on unity of species and difference of origin. Most of them are now interesting only to the historian of mental aberration, and, their standpoint being mainly polemical rather than scientific, they did little to advance ethnological studies.

Order was at last restored by the craniological school, founded by the elder Retzius (1796–1860), which made the shape of the head the basis of all classification, and thus introduced exact methods into this branch of the subject. The result has shown that craniology alone cannot be depended upon to supply sufficient, or even altogether trustworthy, materials for distinguishing the main divisions of mankind. Its chief elements, such as dolichocephaly and brachycephaly (i.e. length or shortness of the skull as measured from front to back), orthognathism and prognathism (less or greater projection of the jaws), are not constant in any given groups, and in many cases the most surprising diversity prevails where some degree of uniformity might be expected. Thus, the Eskimos, grouped with the more or less brachycephalic Mongol division, are marked by extreme dolichocephaly; the extinct Tasmanians, belonging to the prognathic Negro division, were highly orthognathic; no norma, either of gnathism or cephalism, can be established for the Oceanic Malay and Papuan races,

while every shade of cephalism prevails amongst the Caucasic peoples. Nevertheless, craniology can be neglected by no ethnologist, and its study has already thrown much light on various departments of anthropological science. See SKULL.

Of late years the colour and texture of the hair, the value of which had been anticipated by Linnæus, have steadily risen in the estimation of naturalists as a racial test. It is now regarded as the most constant of all the physical features, and has been made the foundation of their groupings by some of the most eminent modern anthropologists, such as Huxley, Fr. Müller, Haeckel, and Broca. Its constancy is shown by the Negro division, all branches of which, without any exception, have black and more or less frizzly hair, flat or highly elliptical in section; and by the Mongol division, which, including all the American aborigines, is uniformly characterised by straight black hair of the horse-tail type, cylindrical in section. In the Caucasic division this feature varies considerably, but still within certain limits. Thus, it may be straight, wavy, or curly, but never frizzly; the colour also may range from jet black through all shades of brown, and even red, to the lightest flaxen; but there still appears to be a certain correlation on the one hand between the black hair and dark complexion, on the other between the light hair and fair complexion of the two well-marked branches of the Caucasic division.

The other ethnical elements, whether physical or mental, are of little value taken apart, but are often useful aids in combination with themselves, and especially with the three above specified criteria. Such are stature; the shape, colour, and position of the eye; the weight or volume of the brain (cranial capacity); the form of the nose—remarkably constant in some groups; the form of mouth and lips; the superciliary and zygomatic arches, and all such other elements as collectively constitute the broad flat features of the lower, the oval and regular of the higher races—Kollmann's chamoprosopic and leptoprosopic types. Of mental or intellectual criteria immeasurably the most important is language, which, however, has had the misfortune of suffering from friends and foes alike, philologists rating it much too high, anthropologists depreciating it to a corresponding extent. Yet that speech cannot be neglected, even by the purely anthropological student, is obvious from the fact that different phonetic systems often involve different anatomical structure of the vocal organs. Owing to these differences, Europeans find it impossible, even after years of residence amongst the natives, to pronounce the various clicks of Bushman, Hottentot, and Zulu-Kafir tongues, or the many rasping sounds of the Thlinkît, Apache, and other American idioms. The 'absolute impossibility' of imitating certain tones in the Papuan languages of New Guinea is by Miklukho Maclay rightly attributed to 'fundamental differences in the anatomical structure of the larynx, and the whole muscular system of the organs of speech in the two races' (European and Melanesian). And he adds that 'not only the organ of speech, but also that of hearing, plays an important part, for the same word may be heard in a totally different manner by different persons' (*Ethnologische Bemerkungen*). Neither the Jews nor the African negroes in America have yet learned to correctly pronounce the European languages spoken by them as their mother-tongues for many generations. At the same time, 'philology and ethnology are not convertible terms' (Sayce), and extreme caution must always be used in the treatment of language as an ethnical test. It is a helpmate which, in the hands of uncritical writers, has too often proved a pitfall.

Of other mental or moral criteria it will suffice here to mention *religion*, which, owing to the fundamental unity of the psychic element in man, can never be regarded as a true test of race, and *social pursuits*, such as the chase, pasture, and agriculture. On the latter point much misconception prevails, and it is especially a mistake to suppose that the order of progress is necessarily from the hunting through the pastoral to the agricultural state. Some of the lowest African tribes are, and always have been, tillers of the soil, while other peoples, such as the Kirghiz and Kalmucks, ranking much higher in the social scale, are still nomad pastors. These pursuits, in fact, are questions not of race, but of the outward conditions of soil and climate, as we see in the Arabian peninsula, where the stock-breeders of the Nejd plateau become skilful husbandmen in the Yemen uplands.

Basing their conclusions on the comparative study of all these ethnical criteria, the most eminent naturalists, from Linnæus and Blumenbach to Huxley, Virchow, Flower, Broca, and Topinard, mainly agree in classifying the whole human family in three or at most four fundamental divisions. From the foregoing exposition of the subject, it follows of itself that all classifications must be regarded not as *genetical*—i.e. divisions according to common descent, but rather as groupings according to physical and mental resemblances. It also follows that the term *fundamental* is to be understood not absolutely, but only in a relative sense; for all races (this term being here taken as practically equivalent to 'breeds' or 'varieties') are necessarily regarded as belonging to a common primeval stock, constituting a single species. At the same time it does not follow that all must necessarily be supposed to have sprung from a single human pair. On the contrary, the more natural assumption would seem to be a gradual upheaval, so to say—i.e. the slow evolution of a whole anthropoid group spread over a more or less extensive geographical area, in a warm or genial climate, where the disappearance of an original hairy coat would be rather an advantage than otherwise. This view of gradual ascent in a more or less homogeneous mass has the advantage of obviating the many difficulties connected with *unity of species* and *unity of descent*, which are now seen no longer to be identical expressions. It also allows for differences in the physical habitus *from the first*, these differences, however slight, helping in combination with altered environments to account for the divergences that have in the course of ages resulted in the present fundamental human types. Thus, we no longer require to ask ourselves, for instance, whether the black hue shaded into the yellow, the brown into the white; whether prognathism grew into orthognathism, brachycephalic or round into dolichocephalic or long heads, and so on. None of these extremes, but only the germs of all, need be assumed as starting-points; and it is not a little remarkable that the Andamanese Islanders, declared by the highest authority to be 'the most infantile' of human races, are also amongst the least marked in these respects. Their colour is dark, but far from black; their prognathism is not pronounced; their stature is low, but not dwarfish—4 feet 10 inches as compared with the Akka, 4 feet 6 inches, and Batwa, 4 feet 3 inches (Wissmann, Flower, Man). The existing marked types may therefore be taken as collateral developments rather than independent primordial conditions, or gradual modifications of any one extreme type.

The difficulty of determining the exact number of these types is due to the fact, already pointed out by Blumenbach, that none of them are found in what may be called ideal perfection, but that all

tend to merge by imperceptible degrees in each other. But the issue now appears to be narrowed down to a choice between three, four, or at most five primary groups, with one or more marked subdivisions in each. These are the black, frizzly-haired *Ethiopic* (*Negro*); the yellow, lank-haired *Mongolic;* the white, smooth-haired *Caucasic;* the coppery, lank and long-haired *American;* and the brown, straight-haired *Malayo-Polynesian.* But the last is commonly rejected as evidently the outcome of comparatively recent mixture, in which the Mongolic elements predominate. In fact, the Oceanic Malays proper cannot be separated anthropologically from the Asiatic Mongol group. Most authorities also regard the American as a remote branch of the same group, and this view seems justified by the striking Mongolic features occurring in every part of the New World, as amongst the Utahs of the western States and the Botocudos of eastern Brazil. We are thus reduced to the three first-mentioned divisions, a grouping again adopted by Professor Flower (1885), who concludes that primitive man has in the course of ages become differentiated into 'the three extreme types represented by the Caucasian of Europe, the Mongolian of Asia, and the Ethiopian of Africa, and that all existing members of the species can be ranged around these types, or somewhere or other between them.' But it is not to be supposed that all the distinctive characters of these three types are found co-existing in any considerable masses of the several groups. The ideal *homo Æthiopicus, Mongolicus,* and *Caucasicus* must therefore be constructed, so to say, by a sort of eclectic process, by selecting and grouping together the more salient features assumed to be characteristic of each. In this way has been prepared the subjoined comparative scheme of the three main divisions, the points of contrast or resemblance between which will be best shown by their juxtaposition. Here it should be noticed that the Caucasic is divided by Huxley into two distinct branches—the Xanthochroi, or fair, and the Melanochroi, or dark—which in this table are respectively indicated as 1 and 2.

TABLE OF THE CHIEF CHARACTERISTICS OF THE THREE FUNDAMENTAL HUMAN TYPES.

	Ethiopic.	Mongolic.	Caucasic.
Colour and Character of Skin.....	Blackish, sometimes almost sooty black; velvety and cool to the touch, emitting a distinct odour.	Yellowish, passing into olive, and almost every shade of brown; rough in texture; often with a *fade*, washed-out look.	Whitish; (1) very florid or ruddy; transparent, clearly showing the veins; (2) pale, but often dusky or swarthy; both merging in some places in a light olive, in others in various shades of brown.
Hair and Beard.....	Jet black, frizzly or 'woolly,' rather short; flat in transverse section; sometimes said to grow in separate tufts; scant or no beard.	Dull black, coarse, lank, lustreless, sometimes (in America) very long; round in section; moustache developed; beard scant or absent.	(1) Flaxen, light brown, and even red, long, wavy, and silky; (2) black or dark brown, rather straight, but sometimes kinky or curly; both oval in section; both with full beard.
Skull and Face.....	Skull mainly dolichocephalic (long and narrow), sometimes also very high (hypristenocephalic); prognathous lower jaw; high cheek-bone; large, black, round, and prominent eye, with yellowish cornea; broad flat nose; thick, everted lips, showing the red inner skin.	Skull mainly brachycephalic (round, but never quite circular); mesognathous jaw; large cheek-bone; narrow, almond-shaped, black eye, slightly oblique; very small, concave nose; features generally broad and flat, something hatchet-shaped.	(1) Skull mainly dolichocephalic; (2) mainly brachycephalic; both orthognathous; (1) eye blue, hazel, or brown; (2) eye large, black, and bright. Both long, straight nose, often arched or aquiline; small mouth, thinnish lips; features mainly oval and regular.
Stature and Figure...	Generally tall, rather above the average, ranging from 5 feet 6 inches to 5 feet 10 inches and even 6 feet; large, bony frame, stout and robust, but weak in lower extremities.	Generally short, rather below the average, 5 feet to 5 feet 6 or 7 inches; but American branch often very tall; heavy, squat, angular frame, especially on the uplands (Tibet, Bolivia).	(1) Tall, above the average, 5 feet 6 inches to 5 feet 10 inches and 6 feet; (2) below the average, 5 feet 2 inches to 5 feet 6 or 7 inches; but much diversity within each group. (1) Powerful brawny frames, often very strong; (2) lithe, active frames, often with much staying power (Basques).
Temperament.....	Sensuous, unintellectual, cheerful, and even boisterous, but fitful, passing suddenly from comedy to tragedy; hence at once affectionate and cruel; science, art, and letters undeveloped.	Sluggish, somewhat morose and taciturn; hence passive, with little initiative, but with great power of endurance, and subject at times to vehement outbursts; science slightly, art and letters moderately developed.	Highly imaginative, active and enterprising; hence at once speculative and practical; (1) somewhat solid, serious and persevering; (2) fiery, impulsive, but inconstant. Science, art, and letters highly developed in both.
Language.....	All agglutinating, mostly with prefixes and alliterative harmony (Bantu); relatively few abstract terms.	Some isolating and uninflected, with tendency to monosyllabism and tone; some agglutinating, mostly with postfixes and vowel harmony; some polysynthetic; abstract terms numerous.	Nearly all inflecting, mainly by postfixes completely merged in modified root; hence more or less synthetic, with a general tendency towards analysis; abstract terms practically unlimited.
Religion.....	Non-theistic; nature-worship, with fetichism and witchcraft as conspicuous elements.	Polytheistic; spirit-worship (Animism); belief in dreams and visions (Shamanism); also Buddhism.	Monotheistic (Unitarian, Trinitarian), with creeds based on revelations; priesthood (mediation) a prominent feature; also Brahmanism.

Subjoined is a brief summary of the main divisions and subdivisions of these three fundamental groups.

I. The Ethiopic Group falls naturally into a western or African, and an eastern or Oceanic division. The western, occupying all Africa from the Sahara southwards, comprises a northern or *Soudanese* branch (African Negroes proper), and a southern or *Bantu* branch (more or less mixed Negro and Negroid populations), reaching northwards to about 5° N. lat. The former are marked by considerable physical unity and great linguistic diversity; the latter by almost absolute linguistic unity (Bantu languages) and great physical diversity. The chief members of the Soudanese branch are Mandingan, Wolof, Felup, Sonrhai, Haussa, Egbe, Ibo, Yoruba, Fanti, Nupe, Michi Batta (West Soudan, Upper Guinea, Adamawa); Kanuri, Kanembu, Tibu (?), Mosgu, Yedina,

Bagirmi, Maba (Central Soudan, East Sahara, Wadai); Shilluk, Nuba, Dinka, Janghey, Bongo, Bari, Monbuttu, Zandeh (East Soudan, White Nile, and Welle-Mobanji basins); Masai, Kavirondo, Elgeyo, Samburu (Masai Land, Lake Rudolph). The chief members of the Bantu branch are Wa-Pokomo, Wa-Sambara, Wa-Chaga, Wa-Swahili, Wa-Zaramo, Wa-Sagara, Wa-Nyamezi, Wa-Gogo, Ma-Nyanja, Ma-Kua, Ma-Vita, Ajawa (eastern seaboard); Zulu-Kafir, Ba-Suto, Be-Chuana, Tonga, Ba-Rotse, Mashona, Ba-Yeye, Makalaka, Makololo, Maganya (South Africa); Ova-Herero, Ova-Mbo, Ganguella, A-Bunda, Ba-Fyot, A-Bongo, Ma-Yombe, Fan, Ba-Kale, Mpongwe, Ba-Koko, Dwalla, Bubi (western seaboard); Wa-Regga, Ba-Lolo, Tu-Shilonge, Ba-Ngala, Bu-Banghi, Ba-Teke, Ba-Lunda (Congo Basin).

The Oceanic division of the Ethiopic group comprises four branches: (1) The *Papuans* of the Eastern Archipelago and New Guinea; (2) the closely allied *Melanesians* of the Solomon, New Hebrides, New Caledonia, Loyalty, and Fiji archipelagoes; (3) the now extinct *Tasmanians;* and (4) the *Australians*, the most divergent of all Negro or Negroid peoples.

Within both Ethiopic domains are scattered several dwarfish groups, the so-called *Negritos* or *Negrillos*—i.e. 'Little Negroes,' perhaps representing the true aboriginal element in these regions. In Africa the best known are the *Akkas* of the Upper Welle basin, the *Obongos* of the Gaboon, the *Batwas* of the Middle Congo (smallest of men), and the *Bushmen* of South Africa, leading through the taller *Hottentots* to the Negroes proper. In Oceania still survive the *Aetas* of the Philippine Islands, the *Simangs* of the Malay Peninsula, the so-called *Mincopies* of the Andaman Islands, and the *Arfaks* of New Guinea. The *Kalangs* of Java have recently died out. Besides their smaller stature, all the Negritos differ from the Negroes by their extreme brachycephaly.

II. The MONGOLIC GROUP occupies the greater part of the eastern hemisphere, and till the discovery of America was in exclusive possession of the New World. Its chief branches are: (1) The *Mongolo-Tatars* of Central and North Asia, Asia Minor, parts of Russia and the Balkan Peninsula; (2) the *Tibeto-Indo-Chinese* of Tibet, China proper, Japan, and Indo-China; (3) the *Finno-Ugrians* of Finland, Lapland, Esthonia, Middle Volga, Ural Mountains, North Siberia, Hungary (Magyars); (4) the *Malayo-Polynesians* of the Malay Peninsula, the greater and lesser Sunda Islands, Madagascar, the Philippines, Formosa, and Eastern Polynesia (New Zealand, Samoa, Tahiti, Hawaii, and Micronesia); (5) the *American Indians*, comprising all the aborigines of the New World except the *Eskimo*, who, with the *Ainos* of Yesso, form aberrant members of the Mongolic group.

III. The CAUCASIC GROUP, called also MEDITERRANEAN because its original domain is Western Asia, Europe, and North Africa—i.e. the lands encircling the Mediterranean Basin—has in recent times spread over the whole of the New World, South Africa, and Australasia. Chief branches: (1) *Aryans* of India, Iran, Armenia, Asia Minor, and great part of Europe, with sub-branches Hindus, Afghans, Persians, Beluchis, Armenians, Ossetians, Hellenes, Thraco-Illyrians, Italo-Siculi, Celts, Teutons, and Letto-Slavs; (2) *Semites* of Mesopotamia, Syria, Arabia, and North Africa, with sub-branches Assyrians (extinct), Syrians, Arabs, Phœnicians (extinct), Abyssinians, all except the last named now assimilated in speech to the Arabs; (3) *Hamites* of North and East Africa, with chief sub-branches Berbers of Mauritania, Tuaregs of West Sahara, Copts and Fellahîn of Egypt, Fulahs (?) of West Soudan, Bejas (Bishari) and Afars (Danâkil) along west side of the Red Sea, the mixed populations of Galla, Somali, and Kaffa Lands; (4) the *Caucasians* proper (Georgians, Circassians, Abkhasians, &c.); (5) the *Basques* of the Western Pyrenees, now distinguished mainly by their primitive speech from the surrounding Iberian and Gallic populations.

Although treatises on various branches of the anthropological sciences are past counting, comprehensive works of a strictly ethnological character are not numerous, and of these few can be recommended as safe guides to the student. The subjoined are valuable either intrinsically or as able expositions of particular theories: Blumenbach, *De Generis humani varietate nativa* (3d ed. 1795); Prichard, *Natural History of Man* (1843) and *Researches* (1813); Desmoulins, *Hist. Nat. des Races Humaines* (1826); Baer, *Vorlesungen über Anthropologie* (1824); Edwards, *Des Races Humaines* (1829); Bory de Saint-Vincent, *L'Homme* (2d ed. 1827); Courtet de l'Isle, *Tableau ethnographique* (1849); Thomas Smyth, *The Unity of the Human Race* (1851); Carl Vogt, *Lectures on Man, &c.* (English ed. undated); Hollard, *De l'Homme* (1853); Cuvier, *L'Homme* (1857); Nott & Gliddon, *Types of Mankind* (1854) and *Indigenous Races of the Earth* (1854); Knox, *The Races of Men* (1862); D. Wilson, *Prehistoric Man* (1862); Latham, *Man and his Migrations* (1851); *Nat. Hist. of the Varieties of Man* (1850), and other ethnological essays; Waitz, *Anthropologie der Naturvölker* (1864); Müller, 'Ethnographie,' in *Reise der Novara* (1861 *et seq.*); Brace, *The Races of the Old World* (1863); Broca, *Le Linguistique et l'Anthropologie* (1862), &c.; Pouchet, *Plurality of the Human Races* (English ed. 1864); De Quatrefages, *Metamorphoses of Man* (English ed. 1864), &c.; Retzius, *Ethnologische Schriften* (1864); Rolle, *Der Mensch* (1866); Bastian, *Das Beständige in den Menschenrassen* (1868), and many other treatises; Huxley, 'Man's Place in Nature,' in *Journal of Ethnol. Soc.* (1870); Hovelacque, *Langues, Races, Nationalités* (1872); Peschel, *The Races of Man* (1876); Topinard, *Anthropology* (English ed. 1878); C. Bray, *Manual of Anthropology* (1871); Tylor, *Anthropology* (1881); Joly, *Man before Metals* (1883); the publications of the Paris, British, and other Anthropological societies.

Ethyl, $(C_2H_5)_2$, is a colourless, inflammable gas, obtained by the action of iodide of ethyl, C_2H_5I, on granulated zinc. It possesses an agreeable odour, is insoluble in water, but soluble in alcohol. It is not, however, on its own account that ethyl is of importance, but because it is the starting-point of an important series of organic compounds known as the *ethyl series*. In all of these the group CH_2-CH_2 or C_2H_5 is present, and acts as if it were an atom of some elementary substance—e.g. potassium. Thus we have

Potassium,	K;	Ethyl,	C_2H_5
A molecule of Potassium,	K_2;	A molecule of Ethyl,	$(C_2H_5)_2$
Potassium Iodide,	KI;	Ethyl Iodide,	C_2H_5I
Potassium Oxide,	K_2O;	Ethyl Oxide or Ether	$(C_2H_5)_2O$
Caustic Potash,	KOH;	Ethyl Hydrate or Alcohol,	C_2H_5OH.

In these we see that the group of atoms, C_2H_5, always enters into combination as if it were indivisible, and it is usual to call this group ethyl, and to reserve the term diethyl for the compound $(C_2H_5)_2$ described above. Ethyl, C_2H_5, is only hypothetical, and does not exist in the free state, while diethyl, $(C_2H_5)_2$, is an actual gas. See ALCOHOL, BASE, and ETHER.

Ethylamine, $NH_2C_2H_5$, is a substance resembling ordinary ammonia in its odour and many of its properties. It is found in coal-tar, in the oil obtained during the destructive distillation of bones, in the gases evolved during putrefaction, and may be produced by complicated chemical processes. Ethylamine has been called an artificial alkaloid (see ALKALOID), because it is regarded from a chemical point of view as ammonia, in which one atom of hydrogen is replaced by the group Ethyl (q.v.).

Etiolation. See BLANCHING.

Etive, a salmon-river and a sea-loch of Argyllshire. The river, issuing from a loch on Rannoch Muir, near lonely Kingshouse Inn, runs 15 miles south-westward to the head of the loch, which itself extends 10½ miles south-westward, then 8¾ westward, until at Dunstaffnage Castle, 3½ miles NNE. of Oban, it merges in the Firth of Lorne. Narrowing from 1½ mile to less than 2 furlongs at Connel Ferry, its reef-barred entrance, where the depth too decreases from 420 feet to 6 at low-water, this loch offers a good example of an ancient submerged glen. Like that of Loch Awe (q.v.), its scenery is magnificent, the upper reach closely engirt by mountains, of which the loftiest are Ben Cruachan (3689 feet) and Ben Starav (3541). Ardchattan Priory, founded on its north shore in 1281 for monks of the order of Vallis Caulium, is a beautiful ruin; so, too, is Dunstaffnage, the fabled seat of the Dalriadan kings, the stronghold really of Macdougals and Campbells, and the prison for a while of Flora Macdonald. See also BEREGONIUM.

Etna, or ÆTNA (called by the modern Sicilians MONTE GIBELLO—the last part of the name being the Arabic *Jebel* Italianised), an isolated volcanic mountain close to the east coast of Sicily, with a base 90 miles in circumference, and a height of 10,850 feet. The mountain mass rises with gentle and regular slopes up to a single cone, containing the crater, a chasm about 1000 feet in depth and from 2 to 3 miles in circumference. The regularity of the slope is, however, broken by the Val del Bove, an immense gully excavating the eastern flank of the mountain, 4 or 5 miles in diameter, and surrounded by nearly vertical precipices from 2000 to 4000 feet high; it has a singularly dreary and blasted appearance. A striking feature is the very great number of secondary cones dotted all over the flanks of the mountain. Of these the principal are the Monti Rossi, 450 feet high, twin peaks which were cast up during the eruption of 1669. The slopes of the mountain are divided into three sharply defined zones, the cultivated, the woody, and the desert region. This last, extending from about 6300 feet upwards, is a dreary waste of black lava, scoriæ, ashes, and sand, covered during the greater part of the year with a sheet of snow. The wooded region, which stretches down to the line of 2000 feet, though with considerable variation of breadth, is planted with forests of chestnuts, beeches, birches, pines, maples, and oaks. Below this lies the cultivated zone, a thickly peopled region of great fertility, where the vine, date-palm, bananas, sugar-cane, oranges, lemons, olives, figs, almonds, &c. are grown. The ascent is usually made from Catania, a town on the coast to the south. The origin of the mountain goes back to the Pliocene age, when its foundation was probably begun in a submarine bay penetrating into the west coast of Sicily. The geological structure of the Val del Bove lends support to the view that there once existed a second great crater, the centre of permanent eruption.

The most remarkable of the recorded eruptions of Etna are the following: 1169, when Catania and 15,000 of its inhabitants were destroyed; 1329, when a new crater opened near the Val del Bove; 1444, when the cone fell into the crater; 1537, on which occasion two villages and many human beings perished; from 1603 to 1620 Etna was almost continually in activity; in 1666 three new craters were formed. The most violent outburst of all was, however, that of 1669, when a chasm 12 miles long opened in the flank of the mountain, and from it issued a line of flames, whilst a new crater was made. During an outburst in 1755 a large flood of water was poured down from the Val del Bove. In 1852–53 there was a violent eruption which lasted nine months; a torrent of lava, 6 miles long by 2 broad, and some 12 feet in depth, was ejected. About 100 eruptions have been pretty accurately described, 16 having occurred in the 19th century. In 1880 an observatory was built on the south side of the mountain, at a height of 9075 feet above the sea, being the highest inhabited house in Europe (nearly 1000 feet higher than the hospice of the Great St Bernard). See Ferrara, *Descrizione dell' Etna* (1818); Rodwell, *Etna and its Eruptions* (1878); and Sartorius von Waltershausen, *Der Aetna*, edited by Von Lasaulx (2 vols. Leip. 1880).

Eton, a town in the south of Buckinghamshire, on the left bank of the Thames, 21 miles WSW. of London. It lies opposite to Windsor, in Berkshire, and is included in its parliamentary borough. Eton chiefly consists of one long street, and is mainly dependent on the college. Pop. of parish (1851) 3796; (1881) 3984, of whom 3464 were in the town. Pop. of the town in 1891, 2499.

ETON COLLEGE, one among the most famous educational establishments in England, was founded in 1440 by Henry VI., under the title of 'The College of the Blessed Mary of Eton beside Windsor.' The original foundation consisted of a provost, 10 priests, 4 clerks, 6 choristers, 25 poor grammar-scholars, a master, and 25 poor infirm men. The king provided for the establishment out of his own demesne lands and the estates of certain alien priories. A supplementary charter was granted in 1441, in which year also the college buildings were commenced. Henry was very solicitous that the work should be of a durable kind. Some of the buildings were finished in 1443, and were handed over by the royal commissioners to the provost, clerk, and scholars. Political troubles of various kinds retarded the completion of the buildings till 1523. Bishop Waynfleete was the first head-master, and afterwards a munificent supporter of the college. The institution passed through much peril in the reign of Edward IV., and again in the time of the Commonwealth; but it weathered the dangers, and the increasing value of its estates brought in a large income. The original foundation has been greatly modified under the Public Schools Act, 1868. It now consists of a provost and 10 fellows, who constitute the 'governing body,' 2 chaplains or conducts, and 70 king's scholars or collegers. The members of the governing body are nominated by the universities of Oxford and Cambridge and other learned and responsible electors. Several valuable scholarships at King's College, Cambridge, are filled up every year from among the scholars or oppidans by competitive examination. There are also other scholarships and prizes open to all the members of the school, such as the Newcastle and Tomline scholarships, and prizes for modern languages, founded by the late Prince Consort. The scholars are lodged within the college walls. The main portion of the establishment, however, numbering nearly 900, consists of the *oppidans*, students who live in houses held by the masters, and whose friends pay liberally for their education. The tuition is the same for them as for the collegers. Till 1851 the course of education was purely classical, but mathematics was admitted into the curriculum in that year, physical science in 1869, and the college now possesses an admirable museum, laboratory, and observatory. Among famous Etonians have been Bolingbroke, Boyle, Canning, Chatham, Derby, Fielding, Fox, Gladstone, Gray, Hallam, Kinglake, Lyttelton, Milman, Porson, Praed, Pusey, Shelley, the Walpoles, Wellesley, and Wellington.

The college buildings are of various date and varying beauty—from the original work of the 'royal saint' down to a chapel for the younger

boys, a museum, and other school buildings, whose memorial stone was laid by Queen Victoria on 18th May 1889. They include the chapel, hall, library, and schools, the provost's and master's apartments, and the lodgings of the fellows, surrounding two quadrangles. The chapel is of stone, the other buildings of brick; and the effect of the whole is strikingly picturesque, as seen from the terrace of Windsor Castle, on the other side of the Thames. The Gothic chapel is especially beautiful, rich in carving and painted glass. The 'Montem,' or triennial procession to Salt Hill (*ad montem*), was celebrated last in 1846. See Maxwell Lyte's *History of Eton College* (1875; new ed. 1889); Creasy's *Eminent Etonians* (1850; new ed. 1876); and Jesse's *Celebrated Etonians* (1875).

Etretat, a Norman watering-place, 18 miles NE. of Havre, in a country remarkable for picturesque rock formations. Pop. 2000.

Etruria was the country inhabited or ruled by the Etruscans, a very ancient people of Italy. Etruria Propria, with which we are chiefly concerned, lay west of the Tiber and the Apennines, and included the valley of the Arno. In the 6th and 5th centuries B.C. the Etruscans held also the valley of the Po, called Etruria Circumpadana, and a region south of the Tiber, called Etruria Campaniana. Etruria Propria was a confederation of twelve cities or states, the *duodecim populi Etruriæ*. No list of these cities has come down to us, but Veii, Tarquinii, Cære, Clusium, Cortona, Perusia, Vulci, Volsinii, Vetulonia, Volaterræ, and Arretium may probably be included, while the twelfth may have been either Rusellæ, Falerii, or Populonia. To the northern confederation twelve cities are also assigned; among them we may reckon Mantua, Chiavenna, Felsina (Bologna), Ravenna, and Hatria, whose importance is shown

by its having given a name to the Adriatic. In the southern province were Capua and Nola, and possibly Salerno. Some of these cities are now deserted sites, marked only by vast cemeteries and the remains of cyclopean walls, while others still retain more or less of their old importance.

Veii, for four centuries the formidable foe and rival of Rome, from which it is only 11 miles distant, is now utterly desolate. It was taken and destroyed by Camillus in 396 B.C. The necropolis, extending over 16 sq. m., attests the splendour of the ancient city and the vast population which must have dwelt within its walls, 7 miles in circuit. Six miles from the sea, midway between

Fig. 1.

Rome and Civita Vecchia, is the village of Cervetri, which preserves the name and marks the site of Cære, which, under its older name of Agylla, is said to have been a 'Pelasgian' city before the arrival of the Etruscans. On this site inscriptions have been found, written in a language and an alphabet called 'Pelasgic,' and believed to be pre-Etruscan. The paintings in some of the tombs are in a style no less archaic. Of later date is the tomb of the Tarquins, who are said to have fled to Cære when expelled from Rome. Cortona, perched upon a rock, and surrounded by fragments of massive walls, possibly of pre-Etruscan date, occupies the most venerable site in Italy. In the time of Herodotus, Cortona, like Cære, retained its 'Pelasgic' character. Dionysius says it was a great and flourishing city of the Umbrians before it was taken by the Etruscans, who made it their northern capital. The bronze-workers of Cortona were renowned, and the local museum contains noteworthy examples of their skill. The southern capital was Tarquinii, a city purely Etruscan. Corneto, a town 60 miles from Rome, and not far from the sea, occupies a portion of the site. The necropolis of Tarquinii, which extends over many miles, contains several sepulchral chambers, painted in the archaic style of the genuine art of the Etruscans, and giving a curious insight into their religious beliefs. We have scenes from the under-world, representing souls riding on horseback or seated in cars, led away in the charge of good or evil spirits. Elsewhere the daily life of the people is depicted; we see horsemen returning from the chase, chariots, boar-hunts, wrestlers, pugilists, banqueting scenes, dancing girls, and musicians. Fig. 1 represents a dancing girl and musicians from the walls of a tomb called the Grotta del Triclinio, and fig. 2 a death-scene from a tomb called the Camera del Morte. The tombs of Clusium (now Chiusi) exhibit the same archaic character as those of Tarquinii. A vast chambered tumulus called the Poggio Gajella is probably that described by Varro as the tomb of Lars Porsena. Vulci, though barely mentioned by historians, must have been a very wealthy and populous city. The necropolis has yielded a richer treasure of artistic objects than any other Etruscan site. The Cucumella, a huge chambered tumulus like that at Clusium, bears a curious resemblance to the great tomb of Alyattes,

king of Lydia, the father of Crœsus, near Sardis. Volsinii gave its name to Lake Bolsena, on whose shores it stood. It was one of the most powerful Etruscan cities, and one of the last to yield to Rome. From Volsinii we have few monuments or inscriptions, the necropolis not having yet been found. On the other hand, Perusia (now Perugia) has yielded 1200 inscriptions, among them the famous cippus, a stone containing the only Etruscan inscription of considerable length. It has not been deciphered, but appears to be the record of the assignment of a sepulchre to the Velthina family.

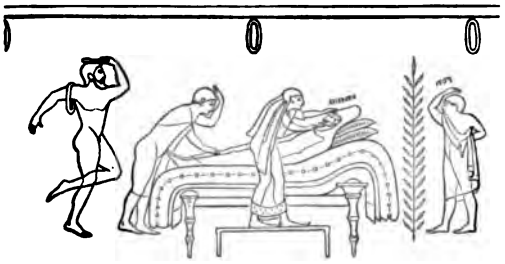


Fig. 2.

Velathri (now Volterra), called Volaterræ by the Romans, stands, like Cortona, upon an almost impregnable rock, surrounded by Etruscan walls, five miles in circuit. It held out against the Romans after all the rest of Etruria had been subdued. The people burned their dead instead of burying them, and the local museum contains 400 ash-chests, like miniature sarcophagi, the sides carved with mythological subjects, or with representations of bull-fights, boar-hunts, horse-races, and gladiatorial combats. Cyclopean walls mark the sites of Rusellæ, Cosa, Saturnia, and of Pupluna (Populonia), a seaport, interesting chiefly for its coins. The walls of Fæsulæ (Fiesole), near Florence, are well known to travellers. Orvieto (*Urbs Vetus*) must have been an important Etruscan site, but its ancient name is unknown. Vetulonia was probably near Magliano, a squalid village in the Maremna. Neither Luna nor Pisæ have yielded any remains of interest. Other Etruscan sites, among them Viterbo (Surrina), Bologna (Felsina), Toscanella (Tuscania), Siena (Senæ), Arezzo (Arretium), Sovana (Suana), and Ferento (Ferentium), are described by Dennis, *Cities and Cemeteries of Etruria* (2d ed. 1878), to which the reader may be referred for fuller information.

History.—The history of Etruria, like that of Carthage, has to be reconstructed from accounts transmitted by hereditary foes. The Roman legends represent Etruria as a powerful and wealthy state before Rome was founded. According to a tradition preserved by Varro, the Etruscan era commenced in 1044 B.C., nearly three centuries before that of Rome. When legend ceases and history begins, we find the Etruscans a great naval power, allied with Carthage against the Greeks, and dominant throughout northern and central Italy, Rome itself being included in the Etruscan dominion, and ruled by Etruscan kings. The legend of the migration of the Tarquin dynasty from Tarquinii may signify the extension of the domination of that powerful city over the regions southward of the Tiber. A cemetery, believed to be Etruscan, has been discovered on the Esquiline, and the Cælian Hill in Rome bears the name of the Etruscan chieftain Cæles Vibenna. The paintings and inscriptions in a tomb at Vulci give an Etruscan version of the Tarquinian story. We see the hero 'Macstrna' (Mastarna), an Etruscan appellation applied to Servius Tullius, cutting the bonds of his friend and companion Caile Vibinas (Cæles Vibenna), while Cneve Tarchunies Rumach (Cn. Tarquinius Romanus) is being killed by an Etruscan. The names of Tarquin, Mastarna, and Cæles Vibenna, thus curiously preserved, prove that Livy's account of the Etruscan kings of Rome is not wholly legendary. But that it was not derived from contemporary sources is indicated by a recent discovery of considerable interest. We learn that in 509 B.C. Lars Porsena of Clusium, as Livy calls him, marched with a great army to the gates of Rome to replace Tarquin on the throne. Now, in a newly-opened tomb at Vulci, a sarcophagus was found, on which is depicted in relief a high official with insignia resembling those of a Roman consul. He is riding in procession on a biga, preceded by two lictors with their fasces, and followed by two servants. The inscription informs us that this deceased magistrate, Tute Larth, was *purtsvana thuns*, 'five times Porsena.' It is manifest that Porsena was not, as Livy supposed, a proper name, but, like 'Pharaoh' in Egypt, the designation of an office; and that the Etruscan chief who took up Tarquin's cause was the elected 'Porsena' or chief-magistrate of Clusium. In like manner, since the word *machs* meant 'first' in Etruscan, it seems probable that Macstrna, the Etruscan appellation of Servius Tullius, was not a proper name, but a designation of the kingly office, equivalent, it would seem, to Princeps. We are also told that Tarquin, with his two sons, Titus and Aruns, took refuge in Cære. Not only are Tite and Arnth usual names in Etruscan epitaphs, but at Cervetri, the site of Cære, there is an immense chambered tomb containing mortuary records of forty-six members of the Tarcna family, which must have been resident at Cære for many generations.

As an Etruscan city, Rome plainly attained a greater height of prosperity than she regained for two centuries. This is indicated not only by the legends of the splendour of the Tarquinian kings, but by the evidence of such vast constructions as the Cloaca Maxima, the Capitoline temple, and the Servian wall. The state ceremonial of Rome appears also to have descended from the period of Etruscan rule. The insignia of consular authority, the toga prætexta with its purple border, the ivory curule chair, the twelve lictors with their fasces and axes, all of Etruscan origin, are not likely to have been copied from the usages of hereditary foes, but are more probably survivals from the period when Rome was one of the Etruscan cities. An Etruscan origin may also be assigned to the circus, the gladiatorial combats, the horse-races, the triumphal processions, the pipe-players, the lituus, the colleges of augurs, as well as the arrangement of the house, the art of constructing aqueducts and sewers, the division of the *as* into twelve parts, the beginnings of military science, and some of the Roman weapons. More than all, the high position of the wife, so different from that which she occupied in Greece, was the same as that which she occupied in Etruria.

How feeble was the Roman republic in its infancy appears from the fact that for a century after the expulsion of her Etruscan lords Rome maintained with varying fortunes the struggle with the Etruscan town of Veii, distant 11 miles only from her gates. That Veii fully held her own is shown by the admission that in the year 476 B.C. she captured the Janiculum. At that time the Etruscans were still the greatest military power in Italy. At the height of their prosperity, in the 6th century B.C., they shared with the Phœnicians and the Greeks the maritime supremacy of the Mediter-

ranean. In 538 B.C., in conjunction with the Carthaginians, they sent a powerful fleet to expel the Greek colonists from Corsica. They attacked the Greek colony of Cumæ in 525 B.C., and again in 474 B.C., when their naval power was shattered by Hiero I. of Syracuse, in a great battle fought off Cumæ, the first event in Etruscan history as to which we possess contemporary records. The victory was celebrated by an ode of Pindar, then resident at the court of Hiero; while from the inscription on a bronze helmet, found at Olympia in 1817, and now in the British Museum, we learn that it was an Etruscan trophy from Cumæ, dedicated by Hiero and the Syracusans to the Olympian Zeus. In 453 B.C. we find the Etruscans still in possession of Corsica, and in 414 they were able to send a contingent of three ships to aid the Athenians at the siege of Syracuse.

But from this time dates the rapid declension of their power. Towards the close of this century the Etruscan dominion in Campania was overthrown by the Samnites and the Greeks of Cumæ, Capua being taken by the Samnites in 423. Then the Gauls swarmed over the Alps, and, after overwhelming the Etruscan cities in the valley of the Po, crossed the Apennines, having destroyed the wealthy city of Melpum in 396 B.C., the year in which the long struggle between Rome and Veii was brought to an end by the capture of the latter by Camillus, after a ten years' siege. The Gauls continued their devastating progress through Etruria, and in 390 plundered Rome, after having vainly laid siege to Clusium. Etruria was fatally weakened by the loss of her two outlying provinces and the devastation of the central province by the Gauls. After a prolonged resistance, southern Etruria submitted to Rome in 351 B.C. In 311 war was renewed; the Romans crossed the natural boundary formed by the Ciminian Forest, and, after repeated defeats of the Etruscans, a decisive contest took place in 283 at the Vadimonian Lake, when Tarquinii lost its independence; and three years later the Romans reached Volaterræ, the northern stronghold of the Etruscans, when the struggle, which had endured for five centuries, came finally to an end.

In the Second Punic War, the chief Etruscan cities furnished supplies for the Roman fleet. It is plain that these cities retained wealth and power as semi-independent allies under the Roman suzerainty. They seem to have been gradually Romanised, and were finally admitted to the Roman franchise in 89 B.C. The great Etruscan families secured leading positions in the Roman commonwealth. Pompey the Great seems to have been of Etruscan lineage, tombs of the Pumpu family having been discovered at Corneto (Tarquinii), Clusium, Cortona, and Perugia. There was a Tarquinian gens at Rome in the time of Cicero, while Mæcenas, who bears an Etruscan name, was from the Etruscan city of Arretium (Arezzo). Families of undoubted Etruscan lineage still linger on in Etruria. The necropolis at Volterra contains the tomb, with Etruscan epitaphs, of the Ceicna (Cæcina) family, members of which distinguished themselves under the early emperors, and whose lineal representative, Nicolas Cæcina, bishop and patrician, was buried in the cathedral of Volterra in 1765.

Origin.—The people of Etruria were called Etrusci or Tusci by the Romans, Tyrrheni or Tyrseni by the Greeks, Tursci by the Umbrians, and Rasena by themselves. Their origin and ethnic affinities have been much discussed. An early tradition, reported by Herodotus, and repeated by twenty-two ancient writers, brings them from Lydia; but Dionysius of Halicarnassus doubts any such migration, because it is not mentioned in the Lydian history of Xanthus, and because the Etruscans differed from the Lydians in language, laws, customs, and religion. Dionysius adds that the Etruscans were a very ancient people, unlike all others in speech and manners.

Modern writers who accept the Lydian tradition point out that Tarquinii, probably the mother-city of the Etruscans, is near the coast, and appeal to striking structural resemblances between tombs at Vulci, Clusium, and Tarquinii, and certain tombs near Sardis. They argue that, if Phocæans settled in Corsica, Lydians may have found their way to Italy, and that, if the Etruscans had entered Italy by the Rhætian Alps, the oldest settlements would be found in the valley of the Po, and not between the Arno and the Tiber. But it must be acknowledged that the migration of so numerous a people by sea is a formidable difficulty. In modern times it has been maintained that their language was Semitic, Celtic, Armenian, Gothic, Basque, or Albanian. Professor Sayce thinks it is *sui generis*, belonging to a family of speech which has everywhere become extinct. The present writer believes that the affinities are Ugro-Altaic, and of late years this opinion has gained ground. The failure of Corssen's attempt to explain the language as an Aryan dialect, akin to Umbrian, Oscan, and Latin, is a gain in the negative direction, and few scholars would now be found to maintain that it belongs either to the Aryan or Semitic families of speech. It seems rather to have been an agglutinative dialect, approximating, like the Finnic, to the inflectional stage.

Mommsen thinks the Lydian tradition arose from a confusion between the Torrhebi of Lydia and the Tyrrheni of Italy. Fresh light has been thrown on the question by the recent discovery in Lemnos of two inscriptions in a language which, if not Etruscan, resembles it in many points. Thucydides says that Lemnos was inhabited by Tyrrhenians, and Dr Pauli thinks these inscriptions prove that the Tyrrhenians (Etruscans) of Italy belonged to a non-Aryan Tyrrhenian race, which also occupied portions of the Ægean coasts.

Probably there were two elements in the population of Etruria, one autochthonous, numerous, and servile; the other an intrusive conquering aristocracy. Cære and Cortona are said to have been 'Pelasgic' cities before they were occupied by the Etruscans. Certain inscriptions from Etrurian tombs, formerly classed as Etruscan, are now attributed to the more ancient 'Pelasgic' race. Conestabile distinguishes between the tombs of an aboriginal people who practised cremation and those of the later invaders who buried their dead. Livy says that the speech of the country-folk in Etruria differed from the language spoken in the towns, and we may well believe that a conquered race would be left to till the soil for the benefit of invaders dwelling in walled towns. The splendid tombs from which our knowledge of Etruscan speech, luxury, and art is derived cluster round the walls of a few great cities, and are mostly the sepulchres of wealthy nobles. We occasionally meet with the urn of a freedman (*lautni*) or of a slave, but we know nothing of the tombs of the inhabitants of the villages, who may well have belonged to another race, and have spoken a different language. Again, the abrupt collapse of the Etruscan dominion in Campania and in the valley of the Po indicates that it was a dominion of conquest rather than of colonisation; and the complete effacement of the language in Etruria proper argues that the Rasena were a ruling aristocracy, comparatively few in number, though high in culture.

The physical type of the Etruscans is decidedly not Aryan. Professor Calori affirms that Etruscan skulls differ markedly in shape from all other Italic

skulls. The descriptions by ancient authors, '*pinguis Etruscus*,' '*obesus Tyrrhenus*,' are confirmed by the recumbent portrait effigies on the sarcophagi, which show they were a sturdy race, short and stout, with large heads, thick arms, high colour, scanty beard, and hair black or occasionally chestnut. It has been remarked that they were not unlike the Kheta (Hittites) who invaded Syria from the north, and whose monuments are found in Asia Minor as far west as the neighbourhood of Sardis. In any case we may agree with Dionysius that the language, customs, and religion of the Etruscans differed from those of any nation with which he could have been acquainted, while their physical type, as represented on their monuments, is so unlike that of other Europeans as to incline us to agree with the dictum of Seneca: *Tuscos Asia sibi vindicat*—'Asia claims the Etruscans as her own.'

Language.—The Etruscans had an extensive literature. The subjects represented on the monuments prove their familiarity with the tale of Troy and the cycle of Greek heroic legend, and we learn that they possessed histories, poems, dramas, and works on augury and divination. But their books have perished, so that in addition to a few doubtful Etruscan words preserved by Hesychius, Varro, and other writers, our knowledge of the language is derived only from inscriptions, of which about 5000 have been discovered. To the meaning of these we have unfortunately no clue, as the few bilinguals consist mainly of proper names. They wrote from right to left, in an archaic form of the Italic alphabet, which was obtained from Eubœa about the 7th century B.C. The Etruscan alphabet differs from the Latin in retaining the letters *theta*, *phi*, *chi*, and *san*, and in rejecting *d*, *b*, *g*, and *o*.

Most of the inscriptions are very short, only five containing more than twenty words. The longest, that on the Perugian cippus, extends to forty-six lines. They have been found as far north as the Alps, near Nice, Turin, and the lakes of Como and Lugano. But they mostly come from five or six sites in Central Etruria, one-fourth of the whole number being from Chiusi, and one-third from Perugia. Some vast cemeteries, such as those of Veii and Bologna, have yielded few or none, possibly because they date from a time when the art of writing had not become general.

About 4000 of the inscriptions are short mortuary records, stating usually the name and parentage of the deceased; his age, his condition in life, and the public offices he held being occasionally added. They occur on the walls or over the entrances of vaults, on steles or pillars erected in front of tombs, or on the labels and seals of sepulchral niches, but they are more usually painted on the urns, or cut in the stone of the sarcophagi, a recumbent figure of the deceased frequently reposing on the lid, while the sides are sculptured with mythological subjects or scenes from the life of the deceased.

Working with such materials, German and English scholars have recently made considerable progress in the decipherment of the language, so that most of the short mortuary inscriptions can now be read with tolerable certainty. The inscriptions contain some 200 Etruscan words in addition to the proper names. Of these names a few, such as Caie (Gaius), Cneve (Gnævus), Marce (Marcus), and Tite (Titus), are borrowed from neighbouring or subject races. Of genuine Etruscan names the most usual for men are Arnth (Aruns), Aule (Aulus), Larth (Lars), Sethre, Vele, Velthur, and Vete; and for women, Arnthia, Aulia, Larthia, Sethria, Fastia, Ramtha, Thania, and Thancvil. Many Roman gentile names, such as Spurinna and Perpenna, were of Etruscan origin, while Pompeius, Petronius, Cafatius, Cassius, Cæcina, Volumnius, and Afinius appear in Etruscan tombs as Pumpu, Petruni, Cahate, Cazni, Ceicna, Velimna, and Afuna. A few Etruscan names have been explained. Thus, Thancvil (Tanaquil) was the wife of Tarquinius Priscus. Thana must have been the Etruscan goddess of maternity (= Juno Lucina), as on a mirror she assists at the birth of Minerva, and *cvil* (or *cver*) denotes 'gift' or 'dedication,' the word Tinscvil being inscribed on objects dedicated to Tinia (Jupiter). Hence Thancvil would mean 'Thana's gift,' and may be compared with such Christian names as Theodore or Diodorus. Again, Spurie, an Etruscan name, seems to be equivalent to the Latin Publius. The words *spural* and *spurana*, inscribed on vessels, armour, and tombs, signify that they were 'civic' or 'public' property; and the phrase *amce marunuch spurana*, in an epitaph, probably means '*fuit curator publicus*.'

Relationship is sometimes expressed by words, such as *puia*, 'wife;' *clan*, 'son;' *sec*, 'daughter;' but more commonly by suffixes. Thus, Aulesa is the 'wife of Aule,' Theprisa the 'wife of the Thepri' (Tiberius), Larthial the 'son of Larthia,' Larthialisa the 'wife of Larthia's son.' Velthur is a 'descendant of Vele,' and Velthurithura a 'descendant of Velthur.' Gentile names are formed by the suffix *-na*, corresponding to the Latin *-ius*. Thus, Vipna is the equivalent of Vibius, Varna of Varius, Caizna of Cæsius. This suffix is a common formative. Thus *suthi*, '*sepulcrum*,' gives *suthina*, '*sepulcralis*.' The suffix *-l* or *-al* has a similar force—e.g. *fufluns*, 'a Bacchic cup,' from *Fufluns*, 'Bacchus;' and *Trual*, 'a Trojan,' from *Truia*, 'Troy.' Other ethnic formatives are *-ach* and *-ate*, as *Rumach*, 'a Roman,' and *Manthvate*, 'a Mantuan.'

Six words inscribed on the faces of a pair of dice give the first six digits, and other numerals appear in records of age which occur in epitaphs. The words *mach*, *ci*, *zal*, *sa*, *thu*, *huth*, *semph*, *cezp*, *muv* are believed to be the digits, while *ce-alchl*, *cezp-alchl*, *semph-alchl*, *muv-alchl*, *zathrum*, and *ciem-zathrum* must be decades. Ordinals and multiplicatives are formed from the cardinals. Thus *ci*, 'two,' gives *ci-s*, 'second,' and *ci-zi*, 'twice.'

The detection of the numerals has made it possible to show that the plural ends in *r* or *l*. Thus, *clan*, 'son,' gives *clen-ar*, 'sons;' as *ci clenar*, 'two sons,' and *clenar zal*, 'three sons.' The phrases *huth naper*, *naper ci*, *naper xii.*, show that *naper* is a plural, meaning '*loculi*' or 'tombs.' The plural in *-l* also appears in *arce ril lxvii.*, '*habuit annos lxvii.*,' and in *mursl xx.* So *tular* signifies 'cippi,' and *suthinesl* 'sepulchral niches.'

The names of men and women already cited, and such forms as *lautni*, 'a freedman,' and *lautnitha*, 'a freed-woman,' show that Etruscan was a gender language. There seems to have been no distinction between nominative and accusative. The genitive ended in *-s*, the dative in *-si* or *-thi;* and, as in the Altaic languages, the plural suffix preceded that denoting the case. Thus, from *clan*, 'son,' we have gen. *clen-s*, dat. *clen-si*, nom. and acc. pl. *clen-ar*, dat. pl. *clen-ar-asi;* while *precuth-ur-asi* is the dat. pl. of *precus*. From *tiv*, 'moon' or 'month,' we have *tiv-r*, '*menses*,' and *tiv-r-s*, '*mensium*;' from *usil*, '*sol*,' *usils*, '*solis*;' and from *suthi*, '*sepulcrum*,' *suthi-thi*, '*sepulcro*.' The suffixes *-c* and *-m* are enclitic conjunctions—thus, *vel. sethre puiac* is the epitaph of 'Vele Sethre and wife,' and *arnth vipis serturis puiac mutainei* that of 'Arnth (son of) Vipi Serturi and (his) wife Mutainei.' According to Dr Pauli, *mi* means 'this,' or 'this is;' while *eshen*, *cen*, or *ecn* means 'here.' The meaning of several substantives, in addition to those already cited, has also been determined with tolerable certainty.

Coming to the verbs, *am-ce* certainly means '*fuit*,' while *ma* appears to be '*est*.' The 3d pers. sing. of the perfect tense ended in *-ce*, and of the present in *-e*. We have *tur-e*, '*dat*;' *tur-ce*, '*dedit*;' *ar-ce*, '*habuit*;' *tham-ce*, '*extruxit*;' *sval-ce*, '*obiit*;' *lupu-ce*, '*decessit*.' Thus, *clenar zal arce* is '*filios tres habuit*,' and *ramtha matulnei sech marces matulnas puiam amce sethres ceisinies* may be translated 'Ramtha Matulnei was the daughter of Marce Metulna, and wife of Sethre Ceisinie.' These examples may serve to show that the once apparently hopeless task of translating the Etruscan inscriptions is at last in a fair way of being accomplished.

Religion.—The Etruscans were proverbially a religious people—'*gens ante omnes dedita religionibus*'—'*genitrix et mater superstitionis Etruria*.' Their tombs bear witness to a belief in a future life, and a dread of the malignant power of their deities. Affairs of state were regulated by the decisions of colleges of haruspices and augurs, who interpreted, according to established rules, omens and portents obtained from the inspection of the entrails of victims, the flight of birds, and from lightning, of which twelve kinds were distinguished. Varro, Cicero, and Martianus Capella have described the methods of divination, as laid down in the *libri disciplinæ Etruscæ*. The heavens were regarded as the *templum* of the gods, and were divided into sixteen regions, in each of which one or more of the gods presided or resided. By ascertaining the precise 'region' in which an omen, such as a flash of lightning, occurred, the fulgurators determined the name of the god who sent the message, and interpreted it in accordance with his functions. Those gods who possessed the power of sending lightning were called the Novensiles, or 'Thunderers.' In the museum at Volterra is an effigy of an augur, holding in his hand the instrument by which these observations were made, and an actual specimen of the instrument has recently been discovered near Piacenza. It is a bronze model of the liver of a calf, which must have been used like a sextant. Beginning with the north, the rim is divided into sixteen compartments, in each of which the name of one of the gods is engraved. The heavens were observed through apertures which correspond to the blood-vessels which supply the liver. One side of the instrument is dedicated to the sun, the other to the moon, probably for observations by day or by night. The protuberance called the *lobus Spigelii* was the 'mount of the gods,' and the gall-bladder was dedicated to Neptune. The names of the deities inscribed on this curious instrument, coupled with the account of Martianus Capella, have supplied unexpected information as to the Etruscan Pantheon, and this is supplemented by the names appended to the deities in the mythological subjects painted on the walls of tombs, or engraved on the backs of the polished bronze mirrors used by Etruscan ladies, of which four hundred are known. In many cases the subjects are taken from the Greek mythology, and the names are merely those of Hellenic or Italic deities, conformed to the phonetic laws of Etruscan spelling. Such are Ani (Janus), Uni (Juno), Maris (Mars), Apulu (Apollo), Nethuns (Neptune), Ercle (Hercules), Menrva (Minerva), Velch (Vulcan), Satre (Saturnus), Artumes (Artemis), Letun (Latona), Vetis (Vedius), Silvans (Silvanus), Aita (Hades), Phersipnei (Persephone), and Charu (Charon). But besides these borrowed names there are a host of genuine Etruscan deities, such as Tinia, who answers to Jupiter, Laran to Mars, Fufluns to Bacchus, Sethlans to Vulcan, Turan to Venus, Turms to Mercury, Thalna to Juno, Thana to Lucina, Thesan to Aurora, while the sun and the moon were called Usil and Lala. Of other deities no analogues have been found in the Greek or Roman Pantheon. Lasa and Mean seem to be recording Fates; Epiur, Snenath, Munthuch, and Malavisch to be guardian spirits; Tuchulcha, Asira, Nathum, and Tarsu avenging Furies; Vanth, Leinth, and Culsu conductors of souls or deities of the tomb. More obscure are the functions of beings called Racuneta, Talitha, Tethum, Thufla, Mlacuch, Achuvitr, Tipanu, Sitmica, and Ethausva. If anything were wanted to prove that the Etruscan mythology differed from that of all Aryan, Semitic, and Hamitic nations, this strange list of names would be sufficient. Classical writers have assigned to the Etruscans other deities whose names are not found in inscriptions, and which may be Sabine, Umbrian, or Faliscan. Among them may be enumerated Mantus and Mania, king and queen

Fig. 3.—Etruscan Mirror from Vulci, with Fufluns (Bacchus), Semla (Semele), and Apulu (Apollo).
Half size. After a Drawing by Mr George Scharf.

of the under-world; Summanus, a god who ruled the night; Vertumnus, the god of autumn; Voltumna, whose temple was the meeting-place of the federated states; Nortia, the goddess of Fortune, in the doors of whose temple at Volsinii nails were driven to mark the successive years; and the Novensiles, a collective name for those gods who hurled thunderbolts.

Civilisation.—The government was a loose federal union of the twelve cities or states, each ruled by magistrates annually elected from a class of hereditary sacerdotal nobles. The titles of these magistrates, Lauchme (Lucumo), Purtsvana (Porsena), and Marunuch, probably correspond to Consul, Imperator, and Curator. The position of the wife was high; she is the social equal of the husband, she takes her place at the feast, her tomb is sumptuously furnished, and descent through the mother is recorded even more uniformly than through the father. The reliefs on the Afuna sarcophagus at Palermo, in which a matron bids farewell to her sorrowing family, afford a touching proof of the affection with which the wife and mother was regarded. Of the high civilisation attained by the Etruscans we have abundant proofs. Till the battle of Cumæ they were one of the three great naval powers of the Mediterranean. They excelled in medicine, astronomy, mining, metallurgy, and such engineering works as the construction of roads, tunnels, and chambered tombs. The walls of their cities, built of huge blocks, admirably fitted together without cement, remain to attest the skill of the artificers. The jewelry, of the Phœnician type, with patterns formed by soldering on minute grains of gold, is unrivalled. The skill of the bronze-workers is shown by the Chimæra and the statue of the Orator at Florence, by the Wolf in the Capitol at Rome, and by a magnificent lamp at Cortona. The earlier coins, which date from the 6th century B.C., show the influence of Asia Minor, while after the repulse of the Athenians in Sicily they are modelled on the coinage of Syracuse.

Many of the painted vases which have been found in such vast numbers in Etruscan tombs were either imported from Greece or made by Corinthian artists who had settled in Etruria, the subjects represented being drawn mainly from Greek mythology or the cycle of Homeric legend. Some of these vases may have been prizes won in the national games, and deposited in the tombs as cherished possessions of the deceased, together with his armour and his weapons. In like manner, the polished mirrors and jewelry of Etruscan ladies were commonly placed in their tombs. But the tombs are themselves the most characteristic works which the Etruscans have left behind them. They are of two kinds: the stone pyramid or cone with interior chambers, which is manifestly a survival of the tumulus, and the rock-cut chamber, which is a survival of the cave. But Etruscan tombs are not merely sepulchres; they are abodes for the spirits of the dead, constructed on the model of the abodes inhabited during life; they are provided with chairs and other furniture; useful and ornamental objects were deposited by the body of the deceased, while the walls were decorated with subjects from daily life, or scenes from the under-world. There is usually an ante-chamber in which the family could assemble at the annual funeral feast to do homage to the spirits of departed ancestors.

More than a hundred books have been written on the subject of the Etruscans and their monuments. The best general work is *Die Etrusker*, by K. O. Müller, edited by Dr Deecke (1877), supplemented by Deecke's *Etruskische Forschungen* and Pauli's *Etruskische Studien*. The inscriptions have been edited by Fabretti in his *Corpus Inscriptionum Italicarum*; the tombs are described by Dennis, *Cities and Cemeteries of Etruria*; the mirrors in Gerhard's *Etruskische Spiegel*. Corssen's great book, *Ueber die Sprache der Etrusker* (1874–75), is already obsolete. See also Cuno, *Vorgeschichte Roms* (vol. ii. 1888); Jules Martha, *L'Art Étrusque* (Paris, 1888).

Etruria, a village of Staffordshire, England, between Burslem and Hanley, with about 5000 inhabitants. Here, on 13th June 1769, Josiah Wedgwood (q.v.) and Thomas Bentley (1731–80) opened their celebrated Etruria potteries, so named after the Etruscan ware.

Ettmüller, Ernst Moritz Ludwig, a learned German philologist, was born 5th October 1802, at Gersdorf, near Löbau in Saxony, and studied first medicine, next German philology and history, at Leipzig and Jena, in 1833 was called to the Zurich Academy, and in 1863 to the university there, as professor of German Literature. Here he died, 15th April 1877. Ettmüller contributed enormously to the knowledge of Middle High German and Middle Low German by his scholarly editions of the literary monuments in these dialects. In 1840 he edited *Beowulf*, in 1850 an Anglo-Saxon chrestomathy; in the following year appeared his much-valued *Lexicon Anglo-Saxonicum*. Ettmüller also studied old Norse literature, edited the *Valuspâ*, translations, and a Norse reading-book. He also published original verse, and *Herbstabende und Winternächte, Gespräche über Deutsche Dichtungen und Dichter* (3 vols. 1865–67).

Ettrick Water, a stream of Selkirkshire, rising on Capel Fell, and winding 32 miles north-eastward, past Thirlestane Castle, Tushielaw, and Philiphaugh, till, after a total descent of 1500 feet, it joins the Tweed, 3 miles below Selkirk, and 5 from the influx of its chief affluent, the Yarrow. In Ettrick churchyard, towards the stream's source, lie Boston and Hogg the 'Ettrick Shepherd.' Ettrick Forest, erst so 'fair,' now treeless and pastoral, included all Selkirkshire, with parts of Peebles and Edinburgh shires. It was a favourite royal hunting-ground till James V.'s expedition against the Border thieves (1529), after which deer gave place to sheep. See Craig-Brown's *History of Selkirkshire* (1886).

Etty, William, R.A., painter, was born at York, 10th March 1787, the son of a miller and spice-maker. For seven years he was apprenticed to a printer in Hull, working at art during every moment that could be spared from his uncongenial employment. In the beginning of 1806 he removed to London, where in 1807 he became a student in the Royal Academy schools; and for a year he was a pupil of Sir Thomas Lawrence. His progress was at first slow; he competed unsuccessfully for prizes and medals; but in 1811 his 'Sappho' was hung in the Royal Institution, and his 'Telemachus rescuing Antiope' found a place on the walls of the Royal Academy. In 1820 he produced 'Pandora,' followed by 'The Coral-finders' (1820) and 'Cleopatra's Arrival in Cilicia' (1821). In 1822 he spent eighteen months in Italy—to which he had made a very brief visit in 1816—studying the works of the great masters, especially the Venetians, upon whom his own practice as a colourist is very distinctly founded. Two years later he was elected A.R.A., and soon after he began a series of large subjects—'Woman pleading for the Vanquished' (1825), three scenes from the history of Judith (1827–31), and 'Benaiah' (1829), all of which were acquired by the Royal Scottish Academy, and now hang in the National Gallery of Scotland. In 1828 he attained full academic honours. Among his other chief works are 'Youth at the Prow and Pleasure at the Helm' (1832), in the National Gallery, London; 'The Sirens' (1837), in the Manchester Institution; and three subjects from the career of Joan of Arc,

executed shortly before his death, which occurred at York, 13th November 1849. As a colourist Etty ranks at the very head of the English school. His painting of flesh is distinguished by the utmost richness, delicacy, and refinement, and the glowing, blending hues of his draperies and of his landscape backgrounds are in admirable harmony with his figures. His drawing is too frequently mannered and inaccurate, though it occasionally possesses style and distinction. He was an indefatigable student of the living figure, and some of his most exquisite works are studies executed in the Life School of the Royal Academy, which he attended during most of his life. See Autobiography in *Art Journal* (1849); and Life by A. Gilchrist (1855).

Étude, a term used in music to designate compositions intended either to train or to test the player's technical skill. It is applied equally to pieces written for the beginner as to those written for the skilled expert, no matter what his instrument be.

Etymology (Gr.), the investigation of the origin or derivation and of the original signification of words. It forms a subsidiary part of the science of comparative philology, and, though it has occupied the attention of the learned and the curious in every age, it is only within the 19th century that its study has been pursued on really scientific principles. Ignorance, or what is still more dangerous, half-knowledge, has often suggested false etymologies, and many more have sprung from that excess of confident and self-sufficient ingenuity which will not take plain words like *beef-eater* and *welsh-rabbit* for what they are. Folk-etymology, properly so called, has played an important rôle in the development of languages. The words that the people have known from their infancy are for them things, but it is quite different with the new terms they meet. These arrest their curiosity, and, as they believe that every word has its signification, they seek for this, guided by resemblances of sound with words already known, and consequently reach conclusions often hopelessly distorted by false analogies. We see the same illogical process in the Old Testament interpretation of personal names, applied conveniently after the fact; in the Homeric explanations of the names of gods and men; in the quaint etymologies so common in medieval writers, and in such moderns as Thomas Fuller; in the vagaries of our Celtic topographers; and even in the pages of some modern dictionaries it is possible to find such a statement as that the English word *news* is derived from a certain conjunction of the points of the compass, N. E. W. and S. These whimsical etymologies were laughed at by Dean Swift, whose *ostler = oat-stealer*, was a stroke of genius, but have not yet disappeared; and, indeed, the modern Englishman's ideas of method in etymology are hardly at all beyond the point attained by the grammarians of Alexandria and by Varro among the Romans. It was the birth of philology and the study of the languages of the East that made a scientific etymology possible. It no longer sought the relations of the words of a single language exclusively within itself, but extended its view to the whole group of cognate tongues, or, wider still, to a whole family, and became a new science under the name of Comparative Grammar. Grimm's Law was the first finger-post that pointed out the path; among his greatest successors are Curtius and Fick. The Teutonic revival within England in the 19th century commenced the history of English upon an historical method, from which has grown a really scientific English etymology, as seen in the dictionaries of Professor Skeat and Dr Murray. No more useful chart of warning could be given than the former's canons for etymology: 'Before attempting an etymology, ascertain the earliest form and use of the word, and observe chronology. If the word be of native origin, we should next trace its history in cognate languages. If the word be borrowed, we must observe geography and the history of events, remembering that borrowings are due to actual contact.' See Curtius, *Grundzügen der Griechischen Etymologie* (5th ed. 1879); Fick, *Vergleichendes Wörterbuch der Indo-germanischen Sprachen* (3d ed. 4 vols. Gött. 1874–76); Karl Andresen, *Ueber Deutsche Volksetymologie* (1876); and A. S. Palmer's *Folk-Etymology* (1882).

Etymologicum Magnum is the name of a Greek lexicon, the oldest of the kind, professing to give the roots of the words. It appears to belong to the 10th century; the author's name is unknown. The etymologies are mere guesses, sometimes right, often wildly absurd; but the book is valuable, as containing many traditions and notices of the meanings of old and unusual words. There is an edition by Schäfer (Leip. 1816); one by Sturz, called *Etymologicum Gudianum* (Leip. 1818); and another by Gaisford (Oxford, 1849).

Etzel. See ATTILA.

Eu, a town in the French department of Seine-Inférieure, on the Bresle, 2 miles from its mouth, and 21 NE. of Dieppe by rail. It is remarkable for its fine 13th-century Gothic church, and for the Château d'Eu (1578), a low building of red brick, with high, tent-shaped roofs of slate. The seat from 996 of the Counts of Eu, a collateral branch of the Norman ducal line, after various vicissitudes Eu was purchased by Mademoiselle de Montpensier in 1675, whose fanciful taste has perpetuated itself in the decoration of the château; eventually, in 1821, it came to Louis-Philippe, who expended large sums on the embellishment of the château and its park, and who here received Queen Victoria in 1843. In 1874 Viollet-le-Duc restored it for the Comte de Paris. Pop. 4748.

Eubœa (ancient *Euboia*, Turk. *Egripo*, Ital. *Negroponte*), an island of Greece in the Ægean Sea, runs parallel to the mainland for 98 miles, its breadth varying from 30 miles at its widest part to barely 4 at its narrowest. Area, 1420 sq. m., or a little smaller than Suffolk. About midway along its west shore, near Chalcis, the strait (Euripus) separating Eubœa from the mainland contracts to 120 feet, and is spanned by two bridges, resting on a rocky islet in the middle. The island, which has its long axis disposed north-west and south-east, is traversed longitudinally by a chain of mountains, rising in the centre, in Mount Delphi, to an elevation of 5725 feet. Iron and copper occur in the mountains; and at Carystos, in the south of the island, the marble called *cipolino*, so largely used in the buildings of Rome, is quarried. Hot springs (sulphur) exist in the north. Although the east coast is steep and rocky, the west side of the island slopes gradually, and its pastures support numerous herds of swine, sheep, and goats, whilst the arable land produces wheat, oil, figs, and wine. Honey also is an important article of trade. The declivities of the mountains are covered with forests. The climate is salubrious. The chief towns are Chalcis (q.v.) on the west coast and Carystos (pop. 4119) on the south coast. Pop. of the island (1879) 81,742, mostly Greeks and Albanians. Eubœa was peopled in the early historic times chiefly by Thessalian tribes and by Ionic Greeks, and afterwards by colonists from Athens, who formed a number of independent cities or states. Of these the most powerful were the rival commercial cities of Chalcis and Eretria; and it is around them and their exploits that the history of the island for some centuries mainly concentrates itself. After the Persian wars, however, Eubœa

was subjugated by the Athenians, under whose rule it continued till they, in their turn, were subdued by Philip of Macedon. By the Romans it was finally united with the province of Achaia under Vespasian. In 1351 it came into the possession of the Venetians, and received the name of Negroponte. In the year 1470 the island was taken by the Turks, in whose hands it remained till 1821, when the inhabitants rose to vindicate their independence at the call of the beautiful Modena Maurogenia. Subsequently (1830) it was incorporated in the kingdom of Greece.

Eucalyptus, a genus of Myrtaceæ, including about 150 species, which form the preponderant and most characteristic vegetation of the Australian forest. Their frequently enormous height (150–200 or even 400 feet, higher than the great Californian Wellingtonia or Sequoia; one fallen specimen recorded by Wallace must have been near 500 feet), their entire leathery glaucous leaves, which turn vertically with their edges to the sun, and so cast no shadow, and their frequently ragged bark and peculiar aromatic odour combine to give a uniquely peculiar and unmistakable character. Many species are known as gum-trees, from their resinous exudations. The Blue Gum Tree of Tasmania (*E. globulus*) is best known in Europe from its specially high reputation as a hygienic agent in damp, unhealthy, and malarious situations, and has hence been planted extensively in many parts of Italy, &c. Its value has been alternately ascribed to the antiseptic action of its camphor-like odours, and to its rapid growth (which sometimes even exceeds 10 feet per annum), and the consequent drainage of the soil through the enormous transpiration from the leaf-surfaces. The culture of Eucalyptus has also been introduced with good results into Algeria, Mexico, the Cape of Good Hope, &c. The Red Gum Tree, or Iron Bark Tree, yields a red astringent resin, known as Botany Bay Kino; and *E. robusta*, the Stringy Bark Tree, has also a beautiful red gum. *E. mannifera* yields a copious sweet exudation from its bark and leaves, which

Eucalyptus Amygdalina.

comes into commerce as Eucalyptus manna, and resembles genuine Manna (q.v.) in sweetness and aperient properties. That of *E. dumosa* is also gathered by the natives from the ground, on which it lies like hoar-frost, and is used as food. *E. Amygdalina* is remarkable both for its height and its girth. Eucalyptus timber is at first soft and easily worked, but soon hardens, and is often of great value and durability. The bark of some species is useful as a source of tannin; whilst a liqueur made of Eucalyptus is drunk in Italy, and Eucalyptus honey is said to contain the valuable characteristics of the tree. The seeds were first sent from Melbourne to Paris by M. Ramel in 1854, and subsequently distributed to other parts of Europe. See Sir F. Müller, *Eucalyptographica* (Melbourne, 1881).

Eucharist. See LORD'S SUPPER.

Euchlorine is a very explosive green-coloured gas, possessing bleaching properties, and is prepared by the action of strong hydrochloric acid on chlorate of potash. It is dangerously explosive by heat, and its composition is still a matter of discussion. It is variously supposed to contain chloric and chlorous acids, as well as free chlorine and oxygen.

Euchre, a game at cards, very popular in America, but not played until the first quarter of the 19th century. Euchre is played with a pack of thirty-two cards (all cards below a seven being rejected). The cards rank as at whist, with the exception of the *bowers*. Knave of the trump suit (*right bower*) is the best trump; knave of the same colour (*left bower*) is the next best, that card belonging to the trump suit. Each player receives five cards from the dealer, by two or three at a time, the top card being then turned up for trumps. When two play, the non-dealer either *orders up* the trump, and plays his hand, or *passes*. If he orders up, the dealer discards a card, and substitutes the trump card for it. If he passes, the dealer either *takes up* the trump (discarding as before), and the hand is played, or *passes*. This he signifies by turning down the trump. If both pass, the non-dealer may name any other suit for trumps (called *making it*), or may pass again. If he passes, the dealer may make it. If either makes it, the hand is then played; if both pass again, the hand is thrown up, and the opponent deals. If the hand is played, the non-dealer leads; the dealer plays, and must follow suit, if able. The highest card wins the trick; trumps win other suits, and the play continues as at whist. A player ordering up, or taking up, or making the trump, and winning five tricks (called a *march*), scores two; if he wins three tricks (called the *point*), he scores one. If he fails to make three tricks, he is *euchred*, and his adversary scores two. The game is five up. When four play, they cut for partners, as at whist. If the first hand passes, the second may *assist*, when his partner (the dealer) takes up the trump, and the hand is played. If a player has a very strong hand, he may *play alone*—i.e. single-handed against both adversaries. But he can only play alone when he or his partner orders up, or when his partner assists, or when he takes up the trump, or when he makes the trump. The hands are played as at whist, and the scores are as before; but if a lone player wins five tricks, he scores four. Euchre is sometimes played by three persons (*cut-throat euchre*); but it is not considered a good game, as not only do two players combine against the third, but at some points of the score a player may conspire against his partner. The game most in vogue among good players is the four-handed. The laws of four-handed euchre, revised by a committee of the Somerset Club, Boston, Mass., were adopted by that club on March 1, 1888.

Euclid is known to us almost exclusively from those of his works which have survived. Proclus in his commentaries on the first book of the *Elements* mentions that Euclid lived in the time of Ptolemy I. of Egypt, that he was younger than Plato, but older than Archimedes and Eratosthenes. Hence 300 B.C. may be taken as an approximate date for the middle of his career. He taught in

Alexandria, and probably was the founder of its illustrious mathematical school. His chief extant work is the *Elements* in thirteen books. Books i.–iv. and vi. treat of plane geometry; v. of proportion in general; vii.–ix. of the properties of numbers; x. of incommensurable magnitudes; xi.–xiii. of solid geometry. Besides the *Elements*, there are the *Data*, a collection of geometrical theorems, and the *Phænomena*, or appearances of the heavens. Regarding the genuineness of the *Section of the Scale, Introduction to Harmony, Optics, Catoptrics*, and *Divisions of Superficies*, commentators are divided in opinion, though they lean rather to the view that most if not all of these writings are spurious. Some other works not now extant are attributed to Euclid. The only one of any importance was the treatise on *Porisms*. Euclid's *Elements* has been translated into many languages, and is probably better known than any other mathematical book. With many of its blemishes removed and its deficiencies supplied, it is still widely used in Britain as a text-book of geometry, though attempts have been made for the last 150 years to supersede it. On the Continent it has been almost universally given up, as in America; and after a few years, should secondary education come under state control, it will probably share the same fate in Britain also. Already one united attempt to supplant Euclid was made by the Association for the Improvement of Geometrical Teaching, but their syllabus of geometry and corresponding handbook have as yet failed to command any wide respect. See C. L. Dodgson's *Euclid and his Modern Rivals* (1879). The first printed edition of Euclid was a translation from Arabic into Latin, which appeared at Venice in 1482. The first printed Greek text was published at Basel in 1533. The most recent edition is that of Heiberg in five volumes (1883–88). The only edition which contains all the works attributed to Euclid is that by David Gregory, which appeared at Oxford in 1703. For an account of what the Greeks had done in geometry before Euclid's time, see Allman's *Greek Geometry from Thales to Euclid* (1889).

Euclid of Megara, a Greek philosopher, who has often been confounded with the mathematician of the same name. He was one of the chief disciples of Socrates, but had previously studied the dialectics of the Eleatics; on one occasion Socrates declared that his pupil's subtle logic might win sophists, but never men. After the death of his master (399 B.C.), Euclid established a school of his own, which received the name of the Megaric School. The basis of his system was the Eleatic dogma of a one, only, universal existence; and, blending with this the Socratic idea of the predominance of the moral element, Euclid held this one real existence to be the *Good*, though it receives various names under its special manifestations.

Eudæmonism, the doctrine that happiness (Gr. *eudaimonia*) is the chief good. See ETHICS.

Eudiometer. See GASES, Vol. V., page 96.

Eudocia, the name of several Byzantine princesses. Of these the most celebrated was the wife of Theodosius II. Pulcheria, the emperor's sister, who from her sixteenth year (414) had directed the government under the weak-minded emperor, chose Athenais (born 401), the beautiful and accomplished daughter of an Athenian sophist Leontius, to be her brother's wife. She renounced paganism, took the name of Eudocia, and was married to Theodosius in 421. Soon afterwards a violent rivalry arose between the two sisters-in-law. On the outbreak of the Nestorian controversy, Eudocia took the side of Nestorius, and Pulcheria, conspiring with Cyril of Alexandria, brought about his fall. During the last four years of Theodosius, Pulcheria was banished from the court, and the doctrines of Eutyches (q.v.) and Dioscuros—the opposite of Nestorianism—were victorious at the 'Robber Synod' of Ephesus (449) through the influence of Eudocia. But shortly before the emperor's death (450) Pulcheria regained her former influence, while Eudocia fell into disgrace and retired to Jerusalem, where she spent the remainder of her life in works of piety and charity, and died in 460. Eudocia wrote a panegyric on the victories of Theodosius over the Persians, paraphrases of Scripture, and a poem on the legend of St Cyprian. The *Homero-cento* on the Life of Christ (consisting of 2343 hexameters made up of verses and half-verses culled from Homer), which are doubtfully attributed to her, was edited by Teucher (Leip. 1793). See F. Gregorovius, *Athenais* (1882).

Eudoxus of Cnidus, called by Cicero the prince of astronomers, flourished about 370 B.C. He studied under Plato for some time, and afterwards went to Egypt, where he derived much knowledge from the priests. He is said to have introduced an astronomical system of homocentric spheres into Greece, and the year of 365¼ days, likewise to have distinguished true astronomy from astrology.

Euganean Hills, a range of well-wooded hills, with a north and south axis, lying SW. of Padua in northern Italy. They owe their origin to eruptions of trachyte during the Jurassic period. The highest point, Monte Venda, reaches 1749 feet. On their slopes stand several villas, amongst them Petrarch's house at Arquà.

Eugene, PRINCE. François Eugène, commonly called Prince Eugene of Savoy, one of the greatest generals of his time, was born at Paris, 18th October 1663. He was the youngest of the five sons of Eugene Maurice of Savoy-Carignan, Count of Soissons (grandson of the Duke of Savoy, Charles Emmanuel I.), and of Olympia Mancini, a niece of Cardinal Mazarin. He was intended for the church, but had a strong predilection for the camp, and, after his father's death (1673), his mother's banishment from court by command of the young king Louis XIV., and the latter's refusal to give him a commission, he indignantly renounced his country, and at twenty entered the service of the Emperor Leopold as a volunteer against the Turks. He early displayed extraordinary courage and tactical talent in the Turkish war, especially at the famous siege of Vienna in 1683, and rose rapidly in rank. In the Coalition War against Louis XIV. in Italy, he covered himself with the glory peculiar both to the soldier and the general; he became field-marshal in 1693, and overwhelmed the Turks, who left 30,000 dead on the field, in the famous battle of Zenta, September 11, 1697, which put an end to their power in Hungary. The outbreak in 1701 of the Spanish War of Succession recalled him to the command of the army of Italy, but though he displayed a strategy worthy of Hannibal, inflicted several severe defeats upon the French, and even captured the Duke of Villeroi in Cremona by a daring night-attack, he was prevented from effecting anything of importance by the smallness of his own forces and the skilful tactics of the Duke of Vendôme, who inflicted upon him a severe defeat at Luzzara (15th August 1702). Becoming in 1703 president of the council of war, he took the command of the imperial army in Germany, and helped Marlborough to gain the brilliant victory of Blenheim (13th August 1704). Eugene was checked at Cassano (August 16, 1705) by Vendôme, and twice wounded in the field, but after a daring march appeared before Turin and crushed the French in a complete defeat which closed their career in Italy. He shared with Marlborough the glory of the fields of Oudenarde (in 1708) and Malplaquet (in 1709); but, being

crippled in his resources by the retirement of Holland and England from the contest, he was unable to withstand the enemy on the Rhine, and his defeat by Villars at Denain (24th July 1712) was followed by other disasters, until the peace of Rastadt (6th March 1714) put an end to the war. On the recommencement of the war (in 1716) against the Turks, Eugene with but 64,000 men defeated an army of 150,000 men at Peterwardein, took Temesvar, and in the year 1717, after a desperate battle, carried Belgrade by assault. He had already lain for a month before the city contending against dysentery and a force six times his own, when he determined to stake everything upon a general attack. In the bloody struggle Eugene received his thirteenth wound.

After the peace of Passarowitz (21st July 1718), he returned covered with glory to Vienna, where, during the succeeding years of peace, he laboured with unwearied energy in the cabinet. When the question of the succession to the throne of Poland brought on a new war with France, Eugene appeared again on the Rhine, but owing to insufficient resources and failing vigour he was unable to do more than keep the enemy out of Bavaria. After the peace, he returned to Vienna, where he died, 21st April 1736. Prince Eugene was of middling stature, his face thin and long; his eager dark eyes alone revealed the vigour of his nature. His dress was plain and simple like his manners; he had no passion but that of glory; no appetite save an inveterate relish for snuff. Although a strict disciplinarian and a general who risked his soldiers' lives as freely as his own, he was worshipped by his men, and he has gone down to posterity as a hero in popular song. As 'Prinz Eugen, der edle Ritter,' his memory is green with thousands who never heard of his campaigns. He introduced no new tactics in the art of war, and was deficient in the guidance and command of masses; but by his rapidity of perception and decision, and faculty for turning to instant advantage existing circumstances, he raised the prestige of the Austrian arms to an eminence unequalled before or since his time. He successively served under three emperors, of whom he was wont to say that in Leopold I. he had a father, in Joseph I. a brother, and in Charles VI. a master. Campare Dumont, *Histoire Militaire du Prince Eugène* (with continuation, 1823–29), and the monographs of Kausler (1838–39), Arneth (1858–59), Von Sybel (1861), and Col. Malleson (1888).

Eugenia, a genus of Myrtaceous trees and shrubs, allied to the myrtle, pimento, and clove. See MYRTACEÆ, PIMENTO, CLOVES.

Eugenie, Empress of the French. See NAPOLEON III.

Eugenius, the name of four popes, of whom the last is the most important. Gabriele Condolmiere was born in 1383 at Venice, and became pope as Eugenius IV. in 1431. The great event in his career was the schism created in the church by the proceedings of the Council of Basel, which had been convoked by his predecessor, Martin V., and showed a strong desire for ecclesiastical reform and a diminution of the papal power. Eugenius was compelled to flee from Rome in 1434 by an intrigue of the Colonna faction, whereupon he opened a new council, which met first at Ferrara, next at Florence, and issued a bull of excommunication against the bishops assembled at Basel, whom he pronounced to be 'a satanic conclave, which was spreading the abomination of desolation into the bosom of the church.' The Council of Basel formally deposed him from his pontifical office in 1439, and elected in his stead Amadeus, Duke of Savoy, under the title of Felix V. The conduct of France and Germany seemed to warrant this bold step, for Charles VII. had introduced into the former country the decrees of the Council of Basel, with some modifications, through the Pragmatic Sanction (1438), and the same thing happened in Germany by means of the Deed of Acceptance (1439). At the Council of Ferrara, John Paleologus II., emperor of Constantinople, and upwards of twenty Greek bishops, presented themselves, and a union between the two great divisions of Christendom—the Greek and Latin Church—was thus for a moment effected in July 1439. In 1444 Eugenius was able again to enter Rome, and three years later he died, just after signing a treaty of pacification by which Germany declared against the antipope. His pontificate was stormy and unhappy, and in his old age he regretted that he ever left his monastery. See BASEL (COUNCIL OF).

Eugubine Tables (Lat. *Tabulæ Iguvinæ*), the name given to seven bronze tablets, the inscriptions on which present a comprehensive and very remarkable memorial of the Umbrian language. They were discovered in 1444 at Gubbio (the ancient *Iguvium* or *Eugubium*), where they are still preserved. The characters on four of the tablets are Etruscan, on two Roman, and on one partly Roman and partly Etruscan; the inscriptions run from right to left. The *language* employed, however, is in all cases the same, and differs both from Etruscan and Latin, but resembles somewhat the older forms of the latter and also the Oscan dialects, so far as we know them. The subjects of the inscriptions are directions concerning sacrificial usages and forms of prayer, and they seem to have been inscribed in the 1st and 2d centuries A.D. Philip Bonarota first published them in a complete form in Dempster's *Etruria Regalis* (2 vols. Florence, 1723–24). The first really judicious attempt at interpretation was that of Lanzi, in his *Saggio di Lingua Etrusca* (3 vols. Rome, 1789), who points out the important fact that they related to sacrificial usages, &c. Ottfried Müller, Lassen, Grotefend, and Lepsius continued their study; the last gave the most accurate copy of the inscriptions in his *Inscriptiones Umbricæ et Oscæ* (Leip. 1841). The best and most complete work on the language and contents of the tablets is that of Aufrecht and Kirchhoff, entitled *Die Umbrischen Sprachdenkmäler* (1849–51). See F. W. Newman, *The Text of the Iguvine Inscriptions, with Latin translation and notes* (1864); and Bréal, *Les Tables Eugubines* (Paris, 1875–78).

Euhemerism, the name usually applied to the historical theory of the origin of mythology from Euhemerus, a native of Messene and a contemporary of Cassander of Macedonia in the 4th century. In the course of a voyage to the Indian Sea he professed to have discovered an island called Panchaia, in which he found a number of inscriptions representing the principal gods of Greece as mere earth-born kings and heroes deified after death for their superior strength or capacity. His book, entitled *Hiera Anagraphē*, is lost, as well as its Latin translation by Ennius. It drew upon him the imputation of atheism, and its unblushing inventions made his name with honest inquirers, such as Strabo, a byword for mendacity. Its main theory, however, was adopted by many eminent men, including Polybius, as well as by several of the Christian assailants of paganism—by Minucius Felix, Lactantius, and St Augustine, who found the ground ready prepared for them in their efforts to strip Zeus and the other pagan gods of the attributes of deity. Later Greek writers carried the theory still further, eliminating everything supernatural or extravagant, and leaving only a string of tales perfectly credible and commonplace. Æolus became

an ancient mariner with a special knowledge of the winds, the Cyclopes a race of savages inhabiting Sicily, Atlas a great astronomer, and Scylla a fast-sailing pirate, as was also Pegasus, the winged horse of Bellerophon. Nor has this system yet disappeared from some of the current handbooks of mythology and history. Jupiter is still spoken of as a king of Crete, and Hercules as a Greek adventurer of uncommon strength, while the wars of Troy hold in the minds of many as respectable a place as the struggle between Athens and Sparta or Cæsar's campaigns in Gaul. Euhemerism was the favourite theory with the *soi-disant* philosophical historians of the 18th century in France, and the translation of Abbé Banier's great work, *The Mythology and Fables of Antiquity, explained from History* (Lond. 6 vols. 1739), extended it to England. To this school belong also writers such as Vossius, Bochart, and Huet, who find traces not merely of profane but of sacred history in Greek mythology. Saturn is identified with Noah; his sons, Zeus, Poseidon, and Hades, with Shem, Ham, and Japhet; while Vulcan corresponds with Tubal Cain, and Phaethon with Elijah. The latest and ablest exponent of sacred euhemerism is Mr Gladstone, who sees in Zeus, Hades, and Poseidon the dimmed figures of the Christian Trinity; in Apollo, the Jewish Messiah; and in his mother Latona, the woman whose seed should bruise the serpent's head. Herbert Spencer is also an euhemerist in his explanation of the origin of religion. He bases all the religious emotions on primitive ancestor-worship, and explains totemism, a condition everywhere present in the savage world, as due originally to mere human nicknames, which were gradually forgotten, and afterwards came to have a sense of mystery connected with them.

Eulenspiegel, Till, the prototype of all the knavish fools of later time, is said to have been born in the village of Kneitlingen, near Schöppenstädt, in Brunswick, about the end of the 13th century. His father was called Klaus Eulenspiegel, and his mother Anna Wortbeck. He was thrice baptised, in the font, in mud, having been dropped from his mother's arms, and finally in hot water, to cleanse him from the mud; he afterwards wandered over Europe, and had many comical adventures, and played many rough practical jokes and tricks on the people whom he met with. His tomb is shown at Mölln, about four leagues from Lübeck, where tradition makes him die about 1350; but the inhabitants of Damme, in Belgium, also boast of having his bones in their churchyard, and place his death in 1301. Many regard Eulenspiegel as an altogether imaginary person, whose name was used merely to father a cycle of medieval tricks and adventures; others argue that there were two historical individuals of that name, father and son, of whom the former died at Damme, and the latter at Mölln. The stories that circulate in Germany under Eulenspiegel's name were not collected, as the book containing them itself informs us, till after Eulenspiegel's death, and without doubt were originally written in the Low German tongue; from Low German they were translated into High German by the Franciscan Thomas Murner, and this translation was followed in all the old High German editions of the work. At a later period it underwent considerable alterations at the hands of both Protestants and Catholics, who made it a vehicle for the expression of their own likes and dislikes. The oldest known edition is that printed at Strasburg in 1515, of which but one copy is known to exist—that in the British Museum (new ed. Halle, 1885). Another was issued in 1519, a new edition of which was edited by Lappenberg (Leip. 1854). The next impression, that of 1520–30, originated at Cologne (not in Lower Saxony), and was reproduced by photo-lithography at Berlin in 1865. A metrical version, *Der Eulenspiegel reimenweis*, was made by Fischart, and published at Frankfurt in 1571. For centuries it has been a favourite *Volksbuch*, not only in Germany, but in many other countries. Translations of it exist in Bohemian, Polish, Italian, English (as a miracle play: *A merye Jest of a man that was called Howleglas*), Dutch, Danish, French, and Latin. Simrock gave a good restoration in *Ein kurzweilig Lesen von Till Eulenspiegel, nach den ältesten Quellen* (Frankfurt, 1878); such works as *Till Eulenspiegel, modernes Heldengedicht*, by Böttger (Leip. 1850), and *Till Eulenspiegel Redivivus, ein Schelmenlied*, by J. Wolff (Berlin, 1875), owe to it little beyond the name. A version of the story is given in Roscoe's *German Novelists*.—Eulenspiegel is the origin of the French word *espiègle* ('waggish'). Eulenspiegel became in French 'Ulespiègle,' which, contracted into *Espiègle*, became a generic name for a wag.

Euler, Leonhard, a distingnished mathematician, born 15th April 1707, at Basel, where he afterwards studied under John Bernoulli, and was the friend of Daniel and Nicholas Bernoulli. At the age of nineteen he was second in the contest for a prize offered by the Academy of Paris for the best treatise on the masting of ships. His friends the Bernoullis had been called to St Petersburg by Catharine I., when she founded the Academy, and in 1727 they induced Euler to settle in that capital, where in 1730 he was appointed to the chair of Physics, in 1733 of Mathematics. From that time he continued to labour in the field of mathematics with an ardour that excited the generous rivalry of the Bernoullis. More than half the mathematical treatises in the 26 quarto volumes published by the St Petersburg Academy from 1727 to 1783 are by Euler, and at his death he left more than 200 treatises in MS., which were afterwards published by the Academy. The French Academy of Sciences awarded him its prize on several occasions, and in 1740 his treatise on Tides shared the prize with those of Maclaurin and Daniel Bernoulli. In 1741 he accepted the invitation of Frederick the Great to Berlin, and there published a great number of valuable papers. In 1766 he returned to St Petersburg, where he died, September 18, 1783. The last years of his life were spent in total blindness, amid which he still pursued his researches, dictated his well-known *Introduction to Algebra* to his servant, and perfected, with some assistance, his theory of the moon's motion, constructing new tables, and carrying in his wonderful memory all the elaborate computations involved in his difficult task. After his return to St Petersburg, he also prepared his *Lettres à une Princesse d'Allemagne* (3 vols. 1768–72), in which, along with much theory unsoundly applied, there is a clear exposition of the most important facts in physics. Euler was of an upright, amiable, and religious character, and a man of wider general culture than might have been looked for in one who pursued his special studies so keenly. His proper domain was the abstruser parts of pure mathematics, and here his principal works include his Theory of Planetary Motion, Introduction to the Analysis of Infinities, Institutions of the Differential and of the Integral Calculus, and Dioptrics, which are all, as well as his *Opuscula Analytica*, in Latin. See Rudio's *Leonhard Euler* (Basel, 1884) and *Die Baseler Mathematiker* (*ib.* 1884).

Eume'nides (Gr., 'the benign'), the euphemistic name for the Erinyes, the Roman *Furiæ* or *Diræ*, three fearful winged maidens who dwell in the depths of Tartarus, daughters of Earth or of Night, represented with serpents twined in their

hair, and with blood dripping from their eyes, whose function as early as Homer and Hesiod is to punish men both in this world and after death for such crimes as perjury, murder, and the violation of filial duty and of the rite of hospitality. They were regarded also as goddesses of Fate, somewhat like the Moiræ or Fates, and they had a share in the grim providence which led the doomed ones into the way of calamity. A part of their function was also to hinder man from acquiring too much knowledge of the future. Their number is usually three, and their names Alecto, Megæra, and Tisiphone; but sometimes in the poets they appear as one, and we find a whole chorus of Erinyes in the tragedies of Æschylus. The later poets and sculptors represented them in the more pleasing form of winged virgins, attired in the garb of huntresses, bearing torches in their hands, and with a wreath of serpents round their heads. Gradually, they came to be considered goddesses of the infernal regions, who punished crimes after death, but seldom appeared on earth. In Athens their worship, which, like that of the other infernal deities, was conducted in silence, was held in great honour. The sacrifices offered to them were black sheep and libations of *nephalia*, honey mixed with water. The turtle-dove and the narcissus were sacred to them. They had a sanctuary in the vicinity of the Areopagus, and one at Colonus.

Eumolpus (the 'sweet singer'), in Greek Mythology, the son of Poseidon and Chione, was brought up in Ethiopia, whence he went to Thrace. Afterwards passing into Attica, at the head of a body of Thracians, to assist the Eleusinians in their war against Erechtheus, he and his sons were slain in battle. He was regarded as the founder of the Eleusinian mysteries. An illustrious Athenian family, the *Eumolpidæ*, claimed descent from Eumolpus, and held the office of priests of Demeter in Eleusis.

Eunomius, the leader of an extreme sect of Arians, called after him Eunomians, was born at the village of Dacora, in Cappadocia. He attached himself to Aëtius, then at Alexandria, and became his disciple and associate. Through the influence of Eudoxius he became Bishop of Cyzicum about 360, but was compelled in a short time to resign his see, and after this he came forward as the leader of a party. His confession of faith, sent to Theodosius in 383, was rejected, and Eunomius was seized at Chalcedon, and sent first to Mœsia, then to Cappadocia, where he was still living in his native village in 392. According to Philostorgius, he was unhandsome, with white spots (Gr. *alphoi*) on his face, and had a stammering tongue in spite of his eloquence. The doctrines of Eunomius and Aëtius, which were simply those of Arius carried to an extreme, were condemned at the second Œcumenical Council. After his death the Eunomians (who were also called Exucontians, Heterousiasts, and Anomœans) broke completely with the orthodox church. Their internal disunion quickly put an end to the party. His only extant writings are his two apologies and his confession. See ARIUS; and Klose, *Geschichte und Lehre des Eunomius* (Kiel, 1833).

Eunuch (Gr. *eunouchos*, 'one who has charge of a bed;' *eunē*, 'a bed') is, etymologically, a man intrusted with the charge of women's apartments in the East; but the word means always a person who has been castrated, in order to serve in the harem. The barbarous custom of castrating men is usually an accompaniment of polygamy, and seems to have been earliest practised in Africa; but it established itself, along with Asiatic vices, in the Roman empire. At the Byzantine court the eunuchs often played an important rôle, and became so prominent in affairs of state that the word eunuch came practically to be the name of a great state-officer, the chamberlain. The Italian word *castrato* is that usually employed for a man who has as a youth suffered castration to prevent his voice from breaking. Such persons preserve the pure, clear, high timbre of the boy's voice, and add the grown man's lung power; and in spite of the canonical law and more than one papal bull, came to be highly prized in Italy for singing in churches, in the opera, and at concerts, and till of late were common. In the 18th century it was estimated that 4000 boys were yearly castrated for musical purposes. The castrati were at one time not unknown in France, Germany, and England, as connected with the Italian opera. Many individuals attained high eminence as really great singers. See CASTRATION.

Euomphalus, a large genus of fossil gasteropodous shells, characterised by its depressed and discoidal shell, with angled or coronated whorls, five-sided mouth, and very large umbilicus.

Euonymin is an extract from the bark and root-bark of the *Euonymus atropurpureus*, the Spindle Tree (q.v.), or Wahoo, a shrub indigenous to the United States. It is a mixture of a number of substances which have not yet been thoroughly investigated. It has long been used in America as a cholagogue, tonic and diuretic, but in Britain is employed solely for its stimulant action on the liver.

Eupatoria (formerly *Koslov*), a thriving maritime town of Russia, in the government of Taurida, on a bay in the west of the Crimea, 40 miles NW. of Simferopol. The principal building is the Tartar mosque, built in 1552. Eupatoria exports corn, hides, wool, and salt, and manufactures candles, soap, leather, and marine engines. Its harbour is shallow, and is sheltered only from the north and north-east winds. Pop. 13,416, consisting of Tartars, Karaite Jews, Armenians, and Greeks. The town was taken from the Tartars by the Russians in 1783, in September 1854 was occupied and fortified by a portion of the Anglo-French invading army, and in February 1855 was the scene of a Turkish defeat of the Russians.

Eupatorium, a large genus of Compositæ, allied to Coltsfoot (Tussilago) and Butter-bur (Petasites). The species are mostly tropical and temperate American, but *E. cannabinum* is the common Hemp Agrimony of river-banks and marshy places, formerly used in medicine. The leaves and flowers of several American species are still so employed, notably Thorough-wort (*E. perfoliatum*) and *E. purpureum*. Their astringency gives several South American species a reputation in the treatment of wounds and snake-bites; and the Guaco, reckoned of almost universal efficacy in tropical America, is derived from the allied *Mikania guaco*. The roots of some are used in tanning, and others yield a variety of indigo.

Hemp Agrimony (*Eupatorium cannabinum*).

Eupat'rides, the first class of citizens in ancient Athens, corresponding to the Roman *optimates*, 'the aristocrats or nobles.' The second class was the *geōmoroi;* the third, the *dēmiourgoi*. Just as did the Roman patricians, the eupatrides retained the priestly offices after the establishment of the democracy.

Eupen, a manufacturing town of Rhenish Prussia, in a beautiful valley on the Vedre, close to the Belgian frontier, and 12 miles by rail S. of Aix-la-Chapelle. It has flourishing woollen manufactures, besides dye-works, machine-shops, breweries, &c. It owes its prosperity chiefly to French refugees, who settled here after the peace of Lunéville (1801); in 1814 it came from Limburg to Prussia. Pop. (1875) 14,895; (1885) 15,441; (1890) 15,445, almost all Catholics.

Euphemism (Gr. *eu*, 'well,' and *phēmi*, 'I speak'), a figure of rhetoric by which an unpleasant or offensive matter is designated in indirect and milder terms. Thus, instead of directly calling up an unpleasant image by the word *died*, we may say 'he was gathered to his fathers.' The ancient Greeks used a multitude of euphemisms, to avoid words that were thought to be ominous of evil, or offensive to the unseen powers. They spoke, for example, of the Eumenides, or 'benign goddesses,' instead of the Furies; just as the elves and fairies of more modern folklore used to be spoken of as 'good neighbours.' This instinct of politeness in speech, which seeks to hint at an unpleasant or an indelicate thing rather than name it directly, has had much to do with changing the significations of words: thus, 'plain' has usurped the sense of *ugly;* 'fast,' of *dissipated;* 'gallantry,' of *licentiousness*. It is doubtful whether this modern process is completely to the advantage of our language, which has already lost much of its ancient noble simplicity, and may lose more from a mawkish and prurient nastiness which fondly imagines itself the mother of nice ideas.

Euphonium, a bass Saxhorn (q.v.).—The *Euphonon* was a variation of the Harmonica (q.v.), invented by Chladni in 1790.

Euphorbia, OIL OF, or OIL OF CAPER SPURGE, an extremely acrid fixed oil, obtained by expression, or by the aid of alcohol or ether, from the seeds of the Caper Spurge (*Euphorbia lathyris*),

Caper Spurge (*Euphorbia lathyris*).

a plant common in many parts of Europe, and in some places in America and Britain (see SPURGE). Oil of euphorbia has much resemblance to croton-oil in its properties, although less powerful, and is sometimes used as a substitute for it, in doses of from three to ten drops. It is good for use only when recently extracted.

Euphorbiaceæ, a very extensive order of dicotyledons, probably allied to Tiliaceæ and Malvaceæ, containing upwards of 3500 known species—trees, shrubs, and herbaceous plants, of the most extraordinarily varied, often even cactus-like habit. They abound chiefly in warm countries, and most of all in tropical America. The few species found in the colder parts of the world are all herbaceous. The common Box (if this be indeed truly euphorbiaceous) reaches a more northern limit than any other shrubby species. The other British species are different kinds of Spurge (Euphorbia) and Dog's Mercury (Mercurialis). The Euphorbiaceæ usually abound in an acrid and poisonous milky juice; although there are species of which the juice is bland or becomes so through the application of heat. The conception of Robert Brown, that the peculiar 'flower' in Euphorbia, &c. is really a reduced inflorescence, has given rise to much controversy (see FLOWER). Amongst those most remarkable for the acridity of their juice are the Manchineel (q.v.) and *Excœcaria agallocha*, an East Indian tree—formerly supposed to yield one of the kinds of aloes wood—the smoke from the burning of which is extremely dangerous to the eyes, and of which the juice sometimes blinds the woodcutter. Many of the Euphorbiaceæ are valued for their medicinal properties. Thus, the juice of some of the spurges, the roots of others, the bark of different species of Croton (Cascarilla Bark, Copalche Bark), &c. are used in medicine; and to plants of this order we are indebted for castor-oil, croton-oil, &c. A few of the Euphorbiaceæ yield fragrant balsamic products (see CROTON); a few, although their juice is poisonous, yield a wholesome starch in considerable abundance (see MANIOC); a few are cultivated and used as pot-herbs, particularly species of Plukenetia in the East Indies; a few yield wholesome and agreeable sub-acid fruits, as *Cicca disticha* and *C. racemosa* in the East Indies; the seeds of some are edible, as those of the Candle-nut (q.v.), &c.; the oil of the seeds is also in some cases used for food, like other bland oils, but more frequently for burning, as castor-oil, candle-nut oil, the oil of *Elæococca verrucosa* in Japan and Mauritius, and the solid oil of *Stillingia sebifera*, which is used in China for making candles, and in medical preparations as a substitute for lard. Others yield dyestuffs. The timber of some of the Euphorbiaceæ is valuable—e.g. African Teak (q.v.). Many species are cultivated in gardens and hothouses, more frequently for their curious appearance than for their beauty; but the large, deep crimson bracts of *Poinsettia pulcherrima*, a native of Mexico, make it a very attractive plant.

Euphorbium, an extremely acrid gum-resin, obtained from several species of Euphorbia or Spurge (q.v.), as *E. officinarum* and *E. antiquorum* in the north of Africa, Arabia, and the East Indies, and *E. Canariensis* in the Canary Islands. It is obtained by incisions in the branches, whence issues a corrosive milky juice, which dries in the sun, and becomes a yellowish-gray, waxy gum-resin. The persons who collect it are obliged to defend their mouths and nostrils by a cloth, as its particles produce incessant sneezing, violent inflammation of the nostrils, and a very painful burning sensation in the mouth. On account of its excessive acridity its use is now almost entirely confined to veterinary medicine, although it is still occasionally mixed with Burgundy pitch or other substances to make rubefacient plasters for chronic affections of the joints; and its powder, mixed with much starch or flour, has been employed as an *errhine* in chronic

affections of the eyes, ears, or brain. It was formerly administered as an emetic and drastic purgative, but is dangerously violent in its action.

Euphrasy. See EYEBRIGHT.

Euphrates (Pers. *Ufratu*, Heb. *Phrat*, Syr. *Ephrat*, Arab. *Furat*) is the largest river in Western Asia, and, with the Tigris, forms the most important river-system of that part of the Continent. It has its source in the heart of Armenia in two branches—the Kara-Su (270 miles) and the Murad (300 miles), of which the former rises a few miles NE. of Erzerum, and the latter over 130 miles to the east, near Lake Van—uniting in about 39° N. lat. and 39° E. long., close to Keban Maadin (2664 feet above the sea). From here the united stream flows in a general southerly direction, and breaks through the Taurus in a succession of rapids and cataracts for about 40 miles, emerging at Sumeysát (the ancient *Samosata*), and passing Bír, at which point it is 100 miles distant from the nearest shore of the Mediterranean. Flowing south, it separates for a considerable distance Mesopotamia from Syria and the deserts of Syrian Arabia; then curving to the south-east, it flows on to Kurna, where it is joined by the waters of the Tigris; and the joint river, taking the name of the Shat-el-Arab, empties itself by several arms (only one of which is navigable by large vessels) into the Persian Gulf, 60 miles below Basra, after a course of fully 1700 miles. The principal of its few tributaries after leaving the mountains are the Sajur on the right, and the Balik-su and Khabúr on the left bank, besides the Persian river Karún, which enters the estuary at Mohammera. The chief towns now on its banks are Sumeysát, Bír, Ana, Hít, and Hilla, Basra lying really on a creek a short distance from the main stream; the river between Ana and Hit is studded with islands, many of them inhabited. The Euphrates is more or less navigable for light craft as far as Bir (nearly 1200 miles); war-vessels can ascend to the junction at Kurna (120 miles), and Turkish government steamers make trips annually between Hilla and Balis while the river is in flood (April to August). In ancient times, when canals and embankments regulated the river's inundations, these exercised the same beneficial effect on the country as those of the Nile on Egypt; but barely a hundredth of the old system is maintained to-day. Numerous remains of ancient cities are still to be traced near the banks, such as the famous site of Babylon, and the Birs Nimrúd (see BABYLONIA).

EUPHRATES ROUTE TO INDIA.—Before the Suez Canal was constructed there was a difference of opinion which of the two ancient trade routes to India—that by Suez, or the other by way of Scanderoon and down the Euphrates Valley—was to be preferred. In 1830 Captain F. R. Chesney, R.A., reported to government that the connection of the Mediterranean and Red seas by the Suez Canal was practicable, in spite of the adverse verdict of Bonaparte's engineers. In 1831 he enlarged his survey by descending the Euphrates, and established the fact that the river was navigable for vessels of moderate draught, at least as high up as Ana. In a report (*On the Navigation of the Euphrates*, 1833) he maintained that this was the shortest possible route to Bombay, with less open sea than any other; that the country it would open out was rich in natural products, metals, wheat, cotton, silk, madder, &c.; and that there was little opposition to be apprehended from the Arab tribes. His conclusions were supported by men of influence, such as Sir Stratford Canning, Sir R. Gordon, Lords Lansdowne and Ripon; and in 1834 in the House of Commons Lord Althorp brought in a grant of £20,000, for the purposes of an expedition to survey the Euphrates route, to which the India Board added £5000. The expedition, comprising engineers, sappers and miners, and artillerymen, started under Chesney's command in 1835, and after encountering much opposition from Ibrahim Pasha, and overcoming the only serious natural obstruction on the route, the 140 miles of rocky, mountainous country between Scanderoon and the Upper Euphrates, they launched two iron steamers on the Great River at Birejik, and began the descent, in March 1836. The channel was found to be difficult, but not impracticable; and, though one steamer sank, its loss was due to a simoom of unusual violence, and not to the obstacles presented by the river-bed or currents. The other steamer safely reached the mouth, and the survey justified Chesney's predictions. No further step, however, was taken, either by government or by private enterprise, until in 1856 a company was formed, chiefly by the energy of Sir W. Andrew, for the construction of a railway along the route already surveyed. Adapting himself to the new phase of his scheme, Chesney again went to the Levant, obtained a firman from the sultan, and with the help of Sir John Macneill laid down a practicable route for the railway, by which the passage from England to Karachi (Kurrachee), the nearest port of India, would be 1000 miles shorter than by way of Suez. The immense political importance of the scheme, by which Hither Asia would necessarily be subject to overwhelming British influence, was its destruction. Everything seemed settled, the concession was granted by the Porte, when, in deference, it is said, to the jealousies of foreign powers, Palmerston threw over the scheme. Another attempt in 1862, with a new company under the chairmanship of Lord Stratford de Redcliffe, ended in a similar collapse, since government refused its countenance. As an alternative to the Suez Canal, and as an instrument for opening up a rich but neglected country, the Euphrates Valley route would still be a valuable channel of commercial and military communication for the British empire.

See Chesney, *Expedition for the Survey of the Rivers Euphrates and Tigris* (1850); *Narratives of the Euphrates Expedition* (1868); *Evidence before Select Commission* (1872); also *Life of General F. R. Chesney* (1885); V. L. Cameron, *Our Future Highway* (2 vols. 1888); and W. F. Ainsworth, *The Euphrates Expedition* (1888).

Euphro'synē (i.e. 'the joyous one'), one of the Graces (q.v.).

Euphuism, a term used in English literature to denote an affected and bombastic style of language, fashionable for a short period at the court of Queen Elizabeth and in the literature of the time. The word was formed from the title of the book which brought the style into vogue, the *Euphues* of John Lyly (q.v.). Euphuism is usually taken to have been an exaggeration of the prevailing Italian taste; but Dr Landmann (*Der Euphuismus*, Giessen, 1881) has sought to prove that the peculiarities of Lyly's style are directly to be traced to Antonio de Guevara (1490–1545), Spanish court preacher, historiographer, bishop, and moralist. His chief work was an historical romance, based on the life and the meditations of Marcus Aurelius, one English translation of which by Lord Berners appeared in 1531, another by North (as *The Dial of Princes*) in 1558–67. This work, exceedingly popular in the last-named translation, has the same characteristics of style as Euphuism, which has even been called *Guevarism*. In Holofernes in *Love's Labour's Lost*, and in Sir Piercy Shafton in the *Monastery*, Euphuism is caricatured.

Eu'poda, a section of vegetarian beetles in the Tetramerous division. The gorgeous Kangaroo-

beetles of tropical Asia and Africa, the Donaciæ on water-plants, the species of Crioceris on lilies, asparagus, &c. are examples. Comparatively few are British; quite a number are North American.

Eurasians is a convenient term for the offspring of Europeans and Asiatics, and is chiefly used in India of the children by European fathers of Hindu mothers, and their descendants. It occurs in *A Few Local Sketches*, by J. M. (Calcutta, 1844).—The term Eurasian is also used in geography for facts true of Europe and Asia (Eurasia) taken as one continent.

Eure, a department of Normandy, immediately south of the department of Seine-Inférieure, contains an area of 2290 sq. m. Pop. (1881) 364,291; (1891) 349,471; the decrease has gone on steadily since 1846 (423,247), small families, often limited to one child, prevailing among all classes. The surface is generally level; the highest point reaches only 790 feet. The principal river is the Seine. The Eure, from which this department derives its name, and the Rille, both affluents of the Seine, are the only other important rivers; the Eure, which rises in the department of Orne, has a course of 141 miles, and is navigable for 54 miles. The climate is mild, moist, and foggy. Along the Seine the soil is in some parts sandy, stony, and barren, but the greater part is very fertile. The chief natural products are corn, hemp, flax, vegetables, and fruit, particularly apples and pears, from which large quantities of cider and perry are made. The breeding of cattle, horses, and sheep is favoured by extensive meadows and pasture-lands. Iron is found in considerable quantities. There are extensive iron and copper works and pin-manufactories. Cotton goods, cloth, linen, paper, and beet-sugar also are manufactured. The department is divided into five arrondissements—Evreux, Louviers, Les Andelys, Bernay, and Pont-Audemer. The capital is Evreux.

Eure-et-Loir, a department of France, to the south of the preceding, with an area of 2260 sq. m. Pop. (1872) 282,622; (1891) 284,683. It is watered mainly by the Eure in the north, and the Loir in the south. It is in general level, the east and south being occupied by high and extensive flats; while in the west the scenery is finely varied by wooded hills and valleys. The soil is fertile, and good crops of wheat and oats are raised, besides considerable quantities of vegetables and fruit; cider is prepared, and some wine. Stock-raising also is of importance, and iron and a few other minerals are worked. The rivers, though not navigable, furnish valuable water-power for the numerous mills on their banks; besides foundries, there are manufactories of beet-root sugar, cotton, wool, silk, paper, boots, and hats. The department is divided into the four arrondissements of Chartres, Châteaudun, Dreux, and Nogent-le-Rotrou, with the town of Chartres for capital.

Eureka, (1) a port and capital of Humboldt county, California, on Humboldt Bay, chiefly noteworthy for its mild, equable climate. It has several lumber-mills, and exports great quantities of redwood lumber from the giant forests around. Pop. 6000.—(2) A mining-town, capital of Eureka county, Nevada, 90 miles by rail S. of the Palisades station on the Central Pacific Railroad. Here are silver and lead mines. Pop. 1609.

Euripides, the latest of the three great Greek tragedians, was born at the time when the Persian attack upon the freedom of Greece was being repelled in a series of glorious victories; and this fact is expressed in the story that he was born 480 B.C. at Salamis, whither the Athenians had fled, and where the Persian fleet was defeated in that year. The first half of his life coincided with the growth of the Athenian empire, the second with its decline. Æschylus, the first of the three tragedians, a man of forty when Euripides was born, probably had died before Euripides produced his first play—at which time Sophocles had already been thirteen years before the public, and Aristophanes, the comedian, who was to be the constant opponent of Euripides, was not yet born. Euripides was the son of wealthy parents, who probably had made their fortune by trade, for Aristophanes (*Ach.* 478, *Ran.* 840) banters him on the subject with jests which would have been pointless had they not contained some truth. Tradition says that his father intended him to compete in the national athletic festivals of Greece; and this may account for Euripides' pronounced dislike of athletes (*Frag.* 284). He then took to painting, but, like Théophile Gautier, abandoned it for literature; and he has indeed the painter's eye for an effective situation. Tradition represents him as the friend of Socrates, and the pupil of Prodicus, Protagoras, and Anaxagoras; and he does more than once reproduce in his plays Anaxagoras' doctrine of the origin of all things from the wedlock of Earth and Air (cf. *Frag.* 836, 890, 935; Ar. *Ran.* 892). He is said to have been married twice, and to have had three sons. Scandal has been busy with his wives, but there can be no truth in it, otherwise we should have heard of it from Aristophanes; and his reputation as a woman-hater is not confirmed by an impartial study of his plays. How many dramas he wrote we do not know, but the names and some fragments of about eighty are known to us, and of these eighty we possess eighteen complete. He won the tragic prize only five times, and he died 406 B.C. at the court of Archelaus, king of Macedonia. His habits were those of the scholar and the recluse. He was one of the first and the few private persons in Greece to possess a library (cf. *Hipp.* 452, 954; *Iph. A.* 798; *Alc.* 962; *Frag.* 629; Ar. *Ran.* 943, 1403). He took no such part in public life as did Æschylus and even Sophocles. In politics he was a moderate, approving of democracy (*Frag.* 628), but not of demagogues (*Hec.* 132, 254). His views of life on the whole were pessimistic: he did not share Aristophanes' romantic illusions as to the past, and the contemplation of the future could bring no comfort in an age when the doctrine of progress had not as yet been formulated. The immoralities of the accepted mythology shocked him as well as other thinkers; but his philosophy sufficed neither to shake off the old religion nor to reconcile him to it. The names and probable order of the surviving plays are: *Alcestis*, *Medea*, *Hippolytus*, *Hecuba*, *Andromache*, *Supplices*, *Heraclidæ*, *Troades*, *Helena*, *Phœnissæ*, *Orestes*; the *Bacchæ* and *Iphigenia in Aulis* were put on the Athenian stage only after the author's death; and it is uncertain to what period belonged the *Ion*, *Hercules Furens*, *Iphigenia in Tauris*, *Electra*, and *Cyclops*, whilst it is doubtful whether the *Rhesus* is genuine. Whereas the characters in the plays of Æschylus and Sophocles had been heroic in their proportions and greater than life, Euripides set to work to be human. And in this we have the secret both of his success and of his failure: of his failure, because he made the mistake of imagining human life to be the same thing as everyday life; of his success, because in his treatment of everyday motives and emotions he was, 'with his droppings of warm tears,' the 'most tragic of the poets.' His skill as a playwright is of the highest order; he can construct plots which are exciting beyond anything attempted by his predecessors, and he has an unerring instinct for a 'situation.' But he has all the unscrupulousness of the practical playwright: in his consuming desire to get on to the situation as rapidly as possible, and to bring the curtain down sharp on it, he

substitutes a bald prologue for a proper exposition, and, instead of working out the dénouement, makes a *Deus ex machinâ* cut the knot of the situation. For the sake of the same all-important consideration he will sacrifice consistency in character-drawing, and transgress all the bounds of artistic self-restraint. His popularity increased, indeed we might almost say began, after his death; his plays were 'revived' on the stage more frequently than those of Æschylus or Sophocles; they fill a much larger place in the mind of Aristotle, as appears from his *Poetics*, than those of the other two tragedians; and the number of his plays that have survived is greater than both theirs put together. Nor can we ascribe this wholly to a decline in taste, when we remember that Euripides was a favourite with Theocritus, Virgil, Ovid, Horace, Milton, and Browning. The oldest MSS. known to us go back only to the 12th century, and are very corrupt. The *editio princeps* (Florence, 1496) contains only four plays; the Aldine (1503), eighteen. The critics who have done most for the text are Porson (1797), Elmsley (1813), G. Hermann (1838), C. Badham (1851). The most convenient text is that of A. Nauck (Leip. 1885).

Euri'pus. See CHALCIS, EUBŒA.

Euroclydon, in the A.V., following the ordinary Greek text, was the tempestuous wind by which St Paul's ship was wrecked (Acts, xxvii. 14). The revised translation, taking the Greek reading *euraklyon*, has *Euraquilo*, 'a north-easter.' This is sometimes identified with the Bora (q.v.).

Euro'pa, the daughter of the Phœnician king Agenor, whom Zeus, in the form of a bull, bore off to Crete, where she became the mother of Minos, Rhadamanthus, and Sarpedon.

Europe. Europe is historically and politically by far the most important of the five great divisions of the world. It is, however, next to Australasia, the smallest in area, though, in proportion to its size, the most densely peopled. Geographers are agreed that, apart from its history and significance for the history of civilisation, it should be regarded rather as a peninsula of Asia, or as a portion of the great joint Eurasian continent; in regard to physical geography, fauna, and flora, it is difficult to draw a sharp line between Europe and Asia. On three sides Europe is bounded by sea—north by the Arctic Ocean, west by the Atlantic, south by the Mediterranean, Sea of Marmora, and Black Sea. But on the east the Urals, Ural River, and Caspian, though commonly assumed as the boundary towards Asia, do not mark a precise limit in respect of climate, flora, fauna, or physical conditions generally (see this discussed at ASIA); and actually the governments of Perm and Orenburg in Russia in Europe extend far beyond the Urals. Between the Caspian and the Black Sea, the ridge of the Caucasus seems a convenient dividing line between Europe and Asia, but the Manytch depression is really, from the geographical point of view, a more correct boundary; physically the whole lieutenancy of the Caucasus is part of Asia (q.v.). It is more curious that North Africa and South Europe are very closely related in many respects, geological and biological. It has even been said that the mountains of Auvergne divide northern France more sharply from Provence than the Mediterranean does southern Provence from Morocco and Algiers. But in current usage Europe is bounded on three sides by sea, and elsewhere by the Kara River, the Ural Mountains, Ural River, Caspian, and the Caucasus.

Various etymologies have been proposed for the name Europe. The old mythological one was that it was named from Europa (q.v.)—why, was not very clear. Another was that it came from Eurus, the south-east wind. A third, given by Hermann, notes that the name is first applied, not to the whole continent, but (in the Homeric Hymn to Apollo) to the mainland of Thrace, as distinguished from the Peloponnesus and the Greek islands, and suggests that Europe therefore means Broad Land (*eurus ōps*, 'broad face'). Of late the tendency is to assume that the name was first given by Phœnician traders, and is from the word *Ereb*, 'darkness'—i.e. the land of sunset, of the west. The area to which the name of Europe was applied grew with the extension of Greek geographical knowledge.

Europe has a total length from Cape St Vincent on the south-west to the mouth of the Kara River on the north-east of 3400 miles; and from North Cape in Norway to Cape Matapan, the southernmost point of Greece, a total breadth of 2400 miles. The continent of Europe, irrespective of islands, lies within 36° 20′—71° 10′ N. lat., and 9° 30′ W.—66° 30′ E. long. Its area is estimated at 3,800,000 sq. m., being about a third of that of Africa, a fourth of that of America, and a fifth of that of Asia. It does not greatly exceed the total area of the United States. Its indented coast-line is more extensive in proportion to its size than that of any other great natural division of the globe, and is estimated to measure little less than 50,000 miles. This is caused by its great irregularity, and the number of deep inlets and gulfs which penetrate its surface. It has a population of nearly 330,000,000, which gives an average of nearly 87 for every square mile.

The body of the European continent divides itself naturally into two great portions—the great plain in the north-east, and the highlands from near the centre towards the south-west, the mountainous peninsula of Scandinavia lying apart from either. (See the accompanying physical map of Europe.) The plain occupies about two-thirds (2,500,000 sq. m.) of the entire extent of the continent. It reaches from the eastern boundary of Europe, north to the shores of the Arctic Ocean, south to the Caucasus and the Black Sea, and westward over the whole extent of the continent; gradually, however, becoming narrower towards the west. In shape this plain resembles a triangle; its base rests on the eastern boundary, and it may be said to reach its apex on the shores of Holland. It separates the two mountain-systems of Europe—the Scandinavian system (highest summit 7566 feet) on the north, and on the south the system of southern Europe. The mass of the Alps, covering an area of nearly 100,000 sq. m., forms the centre of the mountain-system of southern and western Europe, and stretches down on four sides towards France, Germany, Hungary, and Italy; the highest summit being 15,732 feet. The other chief mountain-masses are the Carpathians (8343 feet) the Balkans (9750), the Apennines (9574), the Pyrenees (11,170), and the Sierra Nevada (11,660), and in Sicily, Etna (10,850). The highest inhabited spot in Europe is, since 1882, the observatory on Etna (9075 feet), nearly 1000 feet higher than the hospice of the Great St Bernard. See ALPS, APENNINES, BALKAN, CARPATHIANS, PYRENEES, &c.

Europe is surrounded by water on three sides. The White Sea comes in from the Arctic Ocean; the German Ocean and the Mediterranean from the Atlantic. The most important peninsulas are in the north Scandinavia, and in the south the Crimea, Turkey and Greece, Italy, and Spain. With the exception of Iceland, the islands cluster closely round the mainland, the chief being Great Britain and Ireland, Iceland, Nova Zembla, Sardinia, Corsica, and Crete (Candia). The lakes of Europe are small as compared with those of Africa or America, the largest being Ladoga and Onega in Russia, and Wener in Sweden. The Volga (1977

miles), the Danube (1740), the Ural (1450), the Don (1125), the Kama (1055), the Petchora (975), and the Rhine (765) are the largest rivers of Europe.

The details of the geography of Europe are given under the names of its several political divisions, and of its lakes, rivers, and mountains.

Geology.—The oldest rocks of Europe—viz. the Archæan and Palæozoic—occupy the most continuous area in the northern part of the continent. Thus, they extend over all the Scandinavian peninsula, Finland, and a considerable portion of northern Russia. In western Europe they are likewise well developed, as in the British Islands, which (if we except the midlands, and the eastern and south-eastern parts of England) may be said to be mainly composed of Archæan and Palæozoic rocks. Similar rocks cover extensive areas in Brittany, in central France, and in the Iberian peninsula. In central Europe they occur for the most part in sporadic areas of limited extent, which upon a geological map look like islands surrounded by younger strata than themselves. One of the largest of those areas is that which stretches from the north of France through the Ardennes and southern Belgium into Rhenish Prussia, Westphalia, and Nassau. Another considerable tract occupies most of Bohemia, and smaller areas are met with in most of the mountain-ranges of Germany and Austria-Hungary. Archæan and Palæozoic rocks likewise appear to form the nuclei of the Pyrenees, the Alps, and the Caucasus, while the Ural range is exclusively composed of such rocks. In the maritime regions of the Mediterranean, crystalline schists and Palæozoic strata are sparingly met with, as in southern and eastern Spain, in Sardinia, and Corsica. Considerable tracts of schistose rocks, however, extend through Turkey, and appear in many of the islands of the Ægean Sea, as well as in southern Greece, southern Italy, &c. Having mentioned the main areas at which these oldest rocks appear at the surface, it is not necessary to refer to the distribution of the Mesozoic and Cainozoic strata, save in the most general terms. They are confined chiefly to the low grounds of the continent, although now and again, as in the Pyrenees, the Alps, and the Caucasus, they rise to great elevations. It may be added also that they enter into the composition of not a few other hilly regions, such as the Carpathians, the Apennines, the high grounds of Herzegovina, Albania, &c. Accumulations of Pleistocene and Recent age are met with alike in mountainous and lowland regions. They are developed most continuously in the low grounds of central Europe —extending from the borders of the North Sea across Germany far into Russia. They likewise form enormous tracts of flat land bordering on the Black Sea, the Sea of Azov, and the Caspian. The alluvial lands through which the great rivers of Europe flow belong to the same division of geological time, while the glacial deposits which form the under-soils throughout a large part of northern Europe, and which reappear in the mountain-valleys of more southern regions, are all likewise included amongst Pleistocene and Recent accumulations.

Geologists are not yet agreed as to the origin of the Archæan rocks, and it is altogether premature, therefore, to speculate upon the physical conditions of Europe at the period of their formation. All we know for certain is that the earliest land-surfaces, of the former existence of which no doubt can be entertained, were composed of Archæan rocks.

Leaving the Archæan, we find that the next oldest strata are those which were accumulated during the Cambrian period, to which succeeded the Silurian, the Devonian and Old Red Sandstone, the Carboniferous, and the Permian periods—all represented by great thicknesses of strata, which overspread wide regions.

Now, at the beginning of the Cambrian period, we have evidence to show that the primeval ridge which was subsequently to become the continent of Europe was still largely under water, the dry land being massed chiefly in the north. At that distant date a broad land-surface extended from the Outer Hebrides north-eastwards through Scandinavia, Finland, and northern Russia. How much farther north and north-west of the present limits of Europe that ancient land may have spread we cannot tell, but it probably occupied wide regions which are now submerged in the shallow waters of the Arctic Ocean. In the north of Scotland a large inland sea or lake existed in Cambrian times, and there is some evidence to suggest that similar lacustrine conditions may have obtained in the Welsh area at the beginning of the period. South of the northern land lay a shallow sea covering all middle and southern Europe. That sea, however, was dotted here and there with a few islands of Archæan rocks, occupying the site of what are now some of the hills of middle Germany, such as the Riesengebirge, the Erzgebirge, the Fichtelgebirge, &c., and possibly some of the Archæan districts of France and the Iberian peninsula.

The succeeding period was one of eminently marine conditions, the wide distribution of Silurian strata showing that, during the accumulation of these, enormous tracts of the present continent of Europe were overflowed by the sea. None of these deposits, however, is of truly oceanic origin. They appear for the most part to have been laid down in shallow seas, which here and there may have been moderately deep. During the formation of the Lower Silurian the whole of the British area, with the exception perhaps of some of the Archæan tracts of the north-west, seems to have been under water. The submergence had commenced in Cambrian times, and was continued up to the close of the Lower Silurian period. During this long-continued period of submergence volcanic activity manifested itself at various points—Great Britain and Ireland being represented at that time by groups of volcanic islands, scattered over the site of what is now Wales, and extending westward into the Irish region, and northward into the districts of Cumberland and south Ayrshire. Towards the close of the Lower Silurian period considerable earth-movements took place, which had the effect of increasing the amount of dry land, the most continuous mass or masses of which still occupied the northern and north-western part of the continent. In the beginning of Upper Silurian times a broad sea covered the major portion of middle and probably all southern Europe. Numerous islands, however, would seem to have existed in such regions as Wales, the various tracts of older Palæozoic and Archæan rocks of south Germany, &c. Many of these islands were partially, and some entirely, submerged before the close of Silurian times.

The next great period—that, namely, which witnessed the accumulation of the Devonian and Old Red Sandstone strata—was in some respects strongly contrasted to the preceding period. The Silurian rocks, as already mentioned, are eminently marine. The Old Red Sandstones, on the other hand, appear to have been accumulated chiefly in great lakes or inland seas, and they betoken therefore the former existence of extensive lands, while the contemporaneous Devonian strata are of marine origin. Towards the close of the Upper Silurian period, then, we know that considerable upheavals ensued in western and north-western Europe, and wide stretches of the Silurian sea-bottom were converted into dry land. The geo-

graphical distribution of the Devonian in Europe, and the relation of that system to the Silurian, show that the Devonian sea did not cover so broad an expanse as that of the Upper Silurian. The sea had shallowed, and the area of dry land had increased, when the Devonian strata began to accumulate. In trying to realise the conditions that obtained during the formation of the Devonian and Old Red Sandstone, we may picture to ourselves a time when the Atlantic extended eastwards over the south of England and the north-east of France, and occupied the major portion of central Europe, sweeping north-east into Russia, and how much farther we cannot tell. North of that sea stretched a wide land-surface, in the hollows of which lay great lakes or inland seas, which seem now and again to have had communication with the open ocean. It was in these lakes that the Old Red Sandstone was accumulated, while the Devonian or marine rocks were formed in the wide waters lying to the south. Submarine volcanoes were active at that time in Germany; and similarly in Scotland numerous volcanoes existed, such as those of the Sidlaw Hills and the Cheviots.

The Carboniferous system contains the record of a long and complex series of geographical changes, but the chief points of importance in the present rapid review may be very briefly summed up. In the earlier part of the period marine conditions prevailed. Thus, we find evidence to show that the sea extended farther north than it did during the preceding Devonian period. During the formation of the mountain-limestone, a deep sea covered the major portion of Ireland and England, but shallowed off as it entered the Scottish area. A few rocky islets were all that represented Ireland and England at that time. Passing eastwards, the Carboniferous sea appears to have covered the low grounds of middle Europe and enormous tracts in Russia. The deepest part of the sea lay over the Anglo-Hibernian and Franco-Belgian areas; towards the east it became shallower. Probably the same sea swept over all southern Europe, but many islands may have diversified its surface, as in Brittany and central France, in Spain and Portugal, and in the various areas of older Palæozoic and Archæan rocks in central and south-east Europe. In the later stages of the Carboniferous period, the limits of the sea were much circumscribed, and wide continental conditions supervened. Enormous marshes, jungles, and forests now overspread the newly-formed lands. Another feature of the Carboniferous was the great number of volcanoes—submarine and subaerial—which were particularly abundant in Scotland, especially during the earlier stages of the period.

The rocks of the Permian period seem to have been deposited chiefly in closed basins. When, owing to the movement of elevation or upheaval which took place in late Carboniferous times, the carboniferous limestone sea had been drained away from extensive areas in central Europe, wide stretches of sea still covered certain considerable tracts. These, however, as time went on, were eventually cut off from the main ocean and converted into great salt lakes. Such inland seas overspread much of the low-lying tracts of Britain and middle Germany, and they also extended over a broad space in the north-east of Russia. It was in these seas that the Permian strata were accumulated. The period, it may be added, was marked by the reappearance of volcanic action in Scotland and Germany.

So far, then, as our present knowledge goes, that part of the European continent which was the earliest to be evolved lay towards the north-west and north. All through the Palæozoic era a land-surface would seem to have endured in that direction—a land-surface from the denudation or wearing down of which the marine sedimentary formations of the bordering regions were derived. But, when we reflect on the great thickness and horizontal extent of those sediments, we can hardly doubt that the primeval land must have had a much wider range towards the north and north-west than is the case with modern Europe. The lands from which the older Palæozoic marine sediments of the British Islands and Scandinavia were obtained must, for the most part, be now submerged. In later Palæozoic times land began to extend in the Spanish peninsula, northern France, and middle Europe, the denudation of which doubtless furnished materials for the elaboration of the contemporaneous strata of those regions. Southern Europe is so largely composed of Mesozoic and Cainozoic rocks that we can say very little as to the condition of that area in Palæozoic times, but the probabilities are that it continued for the most part under marine conditions. In few words, then, we may conclude that, while after Archæan times dry land prevailed in the north and north-west, marine conditions predominated farther south. Ever and anon, however, the sea vanished from wide regions in central Europe, and was replaced by terrestrial and lacustrine conditions. Further, as none of the Palæozoic marine strata indicates a deep ocean, but all consist for the most part of accumulations formed at moderate depths, it follows that there must have been general subsidence of our area to allow of their successive deposition—a subsidence, however, which was frequently interrupted by long pauses, and sometimes by movements in the opposite direction.

The first period of the Mesozoic era—viz. the Triassic—was characterised by much the same kind of conditions as obtained towards the close of Palæozoic times. A large inland sea then covered a considerable portion of England, and seems to have extended north into the south of Scotland, and across the area of the Irish Sea into the north-east of Ireland. Another inland sea extended westward from the Thüringerwald across the Vosges into France, and stretched northwards from the confines of Switzerland over what are now the low grounds of Holland and northern Germany. In this ancient sea the Harz Mountains formed a rocky island. While terrestrial and lacustrine conditions thus obtained in central and northern Europe, an open sea existed in the more southerly regions of the continent. Towards the close of the period submergence ensued in the English and German areas, and the salt lakes became connected with the open sea.

During the Jurassic period the regions now occupied in Britain and Ireland by the older rocks appear to have been chiefly dry land. Scotland and Ireland, for the most part, stood above the sea-level, while nearly all England was under water—the hills of Cumberland and Westmorland, the Pennine chain, Wales, the heights of Devon and Cornwall, and a ridge of Palæozoic rocks which underlies London being the chief lands in south Britain. The same sea overflowed an extensive portion of what is now the continent. The older rocks in the north-west and north-east of France, and the central plateau of the same country, formed dry land; all the rest of that country was submerged. In like manner the sea covered much of eastern Spain. In middle Europe it overflowed nearly all the low grounds of north Germany, and extended far east into the heart of Russia. It occupied the site of the Jura Mountains, and passed eastward into Bohemia, while on the south side of the Alps it spread over a large part of Italy, extending eastwards so as to

submerge a broad area in Austria-Hungary and the Balkan peninsula. Thus the northern latitudes of Europe continued to be the site of the chief land-masses, what are now the central and southern portions of the continent being a great archipelago with numerous islands, large and small.

The Jurassic rocks, attaining as they do a thickness of several thousand feet, point to very considerable subsidence. The movement, however, was not continuous, but ever and anon was interrupted by pauses. Taken as a whole, the strata appear to have accumulated in a comparatively shallow sea, which, however, was sufficiently deep in places to allow of the growth, in clear water, of coral reefs.

Towards the close of the Jurassic period a movement of elevation ensued, which caused the sea to retreat from wide areas, and thus, when the Cretaceous period began, the British region was chiefly dry land. Middle Europe would seem also to have participated in this upward movement. Eventually, however, subsidence again ensued. Most of what are now the low grounds of Britain were submerged, the sea stretching eastwards over a vast region in middle Europe, as far as the slopes of the Urals. The deepest part of this sea, however, was in the west, and lay over England and northern France. Farther east, in what are now Saxony and Bohemia, the waters were shallow, and gradually became silted up. In the Mediterranean basin a wide open sea existed, covering large sections of eastern Spain and southern France, overflowing the site of the Jura Mountains, drowning most of the Alpine lands, the Italian peninsula, the eastern borders of the Adriatic, and Greece. In short, there are good grounds for believing that the Cretaceous Mediterranean was not only much broader than the present sea, but that it extended into Asia, overwhelming vast regions there, and communicated with the Indian Ocean.

Summing up what we know of the principal geographical changes that took place during the Mesozoic era, we are impressed with the fact that, all through those changes, a wide land-surface persisted in the north and north-west of the European area, just as was the case in Palæozoic times. The highest grounds were the Urals and the uplands of Scandinavia and Britain. In middle Europe the Pyrenees and the Alps were as yet inconsiderable heights, the loftiest lands being those of the Harz, the Riesengebirge, and other regions of Palæozoic and Archæan rocks. The lower parts of England and the great plains of central Europe were sometimes submerged in the waters of a more or less continuous sea; but ever and anon elevation ensued, and the sea was divided, as it were, into a series of great lakes. In the south of Europe a Mediterranean sea would appear to have endured all through the Mesozoic era — a Mediterranean of considerably greater extent, however, than the present. Thus we see that the main features of our continent were already clearly outlined before the close of the Cretaceous period. The continental area then, as now, consisted of a wide belt of high ground in the north, extending roughly from south-west to north-east; south of this, a vast stretch of low grounds, sweeping from west to east up to the foot of the Urals, and bounded on the south by an irregular zone of land having approximately the same trend; still farther south, the maritime tracts of the Mediterranean basin. During periods of depression the low grounds of central Europe were invaded by the sea, the irregular zone of land lying immediately to the south was partially submerged, and so converted into groups of islands, and the Mediterranean at the same time extended north over many regions which are now dry land. It is in these two low-lying tracts, therefore, and the country immediately adjoining them, that the Mesozoic strata of Europe are chiefly developed.

A general movement of upheaval supervened at the close of the Cretaceous period, and the sea which, during that period, overflowed so much of middle Europe had largely disappeared before the beginning of Eocene times. The southern portions of the continent, however, were still mostly under water, while great bays and arms of the sea extended northwards now and again into central Europe. On to the close of the Miocene period, indeed, southern and south-eastern Europe consisted of a series of irregular straggling islands and peninsulas washed by the waters of a genial sea. Towards the close of early Cainozoic times, the Alps, which had hitherto been of small importance, were greatly upheaved, as were also the Pyrenees and the Carpathians. The floor of the Eocene sea in the Alpine region was ridged up for many thousands of feet, its deposits being folded, twisted, inverted, and metamorphosed. Another great elevation of the same area was effected after the Miocene period, the accumulations of that period now forming considerable mountains along the northern flanks of the Alpine chain. Notwithstanding these gigantic elevations in south-central Europe—perhaps in consequence of them—the low-lying tracts of what is now southern Europe continued to be largely submerged, and even the middle regions of the continent were now and again occupied by broad lakes which sometimes communicated with the sea. In Miocene times, for example, an arm of the Mediterranean extended up the Rhone valley, and stretched across the north of Switzerland to the basin of the Danube. After the elevation of the Miocene strata, these inland stretches of sea disappeared, but the Mediterranean still overflowed wider areas in southern Europe than it does in our day. Eventually, however, in late Pliocene times, the bed of that sea experienced considerable elevation, newer Pliocene strata occurring in Sicily up to a height of 3000 feet at least. It was probably at or about that period that the Black Sea and the Sea of Azov retreated from the wide low grounds of southern Russia, and that the inland seas and lakes of Austria-Hungary finally vanished.

The Cainozoic era is distinguished in Europe for its volcanic phenomena. The grandest eruptions were those of Oligocene times. To that date belong the basalts of Antrim, Mull, Skye, the Faröe Islands, and the older series of volcanic rocks in Iceland. These basalts speak to us of prodigious fissure eruptions, when molten rock welled up along the lines of great cracks in the earth's crust, flooding wide regions, and building up enormous plateaus, of which we now behold the merest fragments. The ancient volcanoes of central France, those of the Eifel country and many other places in Germany, and the volcanic rocks of Hungary are all of Cainozoic age; while, in the south of Europe, Etna, Vesuvius, and other Italian volcanoes date their origin to the later stages of the same great era.

Thus before the beginning of Pleistocene times all the main features of Europe had come into existence. Since the close of the Pliocene period there have been many great revolutions of climate; several very considerable oscillations of the sea-level have taken place, and the land has been subjected to powerful and long-continued erosion. But the greater contours of the surface which began to appear in Palæozoic times, and which in Mesozoic times were more strongly pronounced, had been fully evolved by the close of the Pliocene

period. The most remarkable geographical changes which have taken place since then have been successive elevations and depressions, in consequence of which the area of the continent has been alternately increased and diminished. At a time well within the human period the British Islands have been united to themselves and the continent, and the dry land has extended north-west and north, so as to include Spitzbergen, the Faröe Islands, and perhaps Iceland. On the other hand, the British Islands have been within a recent period largely submerged.

The general conclusion, then, to which we are led by a review of the greater geographical changes through which the European continent has passed is simply this—that the substructure upon which all the sedimentary strata repose is of primeval antiquity. The dry lands are built up of rocks which have been accumulated over the surface of a great wrinkle of the earth's crust. There have been endless movements of elevation and depression, causing minor deformations, as it were, of that wrinkle, and inducing constant changes in the distribution of land and water; but no part of the continental ridge has ever been depressed to an abysmal depth. The ridge has endured through all geological time. We can see also that the land has been evolved according to a definite plan. Certain marked features begin to appear very early in Palæozoic times, and become more and more pronounced as the ages roll on. All the countless oscillations of level, all the myriad changes in the distribution of land and water, all the earthquake disturbances and volcanic eruptions—in a word, all the complex mutations to which the geological record bears witness—have had for their end the completion of one grand design.

Climate, Flora, and Fauna.—In respect of climate, by far the greater portion of the area of Europe belongs to the northern section of the temperate zone, though parts of Norway, Sweden, and Russia lie within the Arctic Circle. The southern parts of Spain, Sicily, and Greece are some twelve degrees from the northern tropic. For Rainfall, see the article RAIN; see also TEMPERATURE.

The natural history of Europe very much agrees with that of the corresponding latitudes of Asia. The natural history of the European countries on the Mediterranean Sea is very similar to that of Asia Minor and of North Africa. The natural history of the more northern regions of Europe resembles that of the great plains of Central Asia and Siberia. The most northern regions have the strictly arctic flora and fauna common in a great measure to all the arctic and sub-arctic regions; whilst the natural history of the most southern countries assumes a subtropical character.

The temperature of the western and northern parts of Europe being raised by the Gulf Stream and the winds from the great mass of dry and desert land in Africa above what is elsewhere found in similar latitudes, the flora and fauna exhibit a corresponding character, affected, however, by the great amount of moisture derived from the Atlantic Ocean, and also to a still greater degree by the comparative uniformity of temperature which the proximity of the ocean produces. The effect of the last-mentioned causes is so great that the northern limit of some plants is sooner reached on the shores of the Atlantic than in the more central parts of Europe, where the winters are much colder, and the average temperature of the year is lower. Of this the vine and maize are notable examples. Plants which require a mild winter will not grow in the north—and scarcely even in the centre of Europe—but they advance along the western coast under the influence of the maritime climate. Thus, the myrtle—although not indigenous—grows even in the south of England. Amongst plants the date palm, and amongst animals a species of ape, are found in the south of Europe (the ape only on the Rock of Gibraltar); whilst some strictly African birds are frequent visitants, and many birds—as the cuckoo, swallow, &c.—are common to Europe and Africa, inhabitants in summer even of very northern regions, and returning in winter to the warm south.

Of the plants now most commonly associated in our thoughts with the southern countries of Europe, many have probably been introduced from Africa or from the East. This has probably been the case even with the myrtle, and certainly has been the case with the vine, the olive, the orange, lemon, &c., the fig, the peach, the almond, the apricot, &c. Some of the most extensively cultivated fruits are certainly indigenous to Europe, as the apple, pear, plum, and cherry, although even of these the first improved varieties may have been introduced from the earlier seats of civilisation in the East. Among the wild animals of Europe at the present day, the bison is still reckoned; and the ox existed at no very remote period in a truly wild state. The reindeer inhabits the extreme north of Europe; the elk, the stag, the fallow-deer, and the roebuck are found in more southern regions; the ibex or bouquetin exists on the high central mountains; two species of antelope—the chamois of the Alps, and the saiga of the Russian plains—connect the European fauna with the Asiatic and African. Of mammals peculiar to this part of the palæarctic region, the most notable are the chamois, the musk rat, the fallow-deer, the civet, ichneumon, and porcupine. Of carnivorous animals, the most worthy of notice are the bear, the wolf, the fox, and the lynx. On this head see the article GEOGRAPHICAL DISTRIBUTION, and the sections on animal and vegetable life in the articles on the various countries. The European seas afford valuable fisheries, particularly of herring and of cod in the north, and of tunny, anchovy, &c. in the Mediterranean.

Ethnology.—The European races belong in the main to the various branches of the Aryan stock (see ARYAN RACE, ETHNOLOGY), though in few European countries is there a pure race—the admixture of various stocks being in some cases very great and close. But, generally speaking, Celtic blood is most largely found in France (especially in Brittany, where a Celtic tongue is still spoken) and a part of Great Britain and Ireland; Teutonic peoples occupy Germany, Switzerland, Netherlands, part of Belgium, part of Austria, Denmark, Norway and Sweden, Iceland, and Great Britain. Slavonic races are found in Austria, Prussia, the Balkan peninsula, and Russia (see SLAVS). Romanic language and blood are prominent in Italy, France, Spain and Portugal, and Roumania. The Greeks belong to the same Greco-Italian branch of the Aryans as the Italians. Non-Aryan peoples are the Finns, Lapps, and Samoyedes of the north and north-east, various Turanian tribes in the east of Russia, the Hungarians and the Turks, and the Basques of the Pyrenees; and a strong element of pre-Aryan blood is also to be traced in other parts of western Europe, as in Ireland and Britain. The most obvious method of classifying races is language. By this test, some 105,000,000 Europeans are Teutonic (German, English, Dutch, Flemish, Swedish, Norwegian, Danish); 95,000,000 Slavs (Russian, Polish, Czech, Slovak, Serb, Croat, Slovenian, Bulgarian); 100,000,000 Romance-speaking (French, Italian, Spanish, Portuguese, Roumanian, Walloon, Rhætian); 3,000,000 Letts and Lithuanians; 5,250,000 Greeks and Albanians; 3,600,000 Celtic (Welsh, Breton, Irish, Gaelic,

Manx); 1,050,000 Armenians, Ossetians, and Gypsies. Some 18,000,000 are non-Aryan (Magyars, Finns, Ugrians, Tartars, Turks, Kalmucks, Basques, Circassians, &c., and Maltese). Upwards of fifty languages are spoken in Europe. But language is by no means a sure test of race; thus, the Normans quickly took to speaking the Romance tongue of their Romanised Gallic subjects, the French—who, Celts, with a strong infusion of Frankish-Germanic blood, and a smaller infusion of Italic blood, spoke a modified Latin tongue. Many parts of the German-speaking area are mainly Wendish or Prussian (Slavonic) blood. The Bulgarians, speaking a Slavonic tongue, are originally Ugro-Finnic. Fuller information must be sought in the articles on the various races and countries.

Political Divisions.—The following table gives a comparative view of the states of Europe, their areas, and populations. The populations are given according to the most recent censuses or estimates in 1889.

States.	Form of Government.	Extent in English square miles.	Population.	Number of Inhab. per Eng. sq. m.
Andorra	Republic, with a sovereign council	175	6,000	34
Austria-Hungary	Limited monarchy, two chambers	240,456	40,348,215	167
Bosnia, Herzegovina, &c.	Occupied by Austria	23,179	1,504,091	65
Belgium	Limited monarchy, two chambers	11,373	5,974,743	520
Bulgaria & Eastern Roumelia	Principality and autonomous province (under Turkey)	38,560	3,154,375	82
Denmark	Limited monarchy, two chambers	14,124	1,980,259	140
France	Republic, two chambers	204,092	38,218,903	187
Germany	Limited monarchy, two chambers	211,149	46,855,704	221
Great Britain and Ireland	Limited monarchy, two houses of parliament	120,832	37,453,574	310
Greece	Limited monarchy, one chamber	25,014	1,979,453	79
Italy	Limited monarchy, two chambers	114,410	30,260,065	264
Liechtenstein	Principality, one chamber	70	9,124	130
Luxemburg	Grand-duchy (connected with Netherlands)	998	213,283	213
Monaco	Principality	8	13,304	1663
Montenegro	Principality, limited sovereignty	3,630	236,000	65
Netherlands	Limited monarchy, two chambers	12,648	4,450,870	352
Portugal	Limited monarchy, two chambers	36,028	4,708,178	131
Roumania	Kingdom, two chambers	48,307	5,500,000	113
Russia (in Europe)	Absolute monarchy	2,095,504	88,205,358	42
San Marino	Republic, sovereign council	32	8,000	250
Servia	Kingdom, two chambers	18,750	2,013,690	107
Spain	Limited monarchy, two chambers	197,670	17,358,404	88
Sweden and Norway	Limited monarchy, two chambers for each country.	293,848	6,676,189	23
Switzerland	Republican confederation, federal diet	15,892	2,957,527	186
Turkey (in Europe)	Absolute sovereignty	63,350	4,790,000	75

Religion.—Europe is practically a region of monotheists: though there are Buddhist Kalmucks in South Russia, and Pagans amongst the Lapps, Finns, Samoyedes, and Tcheremisses. The Turks, some Russian Tartars, many Albanians, and some Slavs are Mohammedans (6,600,000), and there are nearly 7,000,000 Jews; but the bulk of Europeans are professing Christians. The Catholic Church may number some 156,600,000 adherents, the Greek Church 80,000,000, while the various Protestant communions number about 76,000,000.

Historical Geography.—The historical geography of the parts of Europe known in the oldest times is treated in the articles Rome, Byzantine Empire, Greece, &c. In the articles on the various countries of Europe (France, Germany, Austria, &c.) will be found detailed accounts of the origin and development of the several nations and countries; or in some cases (Burgundy, Poland) of their gradual disappearance as separate states. In this place it seems desirable to give a sketch of some of the most notable changes in the political distribution and national divisions in the European area since the fall of the Roman empire, and to indicate the outstanding features of the political geography of Europe at the four important periods illustrated in the accompanying historical maps.

On the death of the Emperor Theodosius (395), the Roman empire was finally divided into two parts—the Latin empire, or Empire of the West, the capital of which was Rome; and the Greek empire, or Empire of the East, the capital of which was Constantinople. The Latin empire consisted of six dioceses—Italy, Gaul, Britain, Spain, Western Illyricum, and Africa; the Greek empire consisted of seven dioceses—the East, Egypt, Asia, Pontus, Thrace, Macedonia, and Dacia. In some of these dioceses may be traced the outlines of modern European countries.

Beyond the pale of the organised society of the Roman world lay a great barbaric society, divided into two parts—the German or Teutonic half geographically adjoining the Western empire, and the Slavonic or Scythian half adjoining the Eastern empire. The German barbarians were divided into a number of tribes and nations—Goths, Burgundians, Alemanni, Vandals, Longobards, Franks, Angles, Saxons, &c. Farther away were the nomadic Alans. The Slavs, the ancestors of the modern Russians, Poles, and others, had their seats still farther east, and took less share in the events of medieval history. In the destruction which preceded the resurrection of modern European society, it was chiefly the western or Latin half of the Roman empire that was involved, and the destruction was effected by the irruption chiefly of German nations; it is mainly the Germanic peoples who have created the modern nations of Europe. Amongst the Germanic peoples the Goths were most prominent (see Goths). The Gothic tribes were located, at the period when the movement began, in the extensive tract between the Vistula, the Danube, the Black Sea, and the Don, and were divided into Visigoths or Western Goths, and Ostrogoths or Eastern Goths.

The determining cause of the precipitation of the German races on the Latin empire was, it is well known, the sudden invasion of Europe (375 A.D.) by the Turanian or Ugrian nation of the Huns. Their movement was perhaps ultimately due to the gradual desiccation of the plateaus of Central Asia (see Asia). Subduing the Slavonic region of Europe, and establishing there a Hunnish empire, which superseded that of its previous conquerors the Goths, these fearful Asiatic invaders produced a violent agitation among the Germanic peoples, and pressed them westward—Goths, Vandals, Burgundians, Suevi, Alemanni, Franks, Angles, and Saxons, all together. The agitations produced in Europe by the Huns, and by the consequent irruptions of the Germanic nations, sometimes in confederacy, and sometimes singly, into the provinces of the Western empire,

were protracted over a whole century. It will be sufficient here to mention generally that the diocese of Gaul was overrun chiefly by Visigoths, Burgundians, and Franks; Spain, by Vandals, Suevi, and Visigoths; Africa, by Vandals crossing over from Spain; in Italy, successive invasions had left among the feeble native Italians a deposit of Visigoths, Vandals, Huns, &c.; Britain, abandoned by its Roman garrison as early as 410, had become a prey to the Angles and Saxons.

As soon as this intermixture of the two societies —the Roman or civilised, and the Germanic or barbarian—had taken place, they began to act upon each other. Modern society, in short, is the perfected result of the incorporation of Roman with barbaric society; and it derives ingredients from both. From the barbarians were derived the love of personal liberty and the sense of individual independence. From the Romans, on the other hand, were derived the forms of a regular and long-established civilisation. But more efficient still, as a means of acting on the barbarian conquerors, was the great institute of the Christian Church.

In the 6th century the Franks occupied northern France and part of central Germany; the West Goths, France south of the Loire; Burgundians, the valleys of the Rhone and the Saone and various adjoining territories; while the West Goths were dominant over most of Spain, the Suevi holding the rest. The Thuringians were established in Thuringia; the Saxons in the large territory between the Meuse in the west and the Oder in the east; the Danes and other Scandinavians in the region they still hold. The Ostrogoths held southern Europe from the Burgundian borders to the Danube, and the whole of Italy—which, however, in the latter part of the century, was occupied by the Lombards (see ITALY). The Slavonic Czechs were already in Bohemia; and the Bulgarians were between the Dnieper and the Danube.

In the latter part of the 8th century (see the first of the historical maps) the Frankish empire of Charlemagne extended from the Ebro to the Elbe, and from the North Sea to Rome, the Franks having conquered both the Goths of France and the Burgundians. The Frankish empire was repeatedly divided and reunited; but ultimately the two great divisions of Neustria (the kingdom of the West Franks) and Austria (the kingdom of the East Franks—Franconia, and not at all corresponding to what was later known as Austria) became the nuclei of the kingdoms and nations of France and of Germany.

In what is now Hungary were the Avars; while to the east of the northern portion of the Frankish realms was the region of Slavonia, including Bohemians, Poles, and other Slavic peoples. East of them again were that peculiar people the Khazari or Chazars (q.v.), belonging to the Finnic stock. Of the Gothic power in Spain nought was left but the little kingdom of Asturia; the rest formed the Moslem sultanate of Cordova, the Mohammedans having established themselves in Spain in 711. Most of England and part of Scotland was now occupied by the English or Anglo-Saxons. The Eastern empire had greatly shrunk.

In the 12th century (see Map II.) the kingdom of the East Franks had become the representative and successor of the Western empire, and, as the Germanic or Holy Roman empire, extended from the North Sea to the States of the Church, by this time the dominion of the popes. In the empire were the dukedoms or territories of Lotharingia or Lorraine, Francia, Swabia, Bavaria, Thuringia, Bohemia, Austria, and Burgundy (the latter lately an independent kingdom). In South Italy was the Norman kingdom of Sicily. Henry II. of Anjou, king of England, was lord of Normandy, Anjou, Brittany, and Aquitaine or Guyenne; the remainder of France being the kingdom of the successor of the kings of the West Franks. The power of the English kings was more fully established in Guyenne than in Anjou, and Guyenne remained much longer a part of the English dominions in France. England had established her power over the eastern part of Ireland. In Spain the Christian kingdoms of Leon, Castile, and Aragon were growing at the expense of the sultanate of Cordova. Poland and Russia were consolidated states, with heathen Prussians and Lithuanians for their northern neighbours. The Hungarians were in their present dominions; Bulgaria and Servia still limited the decreasing Eastern empire on the north, while the latter was threatened on the east by the dreaded Turks.

At the Reformation in the 16th century Charles V. was not merely emperor in Germany, but king of Spain (whence the Moslems, long confined to Granada, had been driven), Sardinia, Sicily, and Naples, and ruler of the Netherlands and of the county of Burgundy. From the 15th century onwards, the imperial crown remained with the Hapsburgs. Ferdinand I., Archduke of Austria (and, after the abdication of his brother Charles V., emperor), obtained by marriage Silesia, Bohemia, and Hungary (as much of it as was not Turkish). These all became, like the archduchy and connected territories, hereditary domains of the House of Hapsburg; but while Bohemia, like the archduchy, was a fief of the empire, Hungary, with its dependencies, was no part of the empire at all. From the middle of the century till near the end of the 17th, the Hapsburgs held the northwest part of Hungary; while the Turks, who had wiped out the Eastern empire, occupied the rest, a pasha ruling at Buda. Transylvania, Moldavia, and Wallachia were three tributary principalities. Dalmatia long fluctuated between Venice and Hungary. At the peace of Westphalia in 1648 (see Map III.), which closed the Thirty Years' War, the power of the empire was weakened, while that of France had increased, part of Alsace being given to France. By the 15th century France had acquired most of the territory of the old *kingdom* of Burgundy (between the Alps, the Saone, and the Mediterranean). It had absorbed the *duchy* of Burgundy (afterwards the French province of Burgundy or Bourgogne) in 1477; but it was not till 1674 that France seized the *county* of Burgundy (afterwards the French province of Franche Comté), and Strasburg and its territory in 1681. Avignon had become a papal possession in 1348, and did not become French till 1791. The duchy of Savoy was becoming more and more an Italian power. Spain still held the Spanish Netherlands and great part of Italy. The Protestant Netherlands and Switzerland were become independent states. Sweden had acquired territories from Germany, Poland, and Russia, and was one of the great powers. She held not merely Finland, but all the lands around the Gulf of Riga, including Esthonia and most of Livonia. Sweden also held western Pomerania, Wismar, Bremen, and Verden, not as Swedish territory, but as fiefs of the empire; the ancient possessions of Denmark in the northern peninsula were acquired by Sweden in 1658. The duchy of Prussia had become independent of Poland in 1647. Poland, which early in the 16th century had been one of the most powerful states of Europe, holding under its sway a great part of Russia, now lost in power and territory, while Russia steadily grew. Turkey held part of the former dominions of the Eastern empire, the Austrian princes the rest. Venice was the most important native Italian power. Genoa held Corsica till 1768.

Before the outbreak of the French Revolution, Poland had ceased to exist as a state. Prussia had risen to greatness, and Russia had been greatly aggrandised. Sweden had fallen from her temporary hegemony of northern Europe. The Spanish Netherlands had belonged since 1713 to the House of Austria; French Bourbons held those parts of Italy that had been Spanish. The French Revolution began a series of changes in the distribution of power which culminated in the extension of Napoleon's empire over all Germany west of the Rhine, and great parts of northern Germany, the Netherlands, and most of Italy (see Map IV.); a portion being directly incorporated with the empire, another separately held by Napoleon himself as his kingdom of Italy, whilst his brother-in-law was king of Naples and his brother king of Spain. After the fall of the empire, France retired within her old limits; the minor German princes constituted their states in a loose confederation, and of this Austria assumed the presidency. Italy was parcelled out amongst numerous despotic princes, and the Venetian dominions became Austrian. The Netherlands became once more a kingdom, ultimately separated into Holland and Belgium.

The chief changes on the map of Europe since the middle of the 19th century have been the consolidation of Germany as an empire, under the headship of Prussia, and the restitution to it of Alsace-Lorraine; the retirement of Austria out of Germany, and her reorganisation as the Austro-Hungarian monarchy; the unification of Italy as a kingdom; and the gradual diminution of Turkish territory by the recognition of the independence of Roumania, Servia, and Montenegro, and of the autonomy of Bulgaria.

As has been already said, the continuous history of the developments sketched or hinted at here must be sought in the articles on the various countries named; see, too, the *Historical Geography of Europe*, by E. A. Freeman (2 vols. 1881), his *General Sketch of European History* (2d ed. 1876), *Primer of History of Europe* (1876), and *Chief Points of European History* (1886); T. H. Dyer, *History of Modern Europe, 1453–1871* (2d ed. 5 vols. 1877); C. A. Fyffe, *A History of Modern Europe, 1792–1878* (3 vols. 1884–90); Lodge, *Modern Europe* (1886); and the works of Gibbon and Hallam. For Geography and Statistics, see the relevant parts of Klöden and Reclus; 'Europe,' in Stanford's *Compendium of Geography* (1886); J. Geikie's *Prehistoric Europe* (1880); the annual *Almanach de Gotha* and *Statesman's Yearbook*; and the works cited in the articles on the several countries in this work.

Eurotas (mod. *Iri* or *Vasilo*), the chief river of Laconia in Greece, rises in Arcadia, and flows through the valley between the ranges of Taÿgetus and Parnon, passing Sparta on the right, into the Laconian Gulf.

Eury'alē, a genus of Water-lilies (Nymphæaceæ), closely allied to Victoria (q.v.), but with small flowers. The seeds and root-stock of *E. ferox* are eaten, and the plant has been cultivated in China from very early times.

Eurydice. See ORPHEUS.

Eurystheus. See HERCULES.

Eusebius of Cæsarea, the father of ecclesiastical history, was born probably in Palestine about 264 A.D. He took the surname of Pamphili from his friend Pamphilus, Bishop of Cæsarea, whom he faithfully attended for the two years (307–309) in which he suffered imprisonment during the persecution of Diocletian. He then went to Tyre, and afterwards to Egypt, where he was himself thrown into prison on account of his religion. He became Bishop of Cæsarea about 313, took a prominent part at the Council of Nice, and died in 340. Eusebius was the head of the semi-Arian or moderate party in the Council of Nice. That party was averse to discussing the nature of the Trinity, and would have preferred the language of Scripture to that of theology in speaking about the Godhead. Eusebius held that the promise of everlasting life was to him that *believeth on the only-begotten Son*, not to him that *knows how He is begotten of the Father*. He was very reluctant to accept the term *homoousios*, devised by Athanasius to describe the equality of the Son with the Father, and retained the kindliest feelings towards Arius after the views of the latter were condemned (see ARIUS). His moderation and other excellent qualities procured him the favour of Constantine, who declared that he was fit to be the bishop of almost the whole world. Eusebius has the reputation of being the most learned Father of the Church, after Origen and Jerome. His *Chronicon*, a history of the world down to 328 A.D., is valuable as containing extracts from many ancient writers whose works are no longer extant. His *Præparatio Evangelica*, a collection of such statements in old heathen authors as were fitted to make the mind regard the evidences of Christianity in a favourable light, also contains specimens of writings that no longer exist; its complement is the *Demonstratio Evangelica*, in twenty books, ten of which are extant, intended to convince the Jews of the truth of Christianity from the evidence of their own Scriptures. His most important work, however, is the *Ecclesiastical History*, in ten books. This relates the principal occurrences which took place in the Christian church till the year 324, and contains the results of his studies in numerous libraries, and even in the imperial archives, the Emperor Constantine having ordered, at Eusebius' request, an examination of all documents relative to the history of martyrs. One drawback of the work is that Eusebius, on principle, withholds all account of the wickedness and dissensions of Christians, inasmuch as he did not consider such stories for the edification of the church (see CHURCH HISTORY). Besides the foregoing works may be mentioned his *De Martyribus Palestinæ*, the treatises against Hierocles and Marcellus, the *Theophania* (discovered in 1839), and a panegyrical Life of Constantine. The first edition of all Eusebius' works appeared at Basel in 1542; the last was commenced by Dindorf (Leip. 4 vols. 1867–71; unfinished).

Eusebius of Emesa was born at Edessa, and studied under Eusebius of Cæsarea, and at Alexandria and Antioch. Averse to all theological controversies, he declined the bishopric of Alexandria, vacant by the deposition of Athanasius. He was afterwards, however, appointed Bishop of Emesa, in Syria, but was twice driven away by his flock, who accused him of sorcery on account of his astronomical studies. He died at Antioch in 360. The homilies extant under his name are probably spurious.

Eusebius of Nicomedia, Patriarch of Constantinople, related to the Emperor Julian by the mother's side, was appointed Bishop of Beryta (Beyrout) in Syria, and afterwards of Nicomedia. He appeared as the defender of Arius at the Council of Nice, and afterwards placed himself at the head of the Arian party. He baptised the Emperor Constantine in 337, became Patriarch of Constantinople in 339, and died in 342. His enemies are our only sources of information as regards his character and opinions; yet, making the ordinary allowance for partisanship, there would seem to be sufficient reason for concluding that Eusebius was cunning and double-tongued when occasion required, and imperious and violent when he had power in his hands. Athanasius considered him not the disciple, but rather the teacher of Arius. See ARIUS.

Euskara, Euskarism. See BASQUES.

Eustachio, BARTOLOMMEO, an Italian anatomist, who was physician-in-ordinary to the popes, and professor of Medicine in Rome, where he died in 1574. His name is indissolubly associated with anatomical science through his discoveries of the tube in the auditory apparatus (see EAR) and the rudimentary valve at the entrance of the inferior vena cava in the Heart (q.v.), which are called after him. These and other discoveries are recorded in his *Opuscula Anatomica* (Venice, 1564); his *Tabulæ Anatomicæ* were first edited by Lancisi in 1714.

Eustathius, a celebrated Greek commentator on Homer and the geographer Dionysius, was born at Constantinople. He was at first a monk, then a deacon and teacher of rhetoric in his native city; he was Archbishop of Thessalonica from 1160, and of Myra from 1174, and died at an advanced age some time posterior to 1185. Eustathius was profoundly versed in the ancient classic authors, and a man of prodigious acquirements; and the value of his quotations is heightened by the consideration that most of the works from which he extracts are no longer extant. His most important work is his commentary on Homer (1st ed. Rome, 1542–50), a rich mine of knowledge. Of a similar character is his commentary on Dionysius, first printed by Robert Stephens (Paris, 1547). Of his commentary on Pindar, only the *Proœmium* has come down to us (ed. by Schneidewin, Göttingen, 1837); a part of his theological and historical treatises, letters, &c. was published by Tafel in 1832.

Eutaw Springs, a small affluent of the Santee River, in South Carolina, near which the last serious battle in the American war of independence was fought, 8th September 1781. The Americans, under Greene, were repulsed after a desperate engagement; but the British, who had lost seven hundred men, were too much weakened to follow up their victory.

Euter'pe (i.e. 'she who delights'), one of the nine Muses (q.v.), the daughter of Zeus and Mnemosyne. She was the muse of lyric poetry, and is represented in ancient works of art with a flute in her hand.

Euterpe, a genus of Palms (q.v.). *E. oleracea*, the Palmeto or Cabbage-palm, is cultivated in Brazil (Para, &c.), both for its cabbage (the stem then serving for palisades), and for the sake of its fruit, which yields the basis of a refreshing drink. It is common in Central America.

Euthana'sia (Gr.), an easy death, or a painless method of putting to death. The use of narcotics or other means for shortening life in disease has never become a subject of discussion in modern civilised countries, but it is often a very practical question how far such means are admissible for soothing the last hours of life, when the approach of death does not itself dull the consciousness and the sensibility to pain. It must be decided according to all the surrounding circumstances, medical and otherwise, in each individual case. As to the medical treatment to be employed for diminishing the sufferings of the dying, see Munk's *Euthanasia* (1887).

Eutropius, a Latin historian, concerning whom we only know that he filled the office of secretary to the Emperor Constantine, fought against the Persians under Julian, and died probably about 370 A.D. His *Breviarum Historiæ Romanæ*, giving a short narrative of Roman history from the foundation of the city to the time of the Emperor Valens (364 A.D.), is written in an extremely simple style, and appears to have been originally intended for the use of schools. It became very popular as the taste for original investigation declined, and is either copied or followed by the early monkish annalists; it was twice translated into Greek, and was continued by others down to the 9th century. The History existed in three distinct forms at the revival of letters: the genuine work of Eutropius in ten books; the expanded editions of Paulus Diaconus and others; and a complete but largely interpolated copy contained in the *Historia Miscella* (edited by Eyssenhardt, Berlin, 1869). The *editio princeps*, printed at Rome in 1471, was from the impure text of Paul. The best modern editions are those of Tzschucke (Leip. 1796), of Grosse (Halle, 1813), and of Droysen (Berlin, 1879).

Eutyches, an archimandrite at Constantinople, from whom the Eutychian controversy took its name. His christological views were an exaggeration of those of Cyril of Alexandria. He held that after the incarnation of Christ everything human in him had become merged in his divine essence, and that Christ therefore had but *one nature*. His personal enemies Domnus of Antioch and Eusebius of Dorylæum denounced him to Flavian, Archbishop of Constantinople, and at a synod held there in 448 A.D. he was condemned as a Valentinian and Apollinarian heretic. An œcumenical council was, through the influence at court of Dioscurus, Cyril's successor at Alexandria, called to Ephesus for a renewed investigation of the matter in dispute. Leo, Bishop of Rome, at the critical moment reversed the policy of the Roman see (his predecessor Celestine had favoured Cyril), and wrote to Flavian his famous epistle, in which he set forth authoritatively the doctrine of the two natures and one person. The council met at Ephesus in August 449, under the presidency of Dioscurus, and, under fear of the fists of his fanatical monks, decided everything exactly as he wished. Eutyches was restored, and Flavian, Eusebius of Dorylæum, Theodoret, and Domnus of Antioch were deposed. On the death of Theodosius II. the government passed into the hands of his sister Pulcheria and her husband Marcian (28th July 450). The fourth œcumenical council met at Chalcedon (q.v.), 8th October 451, and, though the greater number of the five or six hundred bishops shared the views of Dioscurus, the imperial authority insured the acceptance of the formula of Leo, and the resolutions passed in 449 by the 'Robber Council' (*latrocinium Ephesinum*)—the name given it by Leo—were annulled, as having been extorted by fear. Eutyches, who had previously been a second time excommunicated by Anatolius, Patriarch of Constantinople, was removed from the neighbourhood of the capital by Marcian before the meeting of the council. Afterwards, on the advice of Leo, he was transported to some remote place, but his subsequent history is unknown. The Eutychian sect was from 452 put down by penal laws.

For the later history of the opponents of the decrees of Chalcedon, see GREEK CHURCH. See also Mansi, *Concilia*, vols. v. vi. vii.; Hefele's *Conciliengeschicht* (2d ed. 1873 *et seq.*); Martin, *Le Pseudo-Synode* (1875); Perry, *The Second Synod of Ephesus* (1881); Amelia, *S. Leone e l'Oriente* (Rome, 1882); Krüger, *Monophysitische Streitigkeiten* (1884); Harnack, *Dogmengeschicht*, vol. ii. (1888).

Euxine. See BLACK SEA.

Evagrius, surnamed SCHOLASTICUS, a church historian, was born at Epiphania in Syria in 536. An advocate by profession, he filled more than one administrative office under the Roman emperors. His *Ecclesiastical History*, covering the period from 431 to 594, forms a continuation of that of Eusebius. Although marred by the credulity of its age, it is on the whole fairly trustworthy. The best edition is that by Reading (Camb. 1720).

Evander, son of Hermes by an Arcadian nymph, called in Roman traditions Carmenta or Tiburtis. About sixty years before the Trojan war he is said to have led a Pelasgian colony from Pallantium, in Arcadia, to Italy, and to have landed on the banks of the Tiber, and near the foot of the Palatine Hill. Here he built a town, naming it Pallantium after the one in Arcadia. At a later period it was incorporated with Rome, and is falsely affirmed to have originated the names Palatinus and Palatium. He did much to introduce the habits of social life among his neighbours; he prescribed for them milder laws, and taught them, among other arts, those of music and writing. To him is also ascribed the introduction of the worship of the Lycæan Pan, with that of Demeter, Poseidon, and other deities. Virgil represents him as being still alive when Æneas arrived in Latium after the sack of Troy, and as having sent him aid under his son Pallas, who fell by the hand of Turnus. Evander was worshipped both at Pallantium, in Arcadia, and at Rome.

Evangelical (lit., 'according to the gospel,' Gr. *euangelion*), a designation originally claimed by all Protestants, on the ground that their tenets were derived solely from the Evangel (in the widest sense)—i.e. the Bible, but in later times more particularly attached to the school that insists especially on the total depravity of unregenerate human nature, the necessity of conversion, the justification of the sinner by faith alone, the free offer of the gospel to all, and the plenary inspiration and exclusive authority of the Bible—views largely held by the Presbyterians of Scotland, the Nonconformists in England, and the corresponding churches in America and the British colonies. The adherents of this view within the Anglican communion are commonly called the 'Low Church.' In Germany, it is the special designation of the United church, as distinguished from the old Lutheran and Reformed churches, but the title has recently been assumed by the pietistic party within the Protestant churches, on the ground of their superior orthodoxy and absolute faith in Scripture. See CHURCH HISTORY, and ENGLAND (CHURCH OF).

Evangelical Alliance, an association of evangelical Christians belonging to various churches and countries, which, in the words of the circular issued by members of different churches in Scotland, 5th August 1845, and originating the movement for its formation, seeks 'to associate and concentrate the strength of an enlightened Protestantism against the encroachments of Popery and Puseyism, and to promote the interests of a scriptural Christianity.' At a meeting held at Liverpool, October 1–3 of that year, the scope of the association was extended to the means to be used for counteracting religious indifference. In 1846 (19th August–2d September) the first general conference was held in London under the presidency of Sir Culling Eardley, and was attended by 921 members from all parts of the world, representing as many as fifty different denominations. The association was instituted a free union, not of churches or sects, but of individual Christians, and the membership was confined to those holding 'the views commonly called evangelical' on the following nine points of doctrine—(1) the divine inspiration, authority, and sufficiency of Holy Scripture; (2) the right and duty of individual believers to exercise their judgment in the interpretation of Scripture; (3) one God and three Persons in the same; (4) human nature utterly corrupted by the fall; (5) the Son of God made man, His work of reconciliation for men's sins, and His mediatorial intercession and reign; (6) the justification of the sinner by faith alone; (7) the work of the Holy Spirit in the sinner's conversion and sanctification; (8) the immortality of the soul, the resurrection of the body, the judgment of the human race by Jesus Christ, together with the eternal felicity of the righteous and punishment of the wicked; (9) the divine institution of the Christian ministry, and the obligatory and perpetual ordinance of baptism and the Lord's Supper. General conferences of the association have since been held at London (1851), Paris (1855), Berlin (1857), Geneva (1861), Amsterdam (1867), New York (1873), Basel (1879), and Copenhagen (1885). The Evangelical Alliance has done much to cultivate a spirit of unity among Protestants by the diffusion of exact knowledge of the condition and circumstances of their different churches, and has raised its voice effectively against slavery, profanity, and persecution. Its organ, *Evangelical Christendom, its State and Prospects*, is published in London monthly.

See the Reports of the Proceedings of the different conferences, especially of the preliminary meetings at Liverpool, October 1845 (Lond. 1845), and of the Constitutional Assembly in 1846 (508 pp. Lond. 1847); Massie, *The Evangelical Alliance, its Origin and Development* (Lond. 1847); and L. Bonnet, *L'Unité de l'Esprit par le Lien de la Paix: Lettres sur l'Alliance évangélique* (Paris, 1847).

Evangelical Association, a sect closely akin to the Methodists both in government and doctrine, founded by Jacob Albrecht or Albright, who was born in the state of Pennsylvania, 1st May 1759. Originally a Lutheran, he travelled through several states as an evangelist, and in 1800 organised his adherents in 'classes' after the Methodist manner. In 1807 he was appointed bishop, and down to his death, 18th May 1808, he was the leader of the sect, which in 1818 assumed the name Evangelical Association of North America. Since 1843 it has drawn many adherents from the English-speaking population. In 1887 its membership in the United States amounted to 132,508 (besides upwards of 6000 in Germany), with 1808 churches and 1069 itinerant and other preachers. The association publishes religious periodicals in large numbers. See Plitt, *Die Albrechtsleute* (Erlangen, 1877).

Evangelical Union, the name assumed by a religious body constituted in Scotland in 1843 by the Rev. James Morison of Kilmarnock (afterwards Dr Morison of Glasgow) and other three ministers, along with the congregations adhering to them. They had been separated from the United Secession Church on account of their doctrinal views, and were soon increased by a number of ministers and churches expelled from the Congregational Union of Scotland for holding similar doctrines. Their ecclesiastical system is a modified independency, ministers and representative delegates from the churches forming an annual conference, which has control over all denominational funds, as well as over home-mission work and the theological hall. Individual churches have different forms of internal government, some modelled on Presbyterianism, others on Independent usage. In 1889 there were 93 churches, and there are usually about 20 students attending the hall.

The doctrine of this body is expressed in a *Doctrinal Declaration*, issued in 1858 as an explanation of their faith, but not forming a fixed creed. They are Trinitarians, holding the divinity and substitutionary work of Christ, and the personality of the Holy Spirit. They also hold the Protestant doctrine of justification by faith, and in much their teaching corresponds to that of the Wesleyans. The distinctive elements in their creed, which led to the expulsion of their leaders from the bodies to which they belonged, are, in the words of their

'Basis of Union,' the 'love of God the Father in the gift and sacrifice of Jesus to all men everywhere, without distinction, exception, or respect of persons; of God the Son, in the gift and sacrifice of himself as a true propitiation for the sins of the world; and of God the Holy Spirit in his present and continuous work of applying to the souls of all men the provisions of divine grace.'

Believing in the freedom of the human will, they hold election to salvation to be conditional. The whole movement in which the body originated was a reaction from the Calvinistic doctrine of the Westminster Confession, in so far as that relates to predestination and to unconditional election and reprobation. They have been much identified with temperance reform, all their ministers requiring to be total abstainers from intoxicating drinks. Their doctrines have also been known (from Dr Morison's name) as the Morisonian heresy, or as Morisonianism. Their views have been much misrepresented, and for a full statement of these the reader is referred to the *Doctrinal Declaration* of the Union, and to the 'Basis of Union,' published yearly in the *Evangelical Union Annual*. See also the *History of the Evangelical Union*, by Dr Fergus Ferguson (1876).

Evangelist (Gr., 'a bringer of good tidings') denotes in the New Testament a preacher of the gospel. In Ephesians, iv. 11, 'evangelists' are distinguished on the one hand from the apostles and prophets, and on the other from the pastors and teachers, and hold a rank between both. They were not, like the latter, attached to individual congregations, but preached as *missionaries*, without having the authority of the apostles chosen as witnesses from the beginning by Jesus himself, or of the prophets, who testified from special inspiration. Philip and Timothy were such evangelists.—The term evangelist is also applied to the authors of the gospels (Gr. *euangelion*).

Evans, Sir De Lacy, general, was born in Ireland in 1787, and, entering the army at twenty, saw three years' service in India and three in the Peninsula. In 1814 he was present at the capture of Washington, the attack on Baltimore, and the operations before New Orleans; in 1815 at Waterloo. An advanced Liberal, he sat for Rye in 1831–32, and for Westminster in 1833–65, with the exception of 1841–46. During 1835–37 he commanded the 'Spanish Legion,' 10,000 strong, for the young Queen Isabella against the Carlists, Evans' chief military exploits being the storm and capture of the Carlist lines of Ayetta, near St Sebastian, the storm and capture of Irun, and the capture of Oyarzun and Fontarabia. In 1854, on the declaration of war against Russia, he was appointed to command the second division of the army sent out to the Crimea, with the rank of lieutenant-general. His division was hotly engaged in the battle of the Alma, and Evans received a severe contusion of the shoulder. On 26th October, during the siege of Sebastopol, his division was attacked by a force of 6000 Russians. Evans met the enemy with great gallantry, and drove them back into the town. Invalided home in February 1855, he received the thanks of the House of Commons, and was created a G.C.B. He died 9th January 1870.

Evans, Marian. See Eliot, George.

Evans, Oliver, an American inventor, born in Newport, Delaware, in 1755, made several notable improvements in flouring-mills, and is said to have invented the first steam-engine constructed on the high-pressure principle, the drawings and specifications of which he had sent to England in 1787 and 1795. In 1804 he completed a steam-dredging machine, which propelled itself on wheels to the river Schuylkill, a distance of a mile and a half, and thus is considered the first land-carriage worked by steam in America. Evans also projected a railway between New York and Philadelphia, which his narrow means never allowed him to realise. He died in New York, 21st April, 1819.

Evanston, a post-village of Illinois on Lake Michigan, 12 miles N. of Chicago by rail. It has 22 churches, 2 newspaper offices, the Garrett Biblical Institute, a ladies' college, and the Northwestern University (Methodist). Pop. 5000.

Evansville, a port of entry and capital of Vanderburg county, Indiana, on the Ohio, 162 miles ESE. of St Louis by rail, with some fifty churches, a city hall, a court-house, a handsome post-office and custom-house, and a public library and art gallery. Coal and iron ore abound near by, and the town has a large number of mills, foundries, &c., besides a very considerable trade in tobacco, flour, and other staples. Pop. (1870) 21,830; (1880) 29,280; (1890) 50,756.

Evaporation, or Vaporisation, is the process by which a substance changes into the state of vapour. Some solids visibly evaporate—e.g. solid ice or snow gradually disappears though the temperature may be considerably below the freezing-point. The characteristic smell of certain metals, such as copper or iron, is supposed to be due to slow evaporation (see Sublimation). The change of a liquid into the state of vapour may go on at all temperatures; but the rate of change is greater the higher the temperature is, until at last boiling—i.e. free evaporation—occurs (see Boiling). Slow vaporisation at temperatures below the ordinary boiling-point is used on a large scale for commercial purposes, when it is wished to crystallise out a substance which is held in solution. The rate of evaporation depends upon the amount of surface exposed. It depends, too, upon the pressure under which the vapour is developed, and thus evaporation goes on quickly if the vapour is removed as rapidly as it is formed, as is the case when wind blows over the surface of water or snow. The temperature at which boiling occurs also depends upon the pressure. This may readily be shown by boiling water in a glass flask until the steam has driven out most of the air. If the flask be now corked, and the source of heat be withdrawn, the boiling will cease. But if cold water be poured on the flask the boiling will recommence at once. This is due to the fact that the lowering of temperature causes condensation of some of the steam, and this lowers the vapour-pressure so far as to allow of free evaporation at the reduced temperature. At any given temperature evaporation ceases when a certain pressure of the vapour is arrived at, or, more correctly, a state of equilibrium is reached in which condensation balances evaporation. Condensation occurs at all pressures; but, if the proper pressure corresponding to the temperature is not reached, evaporation exceeds condensation; while, if the vapour-pressure is too great, condensation exceeds evaporation. The presence of another gas or vapour, such as ordinary air, has no effect upon the final value of the pressure which is attained; but the time taken to reach this final pressure does depend very greatly upon the presence of another gas. The time becomes greater as the amount of gas present increases. This state of equilibrium is disturbed at once by any variation of vapour-pressure or of temperature. A vapour is said to be *saturated* when it is in equilibrium in contact with its liquid.

A considerable amount of heat is absorbed in the process of evaporation. The amount depends upon the nature of the liquid, and also upon the temperature of evaporation. Regnault gives for 'total heat' of steam the formula $606{\cdot}5 + 0{\cdot}305t$, in

which t represents the temperature in degrees Centigrade. This means that a pound of saturated water-vapour at 0° C. gives out 606·5 units of heat when it condenses to water at 0° C., while a pound at 100° C. would give out 606·5 + 30·5—i.e. 637 units in changing to water at 0° C. The heat given out by a pound of saturated steam at any temperature when it condenses to water at the same temperature is called the *latent heat* of the steam at that temperature. The term is not a good one. It has reference to the fact that the heat which is required to evaporate a substance without change of temperature disappears so far as ordinary thermometric methods of determining its presence are concerned. If we take into account the variation of the specific heat of steam with temperature, Regnault's measurements of the total heat show that at 0° C. the latent heat is 606·5 units, at 100° C. it is 536·5 units, and at 200° C. it is 464·3 units. It thus decreases very rapidly with rise of temperature. It vanishes at the Critical Temperature (q.v.). The following is the latent heat of vaporisation of a few liquids at a pressure of one atmosphere: water, 536·0; alcohol, 202·4; ether, 90·5; bromine, 45·6. It is evident from these figures that the latent heat of vaporisation of water is relatively large. Were it not for this fact we might have rapid condensation of moisture in the atmosphere in consequence of a very small fall of temperature, and in this way destructive floods might be caused.

Practical use is frequently made of the latent heat of evaporation. Thus, in order to keep water cool it should be stored in vessels of porous earthenware. Some of the water passes through the pores, and evaporates at the outer surface. The latent heat necessary for this is drawn largely from the rest of the water, which is thus kept cool. It is even possible, as was first done by Sir John Leslie, to freeze water by this process. He put some water contained in a shallow earthenware vessel inside the receiver of an air-pump along with a dish of strong sulphuric acid. When the air was exhausted, rapid evaporation resulted; but the vapour was absorbed by the acid as quickly as it was formed, and thus the evaporation was kept up continuously, so that the remaining water was rapidly cooled down to the freezing-point.

The same principle is used in the formation of solid carbonic acid. A jet of liquid acid is allowed to escape from a strong vessel containing it. The outer parts of the jet evaporate, and in consequence the inner parts are solidified. Faraday actually froze mercury in a white-hot vessel by placing it in a little capsule which rested upon a mixture of solid carbonic acid and ether in the spheroidal state.

Evarts, WILLIAM MAXWELL, American lawyer and statesman, was born in Boston, 6th February 1818, graduated at Yale, and was admitted in 1841 to the New York bar, where he afterwards built up a notable practice, receiving in some cases $25,000 or $50,000 for an opinion. He was chief counsel for President Johnson in the impeachment trial in 1868, and filled the office of United States attorney-general to the end of Johnson's administration. He was United States counsel before the Alabama tribunal in 1872, and senior counsel for Henry Ward Beecher in 1875. In 1877–81 he was secretary of state, and he was elected to the United States senate for the term 1885–91.

Eve. See ADAM AND EVE.

Evection, a lunar inequality resulting from the combined effect of the irregularity of the motion of the perigee, and alternate increase and decrease of the eccentricity of the moon's orbit. See MOON.

Evelyn, JOHN, was born of wealthy parentage at Wotton, near Dorking, in Surrey, 31st October 1620. He was brought up by his maternal grandmother at Lewes (1625–37), then entered Balliol College, Oxford, having already been admitted at the Middle Temple, where, without a degree, he took up residence in 1640—the year of his father's death. Having witnessed Strafford's trial and execution, he resolved to absent himself 'from this ill face of things at home,' and so travelled for three months in Holland and Flanders. Back in London, 'studying a little, but dauncing and fooling more,' in November 1642 he joined the king's army, only to leave it in three days' time, lest both himself and his brothers should be 'expos'd to ruine, without any advantage to his majestie;' and the Covenant being pressed on him, he travelled for four years in France, Italy, and Switzerland. At Paris in 1647 he married the ambassador's daughter, Mary Browne (1635–1709); and, returning for good to England in 1652, settled at Sayes Court, Deptford, the home he did so much to beautify. A thorough, if prudent royalist, he was much at court after the Restoration; acted on several public committees; during 1685–87 was one of the commissioners of the privy seal, during 1695–1703 treasurer of Greenwich Hospital; and from the first was a prominent member of the Royal Society. In 1694 he removed to his brother's at Wotton, and let Sayes Court to Admiral Benbow, who sublet it to Peter the Great (a 'right nasty' inmate). In 1699 he succeeded his brother; and, vigorous in intellect to the very last, he died at Wotton, 27th February 1706.

'Almost perfect' is Mr Wheatley's estimate of Evelyn, who was indeed a right worthy gentleman, as active and intelligent as he was honest and God-fearing, yet neither a Sage nor a Hero. His pen was a busy one, and dealt with a multitude of subjects—'architecture, painting, engraving, numismatics, history, politics, morals, education, agriculture, gardening, and commerce.' Of all his thirty-five works the chief are *Sculptura, or the History and Art of Chalcography and Engraving on Copper* (1662); *Sylva, or a Discourse of Forest-trees* (1664); and his delightful *Diary* (first published in 1818). It is to the last that Evelyn owes his present celebrity. Written by one who had accustomed himself to habits of close observation, it covers a period of more than seventy years—and these the most memorable in English history. It is, indeed, of inestimable value; Scott said that he had 'never seen a mine so rich.' See the Life by Henry B. Wheatley, prefixed to the sixth edition of the *Diary* (4 vols. 1879).

Evening Primrose. See ŒNOTHERA.

Everest, MOUNT, a peak of the Himalayas, in Nepal, and the highest ascertained point on the surface of the globe, rises to a height of 29,002 feet above the sea, in 27° 59′ 12″ N. lat., and 86° 58′ 6″ E. long. It was named in honour of Sir George Everest (1790–1866), surveyor-general of India, who completed in 1841 the great trigonometrical survey, and, having retired in 1843, published in 1847 his principal work, *An Account of the Measurement of two Sections of the Meridional Arc of India.* Everest was elected a Fellow of the Royal and other scientific societies, and was knighted in 1861.

Everett, ALEXANDER HILL, an American diplomatist and author, was born at Boston, Massachusetts, 19th March 1792, and in 1806, although the youngest of his class, graduated at Harvard with the highest honours. He was appointed minister at the Hague in 1818, at Madrid in 1825. Four years afterwards he returned to the United States, where he became proprietor and editor of the *North American Review* (1830–35), and also occupied a seat in the legislature of Massa-

chusetts. In the winter of 1840 he resided, as a confidential agent of the United States government, in the island of Cuba. Appointed commissioner to China in 1845, he died in Macao, June 28, 1847. Besides a volume of poems and several works on political subjects, he published two series of *Critical and Miscellaneous Essays* (Boston, 1845–47), probably the most interesting productions of his pen.—His younger brother, EDWARD EVERETT, was born at Dorchester, Massachusetts, 11th April 1794, and graduated at Harvard in 1811. At the age of nineteen he had already gained a high reputation as a Unitarian preacher in Boston. In 1815 he was elected professor of Greek in Harvard College; and to qualify himself more thoroughly for his work he visited Europe, where he resided for four years, and had a distinguished circle of acquaintance. Victor Cousin pronounced him 'one of the best Grecians he ever knew.' In 1820 Everett became editor of the *North American Review*, and in 1824 a member of the United States congress, sitting in the House of Representatives for ten years. In 1835–38 he was four times elected governor of Massachusetts; and in 1841–45 he was minister plenipotentiary at the court of St James. While in England he received the degree of D.C.L. from Oxford, and of LL.D. from Cambridge and Dublin. On his return to America he was elected president of Harvard College; on the decease of Daniel Webster he became secretary of state; and in 1853 he was returned to the United States senate. In 1860 he was nominated by the Constitutional Union party for the vice-presidency of the United States, receiving 39 electoral votes out of 303. He died 15th January 1865. Everett's principal works are *A Defence of Christianity* (1814); several fine poems; and his eloquent *Orations and Speeches* (4 vols. 1836–59), covering a wide range of subjects, and indicating a varied, vigorous, and flexible genius. His Memoir of Daniel Webster is prefixed to the collective edition of his friend's works (6 vols. Boston, 1852).

Everglades, a large shallow lake or marsh in southern Florida, inclosing thousands of islets, which are covered with dense thickets, and containing great numbers of alligators. From this district Florida is sometimes called the Everglade State.

Evergreens are those trees and shrubs of which the leaves do not fall off in autumn, but retain their freshness and verdure throughout the winter, and which may perform their functions during more than one year. Evergreen leaves are generally of thicker and firmer texture than the

A, Ardisia; B, Holly (*Ilex*); C, Skimmia.

leaves of deciduous trees and shrubs. The habit most common among the larger-leaved forms is indicated in the figure—these three distinct and unrelated evergreens, Ardisia (*Primulaceæ*), Holly (*Aquifoliaceæ*), and Skimmia (*Rutaceæ*), having not only the same type of leaf, but very similar small white flowers with red berries. Evergreen leaves are sometimes very small, as in firs and heaths; sometimes pretty large, as in rhododendrons, laurels, magnolias, &c. Evergreens, both trees and shrubs, have always been much sought after by the landscape gardener, and for purposes of ornament and shelter. Some genera of plants consist exclusively, or nearly so, of evergreens, whilst in others they exist only as exceptional species. Most of the Coniferæ are evergreens; and the sombre green of pines, firs, cypresses, &c. is a prevalent characteristic of northern scenery both in summer and winter; whilst the undiminished thickness of the foliage affords winter shelter to animals which could not so well exist in forests composed merely of deciduous trees. Holly and ivy are amongst the finest British evergreens; the box, privet, and different kinds of bay and laurel, rhododendron, phillyrea, myrtle, &c. are also familiar to every one. As instances of genera in which some species are evergreen and others deciduous may be mentioned Barberry and Cytisus. Great numbers have been added to the lists of evergreen trees and shrubs available for ornamenting British gardens and pleasure-grounds by the opening up of China and Japan within the last thirty years. No European country has a greater wealth of evergreen trees and shrubs at its command than Britain, the climate of which, chiefly owing to absence of extremes of cold and drought, meets the requirements of plants from the countries already named, and also in many cases those from New Zealand and the Cape of Good Hope. Evergreens in the United States include, besides many species of the smaller conifers, the Redwood and *Sequoia gigantea* of California.

Everlasting Flower, the popular name of certain plants, the flowers of which suffer little change of appearance in drying, and may be kept for years without much diminution of beauty. They are plants chiefly of the order Compositæ, having their flowers (heads of flowers) surrounded with an involucre, the scales of which resemble the petals of a corolla, but are rigid, membranous, and contain little moisture. Some species of Cudweed (q.v.) (Gnaphalium) are often called everlasting flowers, and the other plants which bear the name belong to nearly allied genera, but particularly to Helichrysum, Rhodanthe, and Acroclinium, which are mostly annuals and natives of Africa and Australia. *Helichrysum arenarium* is frequent on dry, sandy soils in many parts of Europe and the central latitudes of Asia. It is covered with a gray felted down, and has yellow flowers, which, when rubbed, emit a faint aromatic odour. It is often worn on the continent of Europe as an ornament in the hat, particularly by wagoners. *H. angustifolium* and *H. Stœchas* — shrubby species, natives of the south of Europe—have larger yellow flowers. Some of the species have a powerful and pleasant aromatic odour. Several kinds of everlasting flowers are frequently to be seen in our gardens; others, such as Phœnocoma and Aphlexis, natives of the Cape of Good Hope, are of shrubby habit, and choice and beautiful greenhouse plants. As an instance of everlasting flowers in other orders than Composite

Everlasting Flower (*Helichrysum bracteatum*).

may be mentioned the genus Statice; the coloured calyx in nearly all the numerous species of which it is composed is dry, membranous, and very persistent. The French call everlastings *Immortelles*, and often weave them into circular wreaths, which are placed beside recent graves, as emblems of immortality or of loving memory. A very extensive trade is now carried on by France, Germany, and Italy in growing and preserving everlasting flowers for exporting to Britain and America.

Eversley, a village of NE. Hampshire, 13 miles NE. of Basingstoke. Charles Kingsley was rector of the parish from 1842 till his death here on 23d January 1875, and he lies buried in the churchyard.

Evesham, a municipal borough of Worcestershire, on the right bank of the navigable Avon, 15 miles SE. of Worcester. It lies in a beautiful and fertile vale, and the chief industry is market-gardening. There are a fine modern bridge, public gardens, water-works (1884), a 16th-century guild-hall, &c.; but the stately Benedictine abbey (709) is represented chiefly by a beautiful Perpendicular belfry (1533). Till 1867 Evesham returned two members to parliament, till 1885 one. Simon de Montfort was defeated here, 4th August 1265. Pop. (1851) 4605; (1881) 5112; (1891) 5836. See May's *History of Evesham* (1845).

Eviction, in Law, means the dispossession of one person by another having a better title of property in land. In Scotland, the term is applied also to dispossession of movables, although in England and the United States it is restricted to lands and tenements. As popularly employed, eviction generally means the forcible expulsion of a tenant from lands and houses. The technical terms for this process are Ejectment in England, and Removing in Scotland (see EJECTMENT). The law of Ireland as regards evictions is in a different position from that of the rest of Great Britain, from the favour shown to tenants by the recent Irish Land Acts. A tenant's interest in the land can be attached by creditors other than his landlord, and the tenant be evicted for failure to pay his debts, or by foreclosure of mortgage; but the great majority of cases are cases of eviction by the landlord. This eviction proceeds upon the tenant's failure to perform some part of his contract of lease—in general, the agreement to pay rent at stated periods, or the obligation to remove voluntarily when the lease has expired. Under the recent statutes, no tenant in Ireland can be evicted for non-payment of rent unless he owes at least a year's rent. Where proceedings are taken with a view to have a tenant evicted from a holding for which a judicial rent has not been fixed, the tenant may apply to the court to fix a fair rent. If a tenant has been decided by the court to be entitled to compensation for improvements, he cannot be compelled by process of law to quit his holding until the amount due to him as compensation has been made good. After a landlord has obtained his judgment, six weeks must pass before he proceeds any further, in which time the tenant may pay the amount due, and thus stay the eviction. Before the passing of the Land Act of 1887, the eviction then took place if the tenant had failed to settle; and the evicted tenant had a right to redeem for six months, and during this time the landlord was liable to him for the crops on the land. It became a widely prevailing custom for landlords, in these circumstances, to reinstate the tenant immediately after his eviction, as caretaker of the holding. After the period of redemption had run out, this caretaker might again refuse possession of the land, and be again physically removed. If he paid the amount due to the landlord, he became tenant again. The Land Act of 1887 made law such of the rules of this custom as were in favour of the tenant. With reference to holdings of not more than £100 a year of rental (and the greater number of Irish holdings are such), it enacted that, when a landlord had obtained judgment entitling him to evict for non-payment of rent, he should (instead of proceeding to evict the tenant as formerly) serve upon him an eviction notice. The notice informs the tenant that a decree for the recovery of the land for non-payment of rent has been obtained by the landlord; that any person entitled by law to redeem the said land must do so within six months from the service or posting of the notice, by paying to the landlord, or his agent, the sum specified in the notice as rent arrears and costs; and that on service or posting of the notice the person in possession of the land, to whom the notice is addressed, is deemed to be in possession as caretaker only, and not as tenant. A return of such notices filed in court is presented from time to time to parliament, and their number is often mistaken for the number of actual physical ejections from lands which take place in Ireland. But the tenant may redeem his right within six months, and meantime remains in possession of the land as caretaker. He cannot be removed as caretaker until a month after service of the notice, unless by special leave of the court. When a warrant has been applied for for his removal as caretaker, the justices may put a stay upon the issue of the warrant for a month or less, if they think that, by reason of the illness of the caretaker, or any other cause, the proceedings ought to be delayed.

Evidence. Evidence may be defined as the means of proving an unknown or disputed fact. In ordinary legal usage the term has two meanings which should be distinguished. In one it denotes testimony as to the existence of facts; in the other it denotes relevancy to an issue, as when it is said that 'hearsay is not evidence.' Evidence is divided into oral or parole evidence, or statements made by word of mouth by witnesses in court; and documentary evidence, the testimony derived from writing, or the use of any conventional symbols which, like letters, serve to express ideas. Real evidence is the testimony of things, as where footprints in a field give evidence that some one has been there. Another distinction is drawn between direct and circumstantial evidence. Direct evidence is the testimony of witnesses to what they have themselves observed or know of their own knowledge regarding the fact to be ascertained, as when A testifies that he saw B stab C with a knife. Circumstantial evidence is testimony given by witnesses to what they have observed or know regarding facts more or less remotely connected with the unknown or disputed fact, as when A testifies that he found upon B a blood-stained knife. The relative value of direct and circumstantial evidence as proof of fact has been much discussed. Direct testimony is generally esteemed the stronger; but witnesses may be mistaken, deceived, or deliberately false; while circumstances 'cannot lie,' and the conclusion forced upon the mind by an unbroken train of circumstances pointing in the same direction is often more forcible than positive direct testimony.

Instances may be found in which combinations of facts and circumstances are morally satisfactory as grounds of assurance and judgment, and, in many cases where a conviction has proceeded upon circumstantial evidence alone, the prisoner has afterwards confessed his guilt. A good example is the case of Courvoisier, the valet and murderer of Lord William Russell (1840). Here there was no direct testimony whatever to connect the accused with the crime, and there were circumstances designed by the accused to suggest that it was the

work of burglars. It was proved, however, that the prisoner had an opportunity of committing the crime, that some of the abstracted property had been concealed in his pantry, and that he personally had disposed of other portions of it. The evidence, besides, excluded the reasonable belief that any other than the prisoner was guilty, and upon these grounds he was convicted, and afterwards confessed. On the other hand there have been cases, happily rare, in which a miscarriage of justice, and the conviction of the innocent instead of the guilty, have resulted from a reliance by the jury upon circumstantial evidence. The most remarkable of these that has occurred in recent times arose out of a burglary committed at the rectory of Edlingham in 1879. Two burglars, one of whom shot at the rector, were seen on the night by the rector and another person. Two men were arrested and tried for the crime at Northumberland Assizes in 1879. Neither the rector nor the other person who had seen the burglars was able to identify the prisoners, and the defence was that the case for the prosecution was wholly one of mistaken identity. But a chisel found in the room where the crime was committed was traced to the possession of the prisoners; a piece of newspaper picked up in the same room was found to correspond with a piece in the coat of one of the prisoners; and footmarks found near the scene of the crime corresponded with those of the prisoners. The jury on this evidence found them guilty, and they were sentenced to penal servitude for life. They served in the convict settlement at Portsmouth for nine years; when, in 1888, the true burglars, two other men than those who had been convicted, confessed to the crime. Inquiries were made by the authorities, with the result that the men who had been convicted on the evidence of the chisel, the newspaper, and the footmarks, were set at liberty.

Judges and juries are not allowed by law to proceed upon their private knowledge of facts at issue before them, and must decide according to the evidence adduced. Of some facts, however, a judge takes 'judicial notice,' and these do not require to be proved by evidence. Such are all public acts of parliament, the proceedings and privileges of parliament, the course of proceeding and all rules of practice in force in the Supreme Court of Justice, the ordinary course of nature, natural and artificial divisions of time, the meaning of English words, and many other matters which judges are by statute specially directed to notice. Judges are also bound under the rules of law called presumptions to draw a certain inference from a certain fact unless the truth of such inference is disproved. A *presumptio juris et de jure* does not allow its inference to be disputed. For example, the law presumes that a minor is incapable of managing his own affairs; and, when a man is proved to be a minor, he will be held so incapable without regard to the question whether in truth he is so or not. A *presumptio juris* may be rebutted, as thus: the law presumes that when a woman is married, her husband is the father of her children; but evidence may be adduced to prove the contrary. A third kind of presumption has been distinguished, the *presumptio judicis vel hominis*, but this is merely another name for an argument or inference of logic. With regard to disputed facts that are not matter of judicial notice or legal presumption the general rule is that he who affirms a fact must prove it; and the burden of proof lies in the first instance on the party against whom judgment would be pronounced in the absence of evidence on either side.

The general rule governing questions as to what facts may be proved in judicial proceedings is that facts in issue (or those upon which the existence of the legal right in question depends) and facts relevant to the issue—i.e. those from which the facts in issue may be inferred—may be proved to the exclusion of all other facts. Facts collateral to the issue are not allowed to be proved—e.g. in a question whether A committed a crime, the fact that he formerly committed another crime of the same kind is held to be irrelevant, and not allowed to be proved. Hearsay evidence—i.e. testimony to the fact that a statement was made by a person not called as a witness—is similarly deemed to be irrelevant, the reason generally assigned being that the best evidence must be given. But the rule excluding hearsay suffers exceptions. Thus, voluntary confessions of crime and declarations by persons accused of crime are admitted as evidence against themselves; and declarations made by witnesses at the point of death, or in fear of death, are received as evidence against others. The opinion of a witness, as distinguished from his testimony to a fact, is generally held to be irrelevant; but the opinion of skilled persons or experts as to matters coming within their special province is admitted. Thus, in a question whether a man was sane when he made his will, the testimony of a witness to the fact that the deceased wrote his will in different coloured inks upon medicine labels would be deemed relevant, while the same witness's opinion that 'no sane man would make a will in that way' would be deemed irrelevant; but in a question whether A was poisoned, the opinion of medical men is admitted as to the effects of the poison of which A is said to have died. Evidence as to a person's character is deemed to be relevant in an inquiry regarding his conduct.

Admissible facts may be proved by documentary or by oral evidence. When the contents of documents are proved by the production of the document itself in court, the evidence is said to be primary. When copies are produced, the evidence is said to be secondary. As a general rule the documents themselves are necessary, as being the best evidence; but copies are accepted in certain settled cases—as where the original is in possession of the adverse party, who refuses to produce it; where it has been destroyed or lost; or where it is of such a nature as not to be easily movable, as in the case of a libel written on a wall. Public documents, such as the records of the realm, the acts of parliament, and the like, are proved by copies variously authenticated. When the law requires writing as proof of any proceeding or contract, oral evidence will not be admitted to alter or contradict such writing. Such evidence will, however, be received for the interpretation and construction of documents where they are obscure or couched in language used out of its ordinary sense.

The old rules which restricted or excluded the admissibility of a witness on the ground of religion, of interest, and of character have been gradually swept away by legislation. Objections of interest and character do not now affect the admissibility of witnesses, but are urged against their credibility when their testimony has been received. As a general rule all persons who are capable of giving rational evidence are admissible as witnesses. Extreme youth and mental infirmity will exclude if it is such as to prevent the witness from understanding questions or giving rational answers, or from knowing that he ought to speak the truth. In criminal cases the accused is not admissible as a witness, nor the husband or wife of the accused, except where he or she is the person injured by the crime. Some exceptions to the rule have been made by recent statutes—as e.g. the Criminal Law Amendment Act of 1885, which allows persons

accused of offences under this act and their husbands or wives to be competent witnesses. Thus, a man charged under the act with abduction of a girl under sixteen may give evidence himself, and call his wife to prove that at the time the crime was said to be committed he was not at the place where it was committed; while a man charged with assault with intent to ravish (which is not within the act) can neither testify himself nor adduce his wife's evidence at all. Witnesses are in the ordinary case examined in open court by word of mouth, after taking an oath to tell the truth. If any witness is unwilling to be sworn from conscientious motives, the judge may permit him to make a solemn Affirmation (q.v.). Any person who has made such declaration and wilfully and corruptly gives false evidence may be prosecuted and punished as if he had committed Perjury (q.v.). Witnesses are first examined by the party who calls them into court. After this examination-in-chief they are cross-examined on behalf of the opposite party, and then re-examined. Leading questions—i.e. questions which suggest their own answer—may be put in cross-examination, but not in the examination-in-chief. No witness is bound to answer any question if the answer would expose him to a criminal charge; but if the result of his answer would be to render him liable to a civil suit for debt or otherwise he must answer notwithstanding. Questions may be put in cross-examination to test the accuracy or credibility of the witness, and to shake his credit by injuring his character; but the judge may disallow questions which he considers to be vexatious and not relevant to the issue. Every witness may be examined as to whether he has ever made a different statement regarding the matter of his examination; and, if he denies, proof may be led to contradict him. Spouses cannot be compelled to disclose communications made to one another during the marriage. Confidential communications between parties to legal proceedings and their legal advisers are similarly protected. Medical men and clergymen, on the other hand, may probably be compelled to disclose communications made to them in professional confidence, although the point remains doubtful (see CONFIDENTIALITY). Except in cases of treason and perjury, the evidence of one witness is held sufficient by the law of England to support a conviction; but proof of circumstances to corroborate such witness is usual. The rule runs the other way in Scotland, where no libel can be proved by the unsupported testimony of a single witness; but, as one witness is held sufficient to prove each of a chain of connected facts, the practical effect of the two rules is the same in both countries. See Sir James Fitzjames Stephen's *Digest of the Law of Evidence* (5th ed. 1887), and Kirkpatrick's *Digest of the Scottish Law of Evidence* (2d ed. 1886).

In the United States, state laws prescribe the rules of evidence which govern the state courts, and, in the absence of congressional enactments, federal courts. The effect of recent acts of congress is that there is now no restriction as to the admission of testimony based upon the colour or nationality of the witness; and in general the party in interest both in civil and criminal cases may be a competent witness, subject to the general rule that a party is not compelled to criminate himself, nor shall his silence upon any question create a presumption against his innocence, and subject also to the general rule that a husband shall not be allowed to testify against his wife, nor the wife (unless the offence has been committed by the one against the other) against her husband. Where the evidence relates to the remedy, as in the proving of an instrument by subscribing witnesses, state rules govern both in federal and state courts; hence the practice varies with the locality. Circumstantial evidence is admitted by courts with great reluctance, and in criminal cases, if not corroborated by the positive evidence of at least one witness, it must be of such a character as to be equivalent in weight of evidence to direct and positive evidence, and be entirely inconsistent with the innocence of the party accused.

A belief in God and in divine rewards and punishments, here or hereafter, for deeds done is essential to the admissibility of a witness; and this belief must have no reference to the punishment for perjury by human law; hence one having no belief in God cannot be a competent witness, and no form of oath which he declares to be binding upon his conscience cures this defect. The jury are the judges of the fact, and, as such, of the credibility of the witnesses; hence no jury in the United States is obliged to reject a statement of a witness because uncorroborated by positive testimony, either direct or circumstantial. The general rules as to relevancy; the relative value of written and oral evidence, and the control of the one by the other; and the taking of an oath or affirmation are to the same effect as those observed in England. —For the evidences of religion, see APOLOGETICS.

Evil may be generally defined as that which is opposed to the divine order of the universe. It requires only a superficial observation to perceive that there are many apparent exceptions to the pervading harmony and happiness of creation: there are convulsions in the physical world; there are suffering, decay, and death throughout the whole range of organic existence; and the appellation of Evil is commonly applied to such phenomena. In the face of the human consciousness, such phenomena appear to be infractions of the general order and good, and it pronounces them *evil*. Every form of religion testifies to the recognition of evil in the external world, and superstition in all its shapes mainly rests upon it.

But it is in the sphere of moral life alone that the conception of evil is most deep-seated—evil in human life and manners and history. There is in the moral consciousness of man a sense of violated order, of transgression of divine law, or what is called *sin*, which is *evil* in its essential form. This fact of evil is everywhere appealed to by the Christian religion; it is the aim of this religion to deliver men from its power and misery. Every ethical and judicial code is based upon its recognition, and is designed to protect human society from its injurious consequences.

The question of the *origin of evil* has been greatly discussed, and has received various answers. The simplest and most direct of these answers is that which maintains a double origin of things, or a system of *dualism*. This conception lies at the basis of many forms of religion; it may be said to be the fundamental conception of all mere nature-religions. Interpreting the obvious appearances of nature, these embody in divine personalities its contending manifestations of light and darkness, benignity and terror. The opposition of Ormuzd and Ahriman in the old Zoroastrian faith is one of the most conspicuous examples of this religious dualism. Manicheism, which spread so widely in the 4th and 5th centuries, and the Syrian gnosticism from which it sprang, though accounted amongst Christian heresies, are also historical illustrations of the same principle.

The dualistic theory of the origin of evil, however, could not maintain itself with the advance of speculation and the truer appreciation of Christian truth. It was at once a postulate of the cultivated reason and a dictate of divine revelation that the world proceeded from One absolutely

Divine Creator, holy and good, of whom, and through whom, and to whom are all things. It was necessary, therefore, to reconcile the appearance of evil with this fundamental admission.

The doctrine of the Fall, especially in the later form of development which connects it with the existence of a devil or evil spirit, tempting man in the shape of the serpent, was supposed to explain the appearance of evil in human history. Being tempted of the devil, man sinned, and so fell from his obedience to the divine law. This is the doctrine of orthodox Christian theology, and the answer which it gives to the inquiry, how sin came into the world. And many minds never think of carrying the inquiry further. It is clear, however, that this explanation of the historical origin of evil leaves the question of its real and absolute origin unsettled. The devil being assumed as the cause of man's sin, the further question arises, whence the devil? Is he an absolute personality? in which case we are landed in the old theory of dualism; or is he, according to the traditionary Christian conception, a fallen angel? in which case the question just returns, whence the spring of evil in him? (See DEVIL.) There is no real explanation gained by this removal of the question; it is still the same difficulty—whence the origin of evil in the creation of an all-perfect Being, almighty as well as all-wise and good?

Speculation may please itself with ingenious answers to this question, but in truth it admits of no satisfactory solution. Some, for example, have argued that evil, like darkness or cold, is an indispensable element of alternation or contrast in human life. All individual reality is only the product of opposite forces working together. Character could only arise from the interaction of opposing ethical influences of good and evil. In nature we have attraction and repulsion, rest and motion, positive and negative electricity; why should it be different in the sphere of morals? Here, too, there must be polarity. Good can only exist in contradistinction to evil; the one no less than the other is necessary to constitute the drama of human life and history. Others, again, have argued that evil is the result of what is called metaphysical imperfection. God alone can be perfectly good. The creature in its very nature is limited, defective; and evil is nothing else than the evidence of this limitation in man. It is not something real or positive, but only a privation. It is in morals what cold and darkness are in physics, a pure negation. Thus have argued such profound thinkers as Augustine and Leibnitz. But it requires but little penetration to see that such arguments, however ingenious and so far well founded, do not meet the essential difficulty of the problem. If evil be, according to such views, a necessary element of human life, in the one case in order to develop its activity, in the other case as clinging to its creaturely limitations, then plainly it is not, in the orthodox sense of the word, *evil*. It is not and cannot be a contradiction of the true idea of human life, and at the same time a necessary element of it. Whatever necessarily belongs to life must help its true development, and not injure and destroy it; must be *good* in short, and not *evil*. Such theories, therefore, only solve the problem by eliminating the fact. The origin of evil must remain for ever inscrutable; nor is it wonderful that it should. It is only in its ultimate sense conceivable as a quality of moral freedom, and moral freedom in man or any created being is a profound mystery. It is something which 'we apprehend, but which we can neither comprehend nor communicate.'

The problem of the origin and existence of evil is dealt with by the most notable philosophers, as by Kant and Hegel, but assumes special prominence in the pessimistic philosophers, Schopenhauer and Hartmann. According to Schopenhauer, not merely does pain greatly outbalance pleasure, but existence as such is necessarily evil (see PESSIMISM). John Stuart Mill, in his posthumous essays (1874), held that, in the presence of so much and so great evil, physical and moral, in the universe, it was impossible for him to believe in a deity at once omnipotent and all-benevolent. He felt therefore driven to regard God as a Demiourgos limited in power by the materials on which he had to work. See also SIN, WILL, and Julius Müller, *The Christian Doctrine of Sin* (trans. from the 5th German edition, 1868).

Evil, KING'S. See SCROFULA.

Evil Eye, the power of exerting an evil influence or fascination on any one by a glance from the eyes, one of the most venerable and widespread of human beliefs, sanctioned alike by the classical authors, the Fathers of the Church, the medieval physicians, savage races everywhere, and modern usage in many countries within the range of Christianity. Readers of Virgil will remember the complaint of Menalcas in the third *Eclogue* that some evil eye has bewitched his tender lambs, and every one is familiar with St Paul's bold metaphorical use of the idea to express the spiritual perversion of the Galatians (iii. 1). By the ancient Greeks it was called *Baskania*, by the Romans *Fascinum;* and to both it was an integral part of the popular belief. Amulets of very various forms—the most common those shaped like horns, like a frog, or like a hand—were worn to counteract its effect, and such devices adopted by way of safeguard as spitting on the ground or on the breast, showing something ridiculous to the fascinator, dissimulating good fortune, or doing something unpleasant by way of a counter-penance, like Polycrates of Samos throwing his ring into the sea. It was supposed that fascination was most often due to envy; hence the philosophy of overcoming it, and converting it into laughter and safety, by the exhibition of some ridiculous amulet, often of most indecent description. Such also were the *oscilla* or little masks of Bacchus hung upon fruit-trees to avert the *fascinum* and keep them fertile, and the *phallus* borne about in procession at the Dionysia. Of similar origin is the fact that stated numbers are particularly liable to the *fascinum*, and hence the deep-rooted Jewish disinclination to number flocks or the like, and the no less strong objection of Neapolitan and Scotch fishermen to state the number of their catch. In the folklore of almost every people it is considered unlucky to be praised with any particular warmth, and it is a point of prudence to use certain formulas immediately thereafter. We find this not only among the ancient Greeks, Romans, Celts, and Teutons, but among such people as the Turks, Italians, Spaniards, as well as the Chinese, Japanese, Negroes, and Red Indians. Thus, in Carniola and Corsica a mother does not care to hear her baby praised or a farmer his crops, while even in England here and there sick people still feel uneasy at being told that they are looking much better.

Nowhere at the present day has the belief in the evil eye a more real power than among the Neapolitans. The *Jettatura* is one of the common dangers incident to life, and every one wears his amulet against it. These are usually of silver, in the form of an antelope horn, a hand with the first and little finger doubled down, a key with a heart in its handle, a crescent moon with a face in it, or a sprig of rue. Other very common forms are the *cimaruta*, an emblem combined of all the foregoing, none of which are directly Christian symbols, and the *cavallo marino* ('sea-horse') and *sirena*, the last two being very common in Pompeian

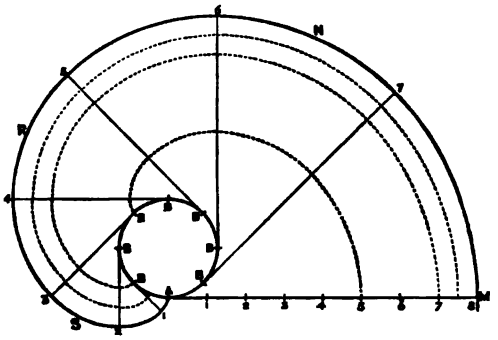
paintings. The horror of this fatal gift of fascination with its blighting influence is deepened by the fact that it is exerted upon any object upon which the eye may first light, often, if not indeed usually, in opposition to the will of the person who is cursed with it. Men now possess it more commonly than women—nay, the *jettatore* is often a priest or monk, and it was long a matter of common belief that it was an unhappy attribute of Pio Nono himself. In ancient times, on the contrary, it was more common in women than men, and was possessed most often by little old women with squint or deep-set eyes, especially those who were lean and melancholy, and had double pupils. The Neapolitan *jettatore* is traditionally a morose and sallow man, eager to cast his blighting influence over men and women, but most commonly children, and usually he is a mean-looking personage, totally unlike the portentous figure idealised in the *Corricolo* of Dumas. Many of the medieval philosophers have seriously discussed the rationale of the evil eye, with its relations to the poisonous rays emitted by toads and basilisks, and the fascination of terror exerted by the serpent upon the bird through keeping its eyes fixed steadfastly upon it. Grimm notes as one of the best means of recognising a witch, that when you look into her eyes you see your image reflected upside down, and suggests that the peculiar conformation may have had something to do with her evil eye. At anyrate this baneful property is characteristic of witches everywhere, of none more than in those of Teutonic mythology.

See the learned discussion of the subject in W. W. Story's *Castle St Angelo and the Evil Eye* (1877); G. Pitrè, *La Jettatura ed il Mal'occhio in Sicilia* (Kolozsvar, 1884); chap. vi. of E. N. Rolfe and H. Ingleby's *Naples in 1888* (1888); and M. Tuchmann's exhaustive series of papers on 'Fascination' in *Mélusine* (vols. ii. iii. and iv. 1884–89). For some valuable eastern evidence, see papers by John de Cunha and Purushottam Balkrishna Joshi in part iii. of the *Journal of the Anthropological Society of Bombay* (1888).

Evil Merodach. See BABYLONIA.

Evolute, Involute, correlative terms first applied to the tracing of curves by Huygens. Under this distinction every mathematical curve is considered as one of a pair which are mutually produced. To measure the curvature at any point, or the amount of bending or deflection from the tangent, we find a circle which coincides with the curve for an elementary distance. This circle of curvature or 'osculating circle' must evidently diminish its radius as the curvature increases, and increase its radius as the curvature diminishes. The centre of this circle is called the centre of curvature for that point; and the successive points of any given curve have in general different centres of curvature, because the amount of deflection is constantly varying. When we trace, for example, an ellipse, the varying centre of curvature is at the same time tracing a companion curve of quite a different shape. The latter is called the evolute and the former the involute. Or we may begin with the evolute. Take a circular disc of metal or wood and wrap a thread round the circumference, which is now to serve as the generating curve. When the disc is held fast to any plane, and the string unwrapped under tension, any point of the latter will describe on the plane an involute of the circle. At any particular moment of the process the straightened or unwound part of the string is the radius of curvature of the outer curve. Thus, (1) the tangent to the evolute at any point is the normal to the involute at the corresponding point; (2) any curve as involute can have but one evolute, but any curve regarded as an evolute has an infinite number of involute companion curves, which are all parallel; (3) the length of any arc in the evolute is the difference between the tangents at its extremities. When the circle is evolute, its involute (see fig.) is obviously spiral; and, when it is itself involute, the corresponding evolute has the exceptional form of being diminished to a point. The evolute of the cycloid is also exceptional, being another equal cycloid, a fact first observed by Huygens. A practical application of the involute of the circle occurs in theoretical mechanism in connection with the shape of the teeth of wheels, under certain circumstances.

From A, the beginning of the involute, draw a tangent AM = length of circumference of the circle.



Circle, BBB, as Evolute and its Spiral Involute, MNRSA.

Divide AM into eight equal parts (as figured) and the circumference into the same number at B, B, B, &c. At these points draw tangents so that line B1 = line A1, B2 = A2, B3 = A3, B4 = A4, &c. The extremities of the tangents show the curve called the involute of the circle. The dotted curves of the diagram show three of the companion involutes, all parallel to the first. They obviously admit of indefinite extension, however small the generating circle may be.

Evolution. Upon every developing mind, whether infantile or consciously philosophic, there presses at times the question of the origin of things. The attempt to answer this is to construct a cosmogony; and is alike the earliest and the latest extension of our common-sense account of things into complete and more orderly form as science. In seeking to do this the greater and more permanent phenomena at first impress us; and our speculative restlessness, if not lulled altogether, may seek to satisfy itself by postulating the existence of the universe substantially unchanged during an infinite past. But this philosophy of things is not only incapable of being really grasped by the highest effort of the intellect, but is incessantly contradicted by experience; it has hence never gained any real acceptance from the simplest common sense, much less any confirmation from science. The alternative then arises of drawing an explanation of the origin of things from our experience not of permanence, but of change. Here it is naturally the most changeful phenomena, the most marked and sudden contrasts, which first and most deeply arouse our attention, and this not only in nature, but still more in human life and affairs. The conception of uniformity among superficially different phenomena has hardly arisen, and the demand for explanations in terms of cause and effect, other than in terms of personal volition, is proportionately weak. The hypothesis of a sudden and unexplained, of a mysterious appearance or creation of things, thus next presents

itself; and the subsequent explanation of this as an act of external will is rendered easy by our personal consciousness. As our practical and industrial powers develop, and the perception of phenomenal order deepens and extends, the original simple association of a simultaneous appearance of all phenomena with a flash of volition is modified. Phenomena are becoming classified and interconnected in larger and larger groups, with which a higher anthropomorphism can henceforth associate a conception of detailed design. The older view only remains provisionally so far as order is not yet apparent; such later creationist theories become increasingly supplemented by a recognition of the changes in progress around us. The importance of these is found steadily to increase, and the conception of evolution, nascent since the crudest view of creation had given place to a more gradual and causal explanation, now becomes independently formulated in each order of phenomena. Human affairs become more and more obviously interpretable than of old, and there arises in their place the characteristically modern idea of progress. Natural science meanwhile has become more active, the very astronomical and geological phenomena from which our ideas of permanence were most derived are seen to be in process of change. Changes which seemed to be catastrophic in their vastness are proved to be only the cumulative product of natural agencies in daily operation; and the idea of the present as the product of the past also becomes extended to the world of organic life. The details, the general mechanism and direction of the processes of change, thus become inquiries of paramount interest to each body of scientific specialists and still more to the philosopher. It is at this period that we find ourselves, and to the brief discussion of these questions therefore that we must pass; but it is useful from the outset to recognise that instead of having well-defined and sharply-opposed theories of creation and evolution, these are but phases of an incomplete evolution. Hence the controversies so active during the middle half of the present century have practically ceased; it is admitted on all hands that the evolution theory only supersedes those cruder anthropomorphisms of arbitrary creation and of mechanical contrivance which presented the universe as a mere aggregate of finished products, without excluding that higher and more unified teleology which interprets it as the orderly unfolding of a cosmic drama. And as we see the evolution theory to be an orderly development beyond its predecessors, mere destructive criticism of these becomes no longer necessary.

Mode of Treatment.—The student of theology or philosophy, or the man of general education, is usually inclined at once to plunge amid the conflicting currents, the perplexing eddies of past cosmogonic speculations. He hence sets out by reviewing the oriental theories of the universe, and comparing these with Hellenic ones; he develops mingled types of both through early Christian thought into the elaborate compromise of the scholastic world; and finally endeavours to trace the modifications and survivals of these in contact with the thought-streams of the Renaissance and the Revolution before reaching the theories of modern times. But it would be a grave mistake to suppose that these last are the product of any continuous development from the preceding course of speculation. They have arisen independently and upon a distinct line, and present themselves as the most generalised result and expression of our concrete studies of natural science. Hence such historic inquiries, in all cases difficult, if not actually misleading, would be in any case premature; whereas, when we have grappled with the scientific theories of evolution, we may then profitably note the analogies or parallelisms, the survivals of, or reversions to, earlier modes of thought which these present.

Scientific conceptions of evolution may themselves be approached from various sides. Minds of the more abstract type or training tend to begin with such a highly generalised analysis and exposition of the subject as that with which the labours of Herbert Spencer have been so pre-eminently concerned. After accepting or modifying this dynamic view of the universe as a whole, we should then seek to satisfy ourselves as to the applicability of our principles to the genesis of the physical world, and thence pass to the phenomena of life, mind, and society. We should then be accustomed to regard the universe no longer as a mere phantasmagoria, nor even merely as an orderly succession of events, but as a process of becoming. And, since this orderly flux of evolution is still in progress, scientific prevision thus becomes possible, and with it a corresponding degree of practical prevision as well. We thus reach a transition from the cosmist to the humanist attitude; the essential step from an evolutionary system of science towards an evolutionary system of ethics would then be made. These general conceptions reached, and an evolutionary philosophy in its broadest outlines being thus settled, we are in a position to review the earlier systems of different historic periods, and rationally criticise and interpret them in the light of our own conceptions; it may be even to recognise defects or deficiencies in these, and to obtain suggestions how to correct or supply them.

A less arduous and more popular method, concrete and inductive moreover, and consequently more in harmony with the modern spirit, is to begin as a scientific specialist, artificially isolating in thought one order of phenomena at a time from the complex unity of nature. Reviewing in this way the physical sciences, next the biological, and finally the mental and social, we shall be able to trace the parallel rise of evolutionary interpretations in each order of phenomena. And, after adequate detailed study of physical and organic processes, we may not only discuss the broader generalisations with fuller grasp and certitude, but proceed to inquire into the evolutionary process in higher sciences with ampler preparation; and thus ultimately approach the philosophic ideal of clearest and completest general view.

In this way we should have again completed the same cycle of thought as that sketched in the preceding section, but this time inductively instead of deductively: we have, as it were, worked our way upwards from our scientific primers instead of down from Mr Spencer's *First Principles* or the like. In short, then, the most simple, safe, and fruitful scientific method of studying the problem of evolution we find to be to reverse the order of the three distinct methods above outlined; to commence with the concrete study of evolution as manifested in the universe as a whole, in the earth's crust, and among plants and animals; gradually to rise toward more abstract expression and more deductive grasp, then to pass to mental and social evolution. Within the present compass the utmost that can be attempted is to sketch out a few of the leading lines of thought and still more briefly indicate others.

Evolution in the Physical Sciences—Astronomy.—Here, as in other sciences, early conceptions of the universe agree in viewing it as being, as far as possible, in permanence and at rest, and not in change and motion. Such static views may be only tacitly implied, but are more usually directly avowed: thus the earth was long viewed as a

plane stably supported, and till very recently the stars were viewed as fixed. But as the static universe of the ancient astronomer passes into that of Copernicus and Kepler, Galileo and Newton, Herschel and Leverrier, dynamic, or more accurately *kinetic*, conceptions have henceforward an assured prominence in at least one science, and that the one most obviously concerned with the universe as a whole. For although evolutionary speculations of more or less vagueness seem to have arisen once and again in almost every science, the first well-developed theory of evolution which has attempted to cope with the observed facts of any science must be credited to astronomy (if not to the professed astronomer) in the famous Nebular Hypothesis (see NEBULÆ), of which the suggestiveness to all other departments of science must be freely admitted. For the mind which has once fairly grasped the conception of stellar and planetary evolution cannot readily stop there.

Evolution in Chemistry.—In chemistry kinetic conceptions must naturally have been rife from the earliest times. The records of ancient chemistry are indeed largely those of the speculative exaggerations of kinetic hypotheses by the alchemists; as its history in more modern times bears the trace of a strong, and in some respects excessive reaction from these, albeit to occupy the more certain ground afforded by the conception of the permanence of matter. But the analytic researches, the studies of atoms and elements, of valencies and molecular constitutions viewed as absolutely definite, are again being used only as starting-points for new dynamic departures, such as those of thermo-chemistry; while new speculations, essentially evolutionist, such as those of Crookes and others, are arising on various hands around the well-known periodic law (see CHEMISTRY). The similarity in composition of our planet with that of sun and stars, and the intimate relation between organic and inorganic compounds, are also suggestive; while the actually observed genesis of many species of minerals by the action of natural causes, and the frequent transmutation of one species into another when some definite change takes place in the surrounding conditions, are not without evolutionary interest.

The recent movement in chemistry above alluded to is indeed only the counterpart of what has been taking place earlier and more fully in physics, thanks largely to astronomy and to the mechanical arts, not to speak of other influences. The laws of motion, the conception of gravitation, the abandonment of the theories of the material nature of light, heat, and electricity, are all steps of the same progress, as are also the positive demonstration of the existence of the imponderable ether, and finally the sublime conceptions of the conservation and dissipation of the evolution and dissolution of energy throughout the universe. And as the analytic task of the chemist and physicist rises from that of weighing and grasping at the atom to that of watching and measuring the wave, our general conceptions are inevitably changing also. The idea of a static universe, essentially constructed once for all of so many different masses and kinds of matter, upon which man of science, philosopher, and theologian alike formerly agreed, is on all hands fully giving place to that of a dynamic unity which owes its manifold and unceasing differentiation to the varying modes or moods of the universal energy.

Evolution in Geology.—That the last-century mineralogist was here and there already widening his interest to the rocks and even meditating as to their nature and origin is well evidenced by the penetrating speculation of Linnæus: 'It may be that the solid rocks are not primeval, but the daughters of time.' As subsequent generations of research have shown us, this solid rock is the product of igneous and that of aqueous action, here reaching back to an incalculable antiquity, or there evolved within the period of human occupancy; while others consist in great part, or even completely, of the remains of extinct animals or plants. These are conceptions now so familiar that it is difficult to realise their once revolutionary appearance and effect. But when we take into account the transition from the cataclysmal and essentially creationist theories which at first prevailed to the uniformitarian, or evolutionist, interpretation of geological phenomena which centres round the work of Lyell, we cannot wonder that such a revolution in geological doctrine should have exercised an influence upon general thought only second to that of the Copernican astronomy itself. More detailed studies, too, would be of no little service to our general theories; note, for instance, how the geologist takes from the astronomer, now a stellar evolutionist, the cooling planet, and outlines its primeval sunderings of land and sea, its wrinkling hills and vales, how he proves that the pulse of ocean is but the dying ripple of a once fiftyfold mightier tidal wave, or how the glacial period is the inexorably recurrent winter of a year of ages. The mineralogist no longer merely measures and analyses, but deciphers the origin and transmutation of mineral species, and of the rocks they form under the forces of the environment (see MINERALOGY); and the typically changeful phenomena of climate and atmosphere are rendered the subject of a typically dynamic sub-science (see METEOROLOGY).

Modal Explanation of Physical Evolution.—We must sooner or later inquire whether any general principle can be found to verify and rationalise the process of evolution in the physical world, and to this the answer has been specially elaborated by Mr Herbert Spencer. His essential principle or Law of Evolution must be stated in his own words: 'Evolution is an integration of matter and concomitant dissipation of motion during which the matter passes from an indefinite incoherent homogeneity to a definite coherent heterogeneity, and during which the retained motion undergoes a parallel transformation.' The deductive and inductive establishment of this principle, and its comprehensive verification and fruitful application throughout the fields of the higher sciences as well, are necessarily left for fuller separate exposition (see SPENCER). And although the student who seeks to follow Mr Spencer in grappling with the riddle of evolution in higher orders of phenomena may not admit that his uncompromising application of the principles of physical evolution to higher categories is so exhaustive and satisfactory as he claims, there can be no doubt that this general treatment has been on the whole amply justified so far as it goes, alike in unifying the sciences, and in the separate organisation of these.

Evolution in Biology.—This portion of the subject demands special attention and fullest outline for many reasons. Not only is the transition from static to evolutionary conceptions of comparatively recent, indeed almost contemporary interest; but the progress of the doctrine of evolution as a general theory of the universe has been most closely connected with progress in biology. And while we can at best merely speculate as to the direct continuity of evolution from the inorganic to the organic world (see BIOLOGY, SPONTANEOUS GENERATION), we are constantly impressed by the fundamental unity of the process in the simplest and most complex forms of life, and by the thoroughness with which the same principles may be traced into the highest 'superorganic' phenomena of mind and society.

At the outset we require some such conception of

the actual historic progress of our concrete knowledge of plants and animals as is outlined in the articles BOTANY and ZOOLOGY, and also of that rise of our more abstract kinetic and static (physiological and morphological) interpretations of the phenomena of life as is given under BIOLOGY and BOTANY. The general argument for evolution appended by Darwin to the classic statement of his theory of Natural Selection in the Origin of Species has been already summarised under DARWINIAN THEORY, and its separate heads are also to be found under separate articles; only the briefest reference to these need here be made. We must keep, for instance, in view the conceptions of the actual evolution of the individual which have become systematised in the sub-science of embryology (see EMBRYOLOGY). Suffice it, however, here to recall that, although it is in this connection that the term *evolution* first makes its appearance, it is used along with *development*, in a sense diametrically opposed to its present significance, as the mere enlargement and unfolding (*evolutio, evolution, Entwickelung*) of a form and structure in all essential respects a perfect miniature of that of the adult.

Without recording or analysing the various conceptions of species (see SPECIES) it is sufficient again to note how the belief in their objective constancy and practical definableness is shaken by such facts as (1) that pre-evolutionary systematists differ hopelessly upon the number and limits of the species of all the more variable groups of plants and animals; (2) that the mere numerical increase of the number of specimens in our museums is constantly compelling us to recognise that great numbers, sometimes even scores or hundreds, of 'type-specimens' of irreproachably described 'species' are but so many individual members of a series linked by the most infinitesimal gradations, yet of which the extremes differ by characters of specific, it may be even generic rank. And when (3) the assumption of the general sterility of hybrids is proved experimentally (see HYBRID) to be an exaggeration, it becomes, to say the least, increasingly difficult seriously to support the dogma of the constancy of species.

Leaving the general external form with which the species-maker is mainly concerned, we must accompany the anatomist through each level of his deepening analyses and comparisons, through organ-systems and organs, tissues and cells, to the ultimate protoplasm itself (see BIOLOGY, MORPHOLOGY). To realise how fully this analysis results in the demonstration of an unsuspected unity of structure not only between species and genera, but far larger groups, some actual study of the concrete facts is indispensable; as also to appreciate the same beautiful unity of type in individual structures so differentiated as the appendages of a lobster (see CRUSTACEA) or the parts of a flower (see FLOWER). Yet here again we have an instance of the tenacity of static conceptions; for although it could not be actually denied that the hypothesis of descent from common ancestors at least *might* explain the structural unity observable under classification, as from a simpler ancestor, that observable under the individual structure, the conception of conformity to a purely ideal 'archetype,' was long maintained. Rudimentary organs, such as the teeth of fœtal whales, were thus explained not as reduced survivals of structures ancestrally useful, but as purely intellectual necessities of this arbitrary 'conformity to type.' This ingenious revival of Platonic ideas in conjunction with scholastic nominalism could not, however, very long survive the demonstration of the frequent absence of rudiments necessary for archetypal purposes; and the alternative evolutionary explanation has thus inevitably succeeded to its place.

It is much to learn from the taxonomist that his classification of species and genera, even the whole world of plants or animals, assumes the form of a vast genealogical tree; and it is no small confirmation of the evolutionary view to note how every new fossil-trove throws some fresh light upon the order in which the branches or branchlets of this tree have historically developed. With all the missing links we can imagine or desire between the modern horse and his simple five-toed ancestor (see PALÆONTOLOGY, FOOT, HORSE), not to speak of other examples, we have indeed evidence which may well satisfy us of the historic fact of evolution; but this brings us no nearer comprehending the rationale of the process. Leaving the morphological sciences, we must pass with Darwin to the study of what we may call the higher physiology. Assuming what is known of the functions of the individual, we must note not only the relations of the species unit (in higher forms usually of course the pair), and so familiarise ourselves with the phenomena of reproduction and sex, of heredity and variation, breeding and relation to offspring, the results of intercrossing, the modification by environment, &c.; we must also consider the wider relations among the members of the same species, between allied species, and finally between practically unrelated ones, whether here of struggle or there of adaptation. He thus introduces us to this vast and practically new field, and gives us a glimpse of the living, whole nature in that magistral series of volumes, which we may as it were group into a *Vita Naturæ*, complementary to the static *Systema Naturæ*, and no less epoch-making for our day than was that of Linnæus for his.

We see how natural it is that the student of biology who thus becomes an evolutionist so largely by help of Darwin, should accept the lucid and comprehensive modal explanation so vitally associated with his whole evolutionary attitude, and thus also become a thoroughly convinced Darwinian, a natural selectionist without more ado: and we can readily understand that the assent of the majority of the intelligent public should have gradually followed the same course during the generation after the publication of the *Origin of Species*.

It is necessary, however, to refer more precisely to the history of opinion both as regards the fact of evolution and the factors in the process. The history of the two questions—of the empirical fact, and of the actual mechanism of evolution—can hardly be separated, though it is of course well known that the former was virtually settled by the demonstrations of Spencer, Darwin, Wallace, Haeckel, and others soon after the middle of this century, while we are still in the midst of keen debate as to the relative importance of the diverse factors. The history of the theory of evolution, so far as the organic world is concerned, is essentially modern, for in spite of vague hints and *a priori* speculations from Empedocles onwards, it was not till the 18th century that evolution began to be very definitely suggested as a modal explanation of the origin of our fauna and flora, or that inquiry began to be seriously directed to what we now call the etiology of organisms.

What was for so long only a germ-idea at length took shape in the mind of Buffon (1749), who not only urged the general conception with diplomatic skill and covert irony, but sought to show how new conditions evoked new functions, how these in turn reacted upon the structure of the organism, and how, most directly of all, altered climate, food, and other elements of the environment might be

the external conditions of internal change, whether for progress or the reverse. Erasmus Darwin (1794), with a truly living conception of nature, emphasised the organism's inherent power of self-improvement, the moulding influence of new needs, desires, and exertions, and the indirect action of the environment in evoking these. To Treviranus (1802–31) organisms appeared almost indefinitely plastic, especially, however, under the direct influence of external forces, nor did his analysis of possible factors fail to recognise what Brooks, Weismann, and others have recently elaborated, that the union of diverse sexual elements in fertilisation was in itself a fountain of change. His contemporary Lamarck (1801–9) is well known to have emphasised the importance of changed conditions in evoking new needs, desires, and activities, while urging also the perfection wrought by practice and the degeneration which follows as the nemesis of disuse. Evolution seemed to him the interaction of two fates—an internal progressive power of life, and the external force of circumstances in the two-fold struggle with the environment and with competitors. Among the philosophers also, especially in the minds of those who had been disciplined in physical or historical investigations, the speculations of the ancients were ever taking fresh form, gaining moreover in concreteness; witness the contributions of Kant and Herder. In Goethe's epic of evolution the adaptive influence of the environment is clearly recognised, while the misty theories of his contemporary Oken chiefly interpret the organic progress in terms of action and reaction between the organism and its surroundings. Wells in 1813 and Patrick Matthew in 1831 forestalled Darwin in suggesting the importance of natural selection, but their buried doctrines were of much less practical importance than those of Robert Chambers, the long unknown author of the *Vestiges of Creation* (1844–53). His hypothesis of evolution emphasised the growing or evolving powers of the organisms themselves, which developed in rhythmic impulses through ascending grades of organisation, modified at the same time by external circumstances acting with most effect on the generative system. In France, Geoffroy and Isidore St Hilaire, father and son, supported the thesis of definite variation under direct environmental influence. And before reaching even the contemporaries of Darwin a complete history would have to take account of the conclusions of many naturalists, such as Von Buch, Von Baer, Schleiden, Naudin, and Wagner. The environmental factor was subsequently recognised with greater clearness and with less exclusiveness by Spencer; while Darwin and Wallace, recognising some truth in most of the above positions, but believing them wholly insufficient, left the problem of the origin of variations alone, and devoted their strength to establishing the theory of the origin of species by means of natural selection, a view which emphasises the destructive or eliminating and the conservative or selective action of the animate and inanimate environment in the struggle for existence.

Even from the above brief sketch of representative conclusions, it will be seen that successive authors accent diverse factors in the evolutionary process: in the view of one the organism has a motor power of variation inherent in its very constitution, or gained by the intermingling of sex-elements from which the individual life starts; to another the moulding power of changed function, the perfecting influence of exercise, the degenerating nemesis of disuse are all important; while to a third organisms seem to have been hammered from one shape into another by the action of that complex series of external influences which we briefly term the environment. Among modern naturalists we find champions of each of these three positions respectively emphasising (*a*) the organism itself, (*b*) its function, and (*c*) its environment; a few remain more or less exclusive Natural Selectionists, with or without theories of the origin of the variations which they postulate; while the majority more and more incline to an eclectic but not yet synthetic view, differing chiefly in regard to the relative importance of the various factors recognised.

The difficulty will be obvious of even briefly discussing so many positions, many of which are better dealt with under the separate articles ENVIRONMENT, HEREDITY, REPRODUCTION, SEX, VARIATION; and it is undesirable here to stereotype any one position as final during an unended controversy. That criticism will be certainly more temperate, and probably not less fruitful, which for a time seems to withdraw from the actual field of battle; which, instead of joining issue on this point or upon that, seeks rather to recognise all the leading points of view from which the subject may be approached, and thence to clear up the various lines on which a modal explanation is or may be offered, or to which it must at anyrate be capable of satisfactory application. We should thus even be able to do more justice to the older naturalists' positions.

Evolution in Psychology.—The psychologist admits the same inability to derive psychical processes and states from the nutritive and reproductive functions and structures which form the subject-matter of biology that the biologist does to derive these from inorganic processes. This fact does not of course interfere with the investigation of the parallelism of each of these higher orders of phenomena (see BIOLOGY), still less with the detailed study of evolution in mind, for which, as Mr Spencer has especially demonstrated, evolution in the preliminary sciences of biology and physics is so suggestive. What most concerns us here is to note how largely the science of psychology, or what stood for it, was wont to be a matter of deduction from that time-honoured axiom that human nature is for practical purposes always and everywhere the same; which, as evolutionists, we now see to have been an erroneous postulate. The older psychology was concerned especially with less or more scientific analyses of the adult mind, and this usually of the isolated 'typical' one (usually of the psychologist himself), but in a form too generalised to admit of much practical application. The modern school recognises the necessity of unravelling the vast complexity of the actual details of psychical processes, and not only eagerly investigates the development of the infantile mind, but scrutinises the kindred though humbler phenomena of animal cerebration. Psychology is drawing new light from the long discredited study of hypnotic states (see ANIMAL MAGNETISM); since here psychical functions can be analysed at various levels, and this apart from the perturbing action of the will. Again, it finds a rich source of knowledge in those morbid variations towards excessive or deficient cerebration and neuration which we group under the complex term Insanity (q.v.). Yet that it reaches also the most complex concrete products of evolution is evidenced by the rise and progress of criticism in literature and art. That we have here the closest parallelism to biology and its progress is manifest, as our current phrases of comparative psychology, of mental physiology, pathology, variation, and the like clearly show. We see, indeed, that the science of psychology is now more biological, more evolutionary, and more unified than biology itself, which is still so largely limited by the numerous and confused dispersive and analytic specialisms from which it has arisen, and which it

is still so far from having reorganised. The transition from the static to the kinetic attitude is thus more nearly complete. The debt of science to practice is here obvious in the gain from education and mental hygiene; while the return of the science into practice, as yet only incipient, promises results of the vastest kind. Education would at length have to be viewed and practised in an evolutionary sense, as the process of assisting the entire development of the individual into, it may be beyond, the actual living powers, into the stature and beauty, of the race; instead of smothering the development under the mere accumulation of its dead results in certain fields of detail. Nor is the parallelism of psychical and physiological processes, which enables us to modify more and more mind through body, failing to open up subtler possibilities of modifying body through mind.

Evolution in the Social Sciences.—Leaving fuller treatment to the article SOCIOLOGY, and such special articles (POLITICAL ECONOMY, &c.) as are therewith connected, we may note that the social science of the pre-evolutionary period, although represented on its concrete side by history, and its abstract side especially by political economy, was essentially static. History was necessarily a record of occurrences at specified dates, which, although sometimes set forth in their minor relations of cause and effect, did not admit of any large co-ordination in scientific terms; though the continual attempt by theologians and metaphysicians to construct a philosophy of history indicated at least the need of this. Upon the abstract side we have those attempts to formulate a purely deductive 'science of political economy,' which still so largely survives; although its pretended laws, deduced from postulates of the archaic psychology, such as that of action exclusively arising from self-interest, or from metaphysical abstractions such as utility, are now being replaced by generalisations drawn from the inductive study of social phenomena, actual and historic, and by principles firmly established in the preliminary sciences. The derivation of our whole body of social knowledge from social practice is here of course absolute, all the phenomena being human ones; and the reaction of theory upon practice can only at first sight seem disproportionately small when we lose sight of the importance of the past thought systematised in legal and religious systems. In the world of material interests static views have as yet essentially prevailed: witness the incomparable antiquity of law as compared with that of the modern process of law-making and unmaking which we call internal politics—a form of activity which, however disappointing in its practical results, has at least had something to do with the even more recent emergence and popularisation of the idea of social progress. This characteristically modern idea became increasingly systematised, on the one hand through special studies, and on the other through the unparalleled progress of the mechanical arts. We must note also that the very recent foundation of sociology as a distinct and unified science depended upon the attainment of a synthetic interpretation of the history of western Europe both material and intellectual as the central process of the general evolution of humanity; while no subsequent labours on behalf of the nascent science have been greater than those of that later thinker who has been far more concerned than any other with the general philosophy of evolution.

That the idea of evolution has originally been projected from the social plane into that of the other sciences, is a proposition which can only be doubted by the specialist who has not inquired into the history of his ideas; evolution in social affairs has not only suggested our ideas of evolution in the other sciences, but has deeply coloured them in accordance with the particular phase of social evolution current at the time. The hermit not unnaturally supposes his cosmist meditations to be wholly unspotted by the world he has left behind, but this cannot prevent the historian from rigorously viewing his whole thought and conduct as a product of that world. Nor is absolute demonstration difficult even from the strictest biological specialist's own postulate—that life is interpretable merely as a biological phenomenon. Be it so: then science is the summed (phylogenetic) experience of the race, and the investigator's contribution to it is of course measured by his own development (ontogeny). But the development of an organism, functional and cerebral, is so far *pari passu* with its adaptation to the world around it, but still more in relation to its own species. In other words, the measure of individuation attained by the individual of any species as compared with its fellows is dependent in the first place upon sexual maturity, (2) upon the relations to offspring towards which this tends to develop, and (3) upon the measure of sociality which in so many species arises through the widening of this direct reproductive relation into that of a larger aggregate. This is a proposition which the biologist should be the last to dispute; hence, while arguing for the evolution of the human species by the same agencies which have shaped the lower ones, it is impracticable permanently to retain the absurd assumption, inherited from pre-evolutionary psychology, that mental development goes on as it were in *vacuo*, without reference to the expansion of the organic functions of self-maintaining and species-maintaining. But as this survival becomes outgrown the pure biologist will of course be the first to emphasise and elaborate the proposition that all human developments, like those of any other species, are in terms of these.

Modal Explanation of Organic Evolution.—The conception thus reached of the measure of evolution of a species being expressible in terms of the progress of its (1) self-maintaining and (2) species-maintaining functions is equally capable of statement in biological, psychological, sociological, or indeed also, as moralists are now agreeing (see ETHICS), in ethical terms; what are termed egoistic or altruistic actions being respectively self-maintaining or species-maintaining ones, of course at different levels of evolution. Here, then, we have a basis for the required inquiry as to the mechanism of the evolutionary processes. The evolutionist at anyrate will not dispute this parallelism between the non-ethical aspects of organic evolution, nor deny that the results and processes of evolution in their highest manifestations may be of service in elucidating or criticising the similar ones which must be supposed to exist in less developed forms. Hence he would be in some respects even better justified in tracing the evolutionary process down from the highest aspects to the more simple ones, and from the human species to humbler ones, than conversely: thus the limitations of the doctrine of natural selection may be better understood, and this on two or three distinct sides. It is not altogether easy to meet the criticism sometimes urged by the economist that the process which kills off the weakest of the race weakens and deteriorates those which survive, and that, while some struggle for existence is needful for individuation, human progress is yet observably associated with an advance of the subsistence fund over the requirements of maintenance. Without

insisting upon the difficulties urged by Wallace, Mivart, and other evolutionists as to the descent of man (see MAN, DESCENT OF), the ethical difficulty so common to all inquiries respecting evolution and natural selection in general, but human evolution in particular, cannot be escaped. For we have as yet little beyond the cheerful optimism which sets off the cumulative gain to the species against the incessant sacrifice of the weak to the strong which is in constant progress alike in nature and in human society. And if this be indeed the spring of human progress, how can we resist the logic which calls upon us to remove those adjustments for the mitigation of the struggle for existence for the protection of the weaker, with which, however, not only our feelings and what we have been accustomed to call our higher instincts, but our whole civilisation, material and moral, are inextricably bound up? A classical statement of the central difficulty, of which the Darwinism and the morals are alike unexceptionable, and the resultant dualism therefore clearly set forth, may be quoted from Huxley: 'From the point of view of the naturalist the world is on about the same level as a gladiator's show. . . . We must say that its governing principle is intellectual, and not moral, that it is a materialised logical process accompanied by pleasures and pains. . . . Society differs from nature in having a definite moral object. . . . The ethical man tries to escape from his place in the animal world founded on the free development of the principle of non-moral evolution, and to found a Kingdom of Man, governed upon the principle of moral evolution. For society not only has a moral end, but, in its perfection, social life is embodied morality. But the effort of the ethical man to work to a moral end, by no means abolished, perhaps has hardly modified the deep-seated organic impulses which impel the natural man to follow his non-moral course.'

The natural selectionist sometimes seeks (as Mr Darwin has indeed himself done) to escape this frank return to a pre-evolutionary ethical dualism by reminding us that, since on his view 'nature trusts to the chapter of accidents for variation,' favourable ethical variations may spontaneously have arisen at the social plane. But even if the dawn of similar variations in lower species did not raise a probability of the definite rather than fortuitous nature of such variations, the unity of all the four aspects of organic evolution is none the less given up.

The theory of natural selection is now, however, itself undergoing an evolution which promises fair for an escape from these difficulties, and this on all hands. In its classic form it assumed selection to operate upon an indefinite number of individual variations, which Darwin, at least in some moods, was quite ready to admit might be produced by environment, increased by function, and the like; but which, once selected, were preserved by heredity and frequently increased by new spontaneous variations in the same direction. Now, however (see HEREDITY), we have an ultra-Darwinian school founded by Weismann, and followed by Lankester and many others, which, denying the heredity of acquired characters, pushes back the origin of all variations of species-making importance into the protoplasm of the sex-elements, and so seems to leave natural selection as the only factor of evolution which we can really hope intelligently to grasp, variation seeming inscrutable. The neo-Lamarckian school, on the other hand, with which Spencer must also be reckoned, holds a very different doctrine, that of the importance of individual function and the transmission of its modifications; while the influence of environment is also coming to be studied with not only speculative acuteness but experimental detail. Variation is again being more and more frequently regarded as taking place on a few definite lines; and the origin of species is viewed as a literal development of internal conditions in the species as in the development of the individual, which environment can only bend and colour, and natural selection no more than prune. Such views (see VARIATION), too often formulated with excessive generality and indeed vagueness, yet on the whole with increasing concrete application to detail, are maintained by Nägeli, Cope, Eimer, and many others, including the present writer. It will at anyrate be recognised that there is ample room for such inquiries, and that the importance claimed by natural selection cannot be safely established until they have been disposed of in favour of that hypothesis of indefinite variability upon which this importance essentially depends. It is becoming more and more apparent that it is the problem of variation which is fundamental to selection.

Amid so many various opinions Mr Wallace has come to stand almost alone as an avowed exponent of the theory of natural selection in its classic form; yet even he not only makes the reserve as to human descent above alluded to, but seeks to replace Mr Darwin's sexual selection (see SEX) by a new hypothesis, and so enlists the services of that heresy of definite variation which is so irreconcilable with Mr Darwin's general argument.

The general drift of the contemporary discussion is thus beginning to be apparent: all theories and criticisms have hitherto started with the individual as the unit, and the origin and differentiation of the self-maintaining structures and functions as the primary problem; after which the origin and differentiation of reproductive and species regarding processes have been left only a secondary and subsequent place. But we are beginning to discover that this method of approach, however natural to the individual thinker, is artificial as respects nature; we have above been noting how many different lines of research are turning from the self-maintaining to the species-maintaining process; and the centre of gravity of the science is in fact undergoing a revolutionary change. In thinking of a species we have been wont to call up and investigate the individual type, and to recognise the process of reproduction subsequently only as giving us a less or more varied repetition of this type; but this is a survival of the static and anatomical view. What the general physiologist is now coming to recognise in the species, and what accordingly the evolutionist *a fortiori* must keep in view, is primarily its living continuity, no longer the details of its separate links. From this most general point of view both are coming to see the most complex individual lives, in Foster's phrase, as but the 'by-play of ovum-bearing organisms.' The species is a continuous undying chain of unicellular reproductive units which indeed build out of and around themselves transient multicellular bodies; but the processes of nutritive differentiation and other individual development of these is the secondary, not the primary question.

Instead, therefore, of beginning with the origin and adaptation of the details of self-maintaining advantage, coming later to those of reproduction and sex, and only recognising the mysterious control of the principle of correlation of organs in the background of the whole process, as Darwin and other evolutionists have been wont to do, a fuller initial recognition of the reproductive process raises the question of correlation between the reproductive and individual functions at the outset. We see the sexual development of animal, and still more obviously of plant, everywhere becoming a most

potent determinant of its adult character, and one of classificatory importance far deeper than the mere individual characteristics of the separate species. We see again how the nature and degree of relation to offspring gives a new key to the larger aspects of classification. Thus it is the central generalisation of botany that despite the individual differentiation of fern, selaginella, cycad, conifer, and flower, these turn out on deepest analysis to be but the surviving phases of a continuous and definite increase in the subordination of the sexual parents to their asexual offspring (see FLOWER). Or in the same way, while we define the orders and sub-orders, genera and species of the mammalia by help of the individual apparatus for maintenance or struggle, the larger question of the characteristics of the mammalia, and of their main subdivisions, does not depend upon any mere accumulation of these, as Darwin's very natural application of Lyell's well-known argument would require: for not only the mammal but its essential types, monotremes, marsupial and placental, and even again the subdivisions of the latter, express so many stages in the progress of maternal sacrifice for offspring. In the same way with the evolution of sociality which arises from reproductive aggregation in so many species, we see this subordinating struggle, greatly facilitating not only the increase in numbers of the species, but their higher specialisation as well. We escape from the conception that progress depends primarily upon internecine struggle for existence—i.e. the subordination of the species to the individual, instead of primarily upon that of the individual to the maintenance of the species in sex, offspring, and society. Thus our ethical difficulty at length disappears, since the greater steps of advance in the organic world compel us to interpret the general scheme of evolution as primarily a materialised ethical process underlying all appearance of 'a gladiator's show.'

The corresponding progress in the historic and individual world from sex and family up to tribe or city, nation and race, and ultimately to the conception of humanity itself, also becomes increasingly apparent. Competition and survival of the fittest are never wholly eliminated, but reappear on each new plane to work out the predominance of the higher, the more integrated and associated type; the phalanx being victorious till in turn it meets the legion. But this service no longer compels us to regard these agencies as the essential mechanism of progress, to the practical exclusion of the associative factor upon which the victory depends, as economist and biologist have too long misled each other into doing. For we see that it is possible to interpret the ideals of ethical progress—through love and sociality, co-operation and sacrifice, not as mere utopias contradicted by experience, but as the highest expressions of the central evolutionary process of the natural world. To continue the generalisation of the process of evolution, organic and super-organic, which Mr Spencer, himself repeating on a higher spiral the thought-cycle of many an earlier thinker, has so fully reopened, is to raise anew all the problems of philosophy, which are indeed in a state of evolutionary flux. The singers too of evolution are gathering fuller voice; we have not only indeed fully entered upon evolutionary reorganisation of thought but the corresponding leavening of all forms of art and even of practical life.

See books cited at DARWINIAN THEORY; also articles on the subjects above mentioned, particularly VARIATION, and those on special authors, as SPENCER, LAMARCK, &c. The converse ascending treatment of Evolution, from protoplasm onwards, as in Spencer's *Principles of Biology*, is outlined under EMBRYOLOGY, CELL, PROTOPLASM, and VARIATION.

Evolution, in Algebra. See INVOLUTION.

E'vora (ancient *Ebora*), one of the most interesting cities of Portugal, capital of the province of Alemtejo, is charmingly situated on a fertile and well-cultivated plain, 72 miles E. of Lisbon by rail. It is surrounded by ancient walls long since in a hopelessly ruinous condition, and to some extent by modern fortifications as yet unfinished. It is a very ancient city; Quintus Sertorius took it in 80 B.C., and it was also conquered by the Moors in 715, but recovered from them in 1139. Among the famous Roman antiquities of Evora are the temple of Diana, with fine Corinthian columns; an aqueduct erected by Quintus Sertorius, and restored in the 16th century, which still supplies the city with water; and the beautiful tower, surrounded by Ionic columns, which rises in the city at the extremity of the aqueduct, and which, although it has existed since 70 B.C., is in almost perfect preservation. The town itself is not well built, and the streets are narrow, winding, and dirty. It has a cathedral, founded in 1186, and afterwards restored in the Gothic style. It has been the see of an archbishop since 1540, and has an archiepiscopal library, containing, besides some 25,000 volumes, several pictures of great merit. There are some manufactures of cotton, cloth, and hats, and a trade in wine. Pop. 13,046.

Evremond, CHARLES MARGOTELLO. See SAINT-EVREMOND.

Evreux (ancient *Mediolanum*, later *Eburovices*), the capital of the French department of Eure, is situated in the fertile valley of the Iton, a feeder of the Eure, 67 miles by rail WNW. of Paris. The cathedral, of various dates from the 11th to the 18th century, is a cruciform structure, with Italian façade, a central spire, and fine painted glass. Other buildings are St Taurin's, with a 13th-century shrine, which once contained the relics of that saint, the first Bishop of Evreux; the episcopal palace (1484); and the 'Tour de l'Horloge,' of the same century. Evreux has extensive manufactures of paper, linen, &c., and a trade in grain, seeds, timber, and liqueurs. Pop. (1872) 10,702; (1891) 13,840. Evreux has sustained innumerable sieges, having been sacked in 892 by the Northmen under Rollo, burned by Henry I. of England in 1119, and in 1194 and 1199 captured by Philip Augustus of France. It was frequently taken and recovered in the wars between France and England during the reigns of our Henry V. and VI.—At the neighbouring village of VIEIL EVREUX, supposed to mark the site of *Mediolanum*, excavations have disclosed remains of a theatre, an aqueduct, baths, &c.

Ewald, GEORG HEINRICH AUGUST VON, the famous Orientalist, was born 16th November 1803, at Göttingen, where his father was a cloth-weaver. From 1820 he studied at the university, under Eichhorn, theology and philology, devoting himself especially to the oriental languages; in 1823–24 he was a teacher at the gymnasium at Wolfenbüttel; in the latter year he published his first work, *Die Komposition der Genesis*, and was appointed a theological tutor in his own university of Göttingen. After this he became in 1827 an extraordinary professor, and in 1831 ordinary professor of Philosophy, and in 1835 nominal professor of Oriental Languages. For his share in the protest of the seven Göttingen professors against the annulling of the Hanoverian constitutional law he was deprived of his chair by a rescript of the 12th December 1837; and after spending some months in England he was called to a chair at Tübingen, where he remained for ten years and a half. He was ennobled by the king of Würtemberg in 1841, and in 1848 was recalled to Göttingen, where he spent the remainder of his life. In consequence of his refusal to take the oath of allegiance to the

Prussian government, he was at his own request pensioned off in 1867. His earlier works, chiefly devoted to the grammar and metres of the oriental languages, include *De Metris Carminum Arabicorum* (1825), *Versuch über einige ältere Sanskritmetra* (1827), *Grammatica Critica Linguæ Arabicæ* (2 vols. 1831–33), and his *Kritische Grammatik der hebräischen Sprache* (1827), which he reproduced in an abbreviated form in his *Grammatik der hebräischen Sprache* (1835, 3d ed. 1838), and with greater fullness of detail in his *Ausführliches Lehrbuch der hebräischen Sprache* (8th ed. Gött. 1870). The scientific results of his travels are partly contained in his *Abhandlungen zur orientalischen und biblischen Litteratur* (1832), and in his *Zeitschrift für die Kunde des Morgenlandes*. The rich fruit of his lifelong study of the Old Testament is stored in *Die Dichter des Alten Bundes* (2d ed. 3 vols. 1866–67; Eng. trans. of Psalms, 2 vols. 1880–81, of Job, 1882), *Die Propheten des Alten Bundes* (2d ed. 3 vols. 1867–68; Eng. trans. 5 vols. 1875–81), *Beiträge zur Geschichte der ältesten Auslegung und Spracherklärung des Alten Testaments* (3 vols. 1844), and finally in his magnificent masterpiece, *Geschichte des Volkes Israel* (3d ed. 7 vols. 1864–68; Eng. trans. in 8 vols. 1867–86), with the supplement, *Die Alterthümer des israelitischen Volkes* (3d ed. 1866; Eng. trans. 1876). To the study of the New Testament Ewald contributed his *Jahrbücher der biblischen Wissenschaft* (12 parts, 1849–65), *Die drei ersten Evangelien* (1850), *Die Sendschreiben des Apostels Paulus* (1857), *Die Johanneischen Schriften* (2 vols. 1862), *Uebersetzung und Erklärung aller Bücher des Neuen Testaments* (7 vols. 1870–72). Of his other works the most noteworthy are his *Erklärung der grossen phönikischen Inschrift in Sidon* (1856), *Ueber die phönikischen Ansichten von der Weltschöpfung* (1857), *Die Sibyllinischen Bücher* (1858), *Das vierte Ezrabuch* (1863), *Sprachwissenschaftliche Abhandlungen* (1861–71), *Abhandlung zur Zerstreuung der Vorurtheile über das alte und neue Morgenland* (1872), *Die Lehre der Bibel von Gott* (3 vols. 1871–75). In his scientific studies, Ewald followed his own way. His hand was against every man, and he was impatient of contradiction. He was an equally vigorous adversary of the 'Tübingen School' and of the orthodoxy of Hengstenberg and Delitzsch. In the prefaces and postscripts of his books, and in his year-books for biblical science, he frequently took occasion to express his uncompromising views on the political and ecclesiastical questions of the day, and frequently shows an entirely unjustifiable severity in criticising those from whom he differed. From 1869 he represented Hanover in the Reichstag, and was a decided opponent of the ambition of Prussia. He died of an affection of the heart, 4th May 1875. An autobiography, which he wrote in the last months of his life, was still unprinted in 1889. A monument was erected by his disciples over his grave at Göttingen. Ewald brought to the interpretation of the Hebrew prophets a spirit akin to their own—Hase describes him as a prophet with backward gaze. His patriotism and courage, his poetic fire and energy, his spiritual insight and marvellous power of sympathetically reproducing primitive experiences by the divinations of genius, and the indefatigable industry with which he applied his perspicacity and insight to understand the Hebrew nation and its sacred literature have secured for him the highest place among the biblical scholars of his century. See two admirable critical papers on the life and work of Ewald by Professor Cheyne, in the *Expositor*, third series, vol. iv. (1886).

Ewald, JOHANNES, a Danish poet, was born 18th November 1743, at Copenhagen, where his father was a pastor of the strictest pietistic views. Before his father's death he went to a school at Sleswick, from which he ran away to seek an uninhabited island like that of Robinson Crusoe, but did not get farther than Hamburg. In 1758 he began to study theology at Copenhagen. His love of adventure led him to Magdeburg, where he entered an infantry regiment. He soon deserted to the Austrian army, in which he was first a drummer, then an under-officer. After taking part in several engagements in 1759–60, he obtained his discharge, and returned to theological study at Copenhagen. A disappointment in love was the turning-point of his life. After this he gave his attention solely to poetry. To this also he attributed the irregularities of his life, which bore bitter fruit in the poverty and ill-health of his later years. The allegorical poem, *Lykkens Tempel*, published in 1764, was well received; but it was not till two years later, in his elegy on the death of Frederick V., that he gave clear proof of his lyrical power. The biblical drama, *Adam og Eva* (1769), shows clear traces of the influence of Klopstock. His other writings include a series of satiric plays; the prose tragedy, *Rolf Krage* (1770); and the two masterpieces, *Balders Död* and *Fiskerne*, the latter containing 'Kong Christian stod ved höjen Mast,' which has become the national song of Denmark. He died on the 17th March 1781, leaving an incomplete autobiography, *Johannes Ewalds Levnet og Meninger*. Though he was scarcely thirty-eight years old at his death, Ewald's work has taken a pre-eminent part in the development of Danish literature. Oehlenschläger has testified in some of his finest poems that Ewald was the creator of the modern poetry of Denmark. As Holberg was the father of Danish comedy, so Ewald was the founder of Danish tragedy. Yet his noblest productions are his lyrical poems and odes, the pure beauty of which is scarcely to be surpassed. The best edition of his works is that of Liebenberg (8 vols. Copenhagen, 1850–55). See the Life by Hammerich (1860).

Ewell, RICHARD STODDERT, Confederate soldier, was born in Georgetown, D.C., in 1817, served in Mexico and against the Apaches, and was actively engaged throughout the civil war. In 1862 he fought with distinction under Jackson, losing a leg near Bull Run in August; and, having been promoted lieutenant-general, he served gallantly at Winchester, Gettysburg, and the Wilderness. At Sailor's Creek, however, he was captured, with his entire force, 6th April 1865. He died 25th January 1872.

Ewing, JULIANA HORATIA ORR, writer for children, was the daughter of the Rev. Alfred Scott Gatty and his wife, Margaret Gatty (1809–73), the author of *Parables from Nature*, &c. Born at Ecclesfield, Yorkshire, in 1842, she early began to compose nursery plays for her brothers and sisters, which were performed with her brother, Alfred Scott Gatty, as musical conductor. But she also became proficient in her youth in the modern languages and classical literature. Her nursery stories are said to have suggested to her mother the starting of *Aunt Judy's Magazine* (1866), to which Mrs Ewing became a contributor. After Mrs Gatty's death, she edited the magazine with her sister for a time, and published in it many of her charming stories. These include *Mrs Overtheway's Remembrances, Jackanapes, Jan of the Windmill, A Flat Iron for a Farthing, We and the World, Lob-lie-by-the-Fire, Six to Sixteen, A Great Emergency, Old-fashioned Fairy Tales*, and *The Story of a Short Life*. Mrs Ewing was a graceful writer, and her studies of children, with the varying lights and shadows of child-life, were simple and natural. In 1867 she had married Major Alexander Ewing, the author of a number of translations

from the Turkish and the German. She died at Bath, 13th May 1885. See *Juliana Ewing and her Books*, by Horatia Gatty (1885).

Ewing, THOMAS, American statesman, was born in Virginia in 1789, and in 1816 was admitted to the Ohio bar, of which he afterwards became the unquestioned leader. He sat in the United States senate in 1831–37, was secretary of the treasury in 1841, and in 1849–50 organised the newly-created department of the interior, afterwards returning for a time to the senate. He died at Lancaster, Ohio, 26th October 1871.

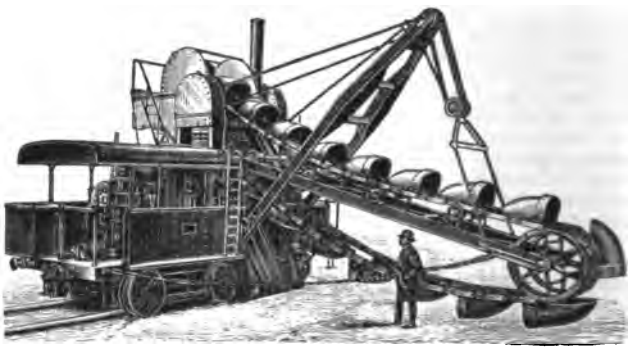
Exanthemata (from a Greek verb, 'to efflorescence,' or come out in a rash), a class of febrile diseases (see FEVER) attended by distinctive eruptions on the skin, appearing at a definite period, and running a recognisable course. To this class belong smallpox, chicken-pox, measles, scarlet fever, and, according to some authorities, plague, typhus, &c.

Exarch was the title conferred by Justinian on his commander-in-chief and vicegerent in Italy, Narses, who reconquered Italy from the Goths (554). The seat of the exarchs was Ravenna. The extent of the *exarchate* was gradually diminished until it embraced only the country about Ravenna (q.v.). This was brought about by the conquests of the Longobards, whose king, Astulf, in 752 put an end to the Byzantine rule at Ravenna; but in 755 he was compelled to resign the exarchate to Pepin, king of the Franks, who gave it over to the Bishop of Rome, Stephen II.—Other Byzantine viceroys were called exarchs; and the title was conferred on certain bishops (afterwards called patriarchs) and other church dignitaries.

Excalibur, the famous mystic sword of King Arthur, which was given him as Merlin promised by the Lady of the Lake, and at his death was flung into the river and caught up by a hand which rose above the waters.

Excambion (from the same source as 'exchange'—Lat. *cambire*, 'to barter'), in Scotland, is the legal name of the contract whereby one piece of land is exchanged for another. The contract usually gives to the parties the right to recur to the original property in case of eviction from the land excambed. Heirs of entail may, with the same consents as are necessary to enable them to disentail, excamb all or any portion of the entailed estate. Where excambed lands are burdened with debts, they are freed of these by the excambion, and burdened with the debts previously affecting the lands acquired in exchange for them. See EXCHANGE (DEED OF).

Excavators. These machines have been brought into use in the making of docks, railway-cuttings, canals, &c. Excavators are made of two kinds, each adapted for different kinds of work, although in some cases they work together very effectively. In making a long 'gullet' or cutting, the first to come into operation has the appearance and all the functions of the ordinary steam-crane, such as is used for loading railway trucks, with the exception that it is mounted on wheels to move on rails, and that, instead of the hook on the end of the chain, there is a large and strong plate-iron bucket or 'scoop,' with a very heavy handle or lever to which a second chain is fastened. The lever is heavy enough to counterbalance the scoop when filled with clay. The machine begins by lowering the scoop, and the two chains are made to push it into the bank until it is full. The suspension chain then lifts the scoop over the wagon, while the chain on the handle lifting it up empties it. The machine now swings round on its centre to renew the operation. The largest size can excavate two cubic yards per minute. As the excavator advances over its rails, those behind are brought to the front. The cutting is made as wide as the arm or 'jib' will reach on both sides of it, which leaves sufficient room for the men to work round it freely, and for wagons to pass. When the cutting has been made the requisite distance forward, the second class of excavator (shown in the engraving) is brought forward to make the cutting wider. The original conception of this is clearly derived from the Dredging-machine (q.v.), which has long been in use in deepening harbours and the mouths of rivers. Its sides are made sloping to an angle of 45 degrees, and on the top of the bank a temporary line of rails is laid a few feet from the edge. The machine is placed on the rails at



Steam Excavator.

the end of the cutting; the jib is lowered until the row of buckets it carries can cut into the clay; these scrape up the bank, reaching the top of it full of soil; they next pass over the machine, and are emptied into the wagons beyond it. The excavator and wagons move forward simultaneously, the latter receiving, in the case of some excavators, a continuous stream of clay equal to about four cubic yards, or two wagon-loads per minute. It will be evident from the foregoing explanation that the first kind of machine is best adapted for docks, and preparing the way in long and deep cuttings for the second kind to follow. It may be said that the first will perform a greater variety of operations, while the second cannot be surpassed in the quantity of material it will remove in a given time. All the movements of excavators are effected by the power of the engine, and two men manage each machine.

Excellency, a title now given to Ambassadors (q.v.), as representing not the affairs alone, but the persons of sovereign princes, to whom it was formerly applied.

Exchange, in Political Economy, is based on the elementary fact that we are ready to give what we do not want for what we do want, or what we want less for what we desire more. Even in very old communities we find a considerable exchange. As soon as the primitive division of labour into agriculturist, weaver, smith, and carpenter was established, there must have followed a mutual exchange of the produce of these callings. But the early exchange was practicable only under very restricted local conditions, for the means of transport and communication were for long not suffi-

ciently developed to convey the staple commodities of industry over very great distances. Indeed, until the means of transport and communication were revolutionised by steam and electricity, all articles that have a considerable weight and bulk in proportion to their value were in general consumed at the place where they were produced. The grain was ground at the village mill, and consumed by those who had produced it; the village smith attended to the iron-work, the village carpenter did the same for the carpentry-work. In the village the wool was spun and woven into cloth, which in general was worn by the people of the locality. The village, parish, or district was an economic unit, within which the business of exchange was for the most part confined.

On the other hand, there had existed from very early times an exchange on a wider scale of commodities which possess a high value in proportion to their bulk and weight, and which are not readily perishable. Gold and silver, precious stones, spices, silk, &c. were the objects of a commerce which was carried on between the Mediterranean countries and the distant East. As civilisation with the corresponding industrial development advanced along the Mediterranean, a more varied and active exchange grew up among the peoples near that great highway of early commerce. Later on it found further scope on the seas and rivers of western and north-western Europe, and along various land routes, especially on those between Italy and Germany. The discovery of America and of the sea-way to India opened up an exchange which has now become universal.

The growth of exchange has simply followed the general social and industrial development. Exchange is based on differences of soil and climate, on differences of social development, on the distinction between town and country, on the growth of the division of labour—in fact, on the wide organic development of the great human society over the different areas of the world. It has particularly depended on the improvement of the means of transport and communication, on the construction of roads and canals, on the development of navigation, and, above all, on the development of steam and electricity. The means of transport are now so perfect that heavy and bulky commodities, such as grain and coal, can be profitably carried half-way round the globe. Exchange has become a dominating principle in economics. Production is only to a very slight degree carried on by the producers for the direct supply of their own needs. Under the large system of industry now prevalent, the outlet for the consumption of any article offered by the producers of it themselves is ridiculously inadequate. Production is carried on for exchange, for a market which may be co-extensive with the world; and through the vast and intricate mechanism of that world-market the consumer obtains the supply for his needs.

The growth of a world-wide exchange has naturally led to a corresponding development of what may be called the instruments and institutions of exchange. First of these is the medium of exchange. In primitive communities we find barter, the simplest method of exchange, still extant; even in the English colonies in North America it was common during the 18th century. The exchange of the civilised world is conducted through the medium of a very elaborate currency. The business of exchange in all the miscellaneous articles known to the civilised world is most largely concentrated in the great markets and exchanges, notably those of London, New York, Paris, Berlin, and Vienna.

Exchange, which up to the end of last century at least was hampered by innumerable restrictions and regulations, may now be generally described as *free;* it is managed by the free competition of buyers and sellers. But there are very important exceptions and modifications which have been indicated in the article COMPETITION.

In exchange the agreement between buyer and seller is reached by a process of bargaining, which has been called the higgling of the market. It is an adjustment of supply and demand, and ultimately of the interests of producers and consumers. The proportion in which things exchange for each other is their Value (q.v.), but this value is generally expressed in money, the medium of exchange, which is their price. But, while the value is expressed in money, exchange itself is always one of commodities against commodities.

It is an evidence of the prominence attained by exchange in the economy of the civilised world that so high an authority as Whately recommended that the science of political economy should be called Catallactics (from Gr. *katallassō*, 'I exchange'). The effect of such a name would be to confound the fundamentals of a science with one of its salient characteristics. Production is a more important department of economics than exchange, while distribution and consumption are fundamental. The chief end of economics is the satisfaction of human needs, production and exchange being alike subsidiary and subordinate to this.

Such is the general doctrine of political economy regarding exchange; but there are some special applications of the word that require notice. Thus, exchange is specially applied to the conversion of the money of one country into its equivalent in the money of another—as by stating the relation which French francs or German marks bear to pounds sterling. It also refers to the difference between the actual value of money, taken by the standard of bullion, in any two places with relation to each other. If in London it costs more than £100 to pay £100 in St Petersburg, the rate of exchange is against the former town, and in favour of the latter; an inhabitant of which will be able to pay a debt of £100 in London with less than £100 worth of bullion in St Petersburg. The process will be best explained by analysing it through means of simple examples. If Thomson & Co. of London buy £100 worth of wine from De la Rue of Paris, and De la Rue, on the other hand, buys £100 worth of cotton goods from Thomson & Co. of London, the two debts, *were there no others between the merchants of the same towns*, would extinguish each other, and there would be no necessity either for transmitting money or drawing bills of exchange. Suppose, however, that it is not De la Rue, but his neighbour Bonchamp who has bought the £100 worth of cotton goods from Thomson & Co., then the debts of all will be settled by Bonchamp paying £100 to De la Rue on Thomson & Co.'s account. Suppose, next, the case of De la Rue being due nothing to Thomson and Co., and Bonchamp being due them only £50, a like sum has to be otherwise found. Van Pradt of Amsterdam is due precisely this sum to Thomson & Co., while either De la Rue or Bonchamp is due the same amount to Van Pradt for a purchase of Gouda cheeses; then it is clear that the several debts can be adjusted among them without the transmission of bullion. It will cost some trouble to adjust the payments, however, and this trouble will have to be paid for. As in paying Thomson and Co. their debt of £100 De la Rue will have to pay for this trouble, the rate of exchange will be against him. If the debt, or any part of it, cannot be met by such an adjustment out of cross debts and credits, it will be necessary for the debtor to send bullion to his creditor; and, this being an expensive process, it throws the rate of exchange

against the debtor who so pays. For instance, if the sum due by the Frenchmen to Van Pradt was only £25 instead of £50, then De la Rue would have had to be at the expense of sending £25 to London in bullion.

No such actual transactions take place in the existing mercantile world, because the accounts in debtor and creditor connected with the three towns above referred to are to be counted in thousands, and ramify into other towns; but the above examples may be held to represent the groups of debtors and creditors, as algebraic signs represent quantities. The individual merchants in one trading town have no idea how the surplus of debit or credit may lie between them, far less can they tell how it may be adjusted by debits and credits in other towns; but, through the agency of bankers, bill-discounters, and other persons who deal in money, the relations of all trading-places towards each other are in a constant state of shifting and adjustment; and any one who has to pay a debt in any trading-place can find out how much he has to give to get that debt paid, and can pay it accordingly. When, through the operation of these complicated transactions, you require to give more than £100 in London to get that amount paid in Paris, then the rate of exchange is against London, and is in favour of Paris, where less than £100 in cash will pay a debt of £100 in London. The difference will generally depend on the difficulty of adjusting questions of debt and credit throughout the field of European commerce in such a manner as to get the debt paid. If it cannot be paid by adjustment, then bullion must be sent; and thus it is generally said that the rate of exchange against any place is limited by the charge of transmitting bullion to it. The rate of exchange is liable to be brought to a level also by commercial exportation and importation, since, whenever it is expensive to get money sent to a country, goods may be sent to that country to compensate the debt. In the general circle of transactions of this kind, the state or town which has the largest amount of transactions will have the largest number of debtors and of creditors, and will thus afford the chief facility for each compensating the other. For this and other reasons London is the centre of the money-market, where all the debts and credits in the world may be said to meet and extinguish each other (see BILL OF EXCHANGE). While the old notions about the Balance of Trade (q.v.) existed, it was supposed that the nation which the exchange was against was going to ruin, while that which it was in favour of was prospering through the other's loss. Such general statements must be tested by a comprehensive analysis of all the relevant facts. Gold-producing countries find bullion their most advantageous export, and the same is the case with countries into which gold has flowed in excess.

Exchange, a term applied to buildings or places of resort for merchants. The name *Bourse* (Lat. *bursa*, 'purse') is applied in France and Belgium to a resort of this kind; and in Germany, *Börse*.

Exchanges originated in the commercial cities of Italy, Germany, and the Netherlands; and Sir Thomas Gresham, who had resided as English agent at Antwerp in 1550, chose the Bourse of that city as a model for the Royal Exchange of London. Gresham's Burse, for so it was originally called, was built on Cornhill in 1566–67. It consisted of a quadrangle with an arcade; above was a corridor (called the *pawn*) with stalls, for the sale of wares; outside were shops. On January 23, 1571, the Burse was ceremoniously opened by Queen Elizabeth, who, by herald and trumpet, caused it to be proclaimed 'The Royal Exchange.' This first exchange of London was almost entirely destroyed by the great fire of 1666. A new exchange was forthwith erected on the spot, and opened in 1669; but it also was destroyed by fire, in 1838. The foundation-stone of the third exchange was laid in 1842; and completed at a cost of £180,000, from the designs of Tite, it was opened October 28, 1844, by Queen Victoria.

The term exchange seems to have been naturally adopted from the circumstance that buying and exchanging of merchandise, and also exchanging and paying away of money, formed the chief object of concourse. In the present day, early intelligence in matters affecting commerce and public finance forms a principal attraction of this kind of resort. Although open daily, there are usually certain days and hours of meeting when the throng is considerable. The meeting is familiarly called 'Change.' The two great days of meeting at the Royal Exchange, London, are Tuesday and Friday, and the busiest time is from three to four o'clock.

In London there are several other exchanges, but for special purposes; among these are the Corn Exchange in Mark Lane, the Coal Exchange in Lower Thames Street, the Hop and Malt Exchange in Southwark, the Hide and Skin Exchange or Market in Bermondsey, and the Stock Exchange, near the Bank of England. Amongst the exchanges in the large towns of England and Scotland, those of Manchester, Liverpool, and Glasgow are specially noteworthy. There are exchanges, many of them for special purposes, in Augusta, Baltimore, Boston, Brooklyn, Buffalo, Charleston, Chicago, Detroit, Louisville, New Orleans, New York, Philadelphia, Richmond, St Louis, San Francisco, and other cities of the United States. See CHAMBER OF COMMERCE, STOCK-EXCHANGE.

Exchange, DEED OF, in English law, a common law assurance, whereby persons severally seised of lands mutually grant them in exchange, each his own land for that of the other. The two subjects must be of the same nature, as lands for lands, chattels for chattels, but not real for personal estate. The parties must take an equal estate—thus, an estate in fee cannot be exchanged for an estate tail; and the word 'exchange' must be used. There must also be entry, and if either party die before entry his heir may avoid the transaction. Exchange must now be made by deed, but this form of conveyance is seldom used, the same purpose being effected by two separate deeds of grant. A mutual warranty and right of entry was formerly implied in an exchange. This effect of the deed has been taken away by an Act of 1848. By the Common Enclosure Act of the same year the commissioners are empowered to make exchanges for the better carrying out of the purposes of the act. A deed of exchange closely resembles in its particulars an Excambion (q.v.) in Scotland. The law as to exchange in most of the American states is founded on and similar to that of England.

Exchanges, MILITARY, are certain arrangements made between officers of the British army to enable them to change their regiments or stations. Officers exchanging must be of the same rank. Artillery, engineer, marine, or departmental officers can only exchange in their respective corps, and do not lose seniority by doing so. Officers of other branches may exchange with each other, but, if they change regiments, go to the bottom of the list of officers of corresponding rank. Exchanges are arranged by Army Agents (see article ARMY), and others who make it their business to carry them out; but each exchange

requires the sanction of the commander-in-chief, and of the two commanding officers affected by it. Considerable sums are often paid by one officer to another to induce him to exchange.

Exchequer. The ancient Exchequer in England was a branch of the King's Court, in which sheriffs and others were held to account for the revenues they received, and questions relating to the royal revenue were decided. The name exchequer (Fr. *eschequier* in the 12th century, from *eschec*, 'check' at chess) was derived from the checkered tablecloth on which money was counted, a practice which was continued in the Scottish Court of Exchequer down to modern times. In England the financial department of the court was called the receipt of the Exchequer. The Chancellor of the Exchequer was originally appointed as under-treasurer, to check the proceedings of the Lord High Treasurer (see TREASURY). He sat as a judge on the 'equity side' of the Court of Exchequer, or on the rehearing of cases in which the other judges of the court were equally divided in opinion. But in modern times his position has been that of first finance minister of the crown; the office is sometimes held by the prime-minister, when he is a member of the House of Commons. The last case in which the Chancellor of the Exchequer sat as a judge was in 1735; the decision then given by Sir Robert Walpole is said to have caused great satisfaction; but his successors have not figured among the judges except on occasions of state and ceremony. The receipt of public revenue now belongs to the several revenue departments, under the supervision of the Exchequer and Audit Department and the Treasury. See Madox, *History of the Exchequer* (1711; new ed. 1769). For exchequer tallies, see TALLY.

The Court of Exchequer was originally, as has been stated, a revenue court, but it obtained a general common-law jurisdiction by means of the writ of *Quominus*, wherein it was set forth that the plaintiff, by reason of the wrong done to him by the defendant, was deprived of the means of discharging his debt to the crown. This fiction was abolished in 1832. The ordinary judges of the court were the Chief Baron and three puisne Barons, so called, according to Selden, 'because they were anciently made of such as were barons of the kingdom.' The equity jurisdiction of the court is said by Coke to date from a statute of 1542; it was transferred to the Court of Chancery in 1842. In 1875 the Exchequer became a division of the High Court of Justice. The Exchequer Division is now merged in the Queen's Bench Division; the office of Chief Baron has been abolished, and no judges are now appointed with the title of Baron. See COMMON LAW, and Coke's *Fourth Institute*.

The Court of Exchequer Chamber was formerly a court of all the judges in England assembled for decision of matters of law. The ordinary jurisdiction of the Court of Exchequer Chamber was as a court of error, in which capacity it revised the judgments of the three courts of common law; the decisions of each court being revised by the judges of the other two. An appeal now lies from each division of the High Court of Justice to the Court of Appeal.

In Scotland, before the Union, the Exchequer was the king's revenue court. It consisted of the treasurer, the treasurer-depute, and as many of the lords of Exchequer as the king was pleased to appoint. The Scottish Court of Exchequer was continued by the 19th article of the treaty of union, until a new court should be established, which was effected in 1707. A privative jurisdiction was conferred on the court as to questions relating to revenues and customs of excise, and as to all honours and estates real and personal, and forfeitures and penalties arising to the crown within Scotland. But questions of *title* to lands, honours, &c. were reserved to the Court of Session. The judges of the court were the high treasurer of Great Britain, the chief baron, and four other barons; and English barristers as well as Scotch advocates were allowed to practise in the court. In cases of difficulty, and where there was a collision of jurisdictions, it was formerly not unusual to hold conferences with the barons; and the form of desiring the conference was to send the Lord Advocate, and, in his absence, the Solicitor-general, to request a meeting, though it has been doubted whether they were bound to carry the message. In 1832 it was enacted that successors should not be appointed to such of the barons as should retire or die, and that the duties of the court should be discharged by a judge of the Court of Session. And in 1886 the Court of Exchequer was abolished, and the jurisdiction transferred entirely to the Court of Session.

The Court of *Exchequer Chamber* in Ireland was established in 1800, but was abolished as an intermediate Court of Appeal between the Irish Courts and the High Court in England.

Exchequer Bills, bills issued at the Exchequer under the authority of acts of parliament, as security for money advanced to the government. They contain an engagement on the part of the government for the payment of the principal sums advanced, with interest. These bills form the chief part of the unfunded debt of the country. They were first issued in the reign of William III., in the year 1696, and were drawn for various amounts from £100 to £5. At that time they bore interest at the rate of 3d. per day on £100. The interest was reduced to 2d. during the reign of Anne. During the war 1793–1814, the rate of interest was usually 3½d. At present it is generally from 1½d. to 2½d. per £100 per diem. Holders of these bills are exempt from all risk, except that arising from the amount of premium or discount they may have given for them. The bills pass from hand to hand as money, and are payable at the Treasury at par. They may also be paid to government in discharge for taxes. When it is intended to pay off outstanding Exchequer bills, public notice is given by advertisement. The advances of money to government by the Bank of England are made on Exchequer bills. These bills are a convenient means whereby government can meet a sudden demand for unusual expenditure. The unfunded debt consists of Exchequer Bills, Exchequer Bonds, and Treasury Bills; the total unfunded debt outstanding at 31st March 1893 was £20,748,270. See NATIONAL DEBT.

Excise, the name of a tax on commodities, from the Latin *excisus*, 'cut off,' as being a portion of the value of the commodity cut off and set apart for the revenue before the commodity is sold. This is not its actual nature, however, for the manufacturer who looks to a profit on his product does not give part of the value to the revenue; he merely counts the tax as part of his expenditure, or, in other words, includes it in the price, the tax being really paid by the consumer. An inland tax on commodities sold and bought for consumption in the country is a very ancient one, but it has generally appeared in the simple shape of a toll or *octroi* on goods brought to market. The complicated arrangement for officially watching the process of a manufacture, for the purpose of seeing that none of the dues of the revenue are evaded, is of comparatively modern origin. It was first introduced into England, upon the Dutch model, by the Long Parliament, which established an excise on liquors in 1643, and in subsequent years on articles of

food, salt, silk and stuffs, and other commodities in general use. Though unpopular, the excise in some form or other has ever since continued to be a material element in the taxation and revenue of Britain. In the earlier part of the 18th century Sir Robert Walpole entertained the notion of enlarging its productiveness, while mitigating its proportional pressure by the bonding system, which suspends the exaction of the duty until the goods are sold, and thus leaves the manufacturer with all his capital to be devoted to production (see BONDED WAREHOUSES). But the rumour of an enlargement of the unpopular excise duty created a general excitement, and the memorable cry of 'Liberty, Property, and No Excise,' compelled Walpole to abandon his project.

An excise, when compared with other taxes, has its good and its bad features. It is a method of extracting money for national purposes from personal expenditure on luxuries, and is especially serviceable when received from those luxuries the use of which in excess becomes a vice. On the other hand, it renders necessary a system of inquisitorial inspection not very agreeable to a free people, and open to abuse and fraud; while at the same time excessively high duties, and duties on commodities strictly of domestic manufacture, lead to smuggling and all its demoralising consequences. The evils of an excise were formerly aggravated by the practice of farming the duties—i.e. by letting them to the highest bidder, whose interest it became, like any other contractor, to make the greatest possible profit by his speculation, and consequently to exact the duties in the most rigorous manner. In every well-regulated revenue system it is, of course, only fair to all parties that the duty, as the law lays it on, should be fully exacted; but in the age of farming the arrangements were all slovenly, and there was much latitude of power in the hands of the farmers. The farming system became very oppressive in France, especially in the *gabelle* or excise on that necessary of life, salt. It is a curious fact, however, that when the farming of the excise was abolished in Scotland by the Union the people grumbled, saying they were easier under the farmers, their own neighbours, who acted on the principle of 'live and let live,' than under the officers sent down from England, who rigorously collected the impost.

An excise works most easily when it is laid on some commodity manufactured on a large scale. In a great distillery the excise officer is almost a portion of the establishment; he has an eye on every step of the process, with the object of seeing that the commodity does not get into the market without government obtaining its proper share—sometimes far the greater part—of the market price. The social influence of such an arrangement is very different from that of the old candle and salt duties, which made it the function of the exciseman to pounce on a farmer melting the surplus tallow of the last killed sheep, or on a fisherman boiling sea-water to procure salt for his potatoes. The manufacturer, however, though he has the benefit of the bonding system, feels the excise regulations to be a considerable drag and hindrance in his operations, since there are numerous minute operations which he cannot perform without sending special notice to the excise department, or having an officer actually present. This renders it necessary, too, that all the steps of the process should not merely be defined as between the manufacturer and the officer, but should be set forth in an act of parliament; and hence deviations for the purpose of economy, or by way of experiment, become difficult, and sometimes impracticable. As difficulties with which the producer has to contend, these things require him to lay on the selling price of the commodity a larger addition than the actual amount of the duty. This objection, however, is less potent than it formerly was, for the introduction of machines and special apparatus, such as alcoholometers, saccharometers, &c., has greatly facilitated the collection of excise duties.

No method of taxation requires a nicer adjustment to the social condition of a country than an excise. While it is now admitted that necessaries of life should be free, yet some form of tax upon consumption is the only method by which certain classes of the people can be made to contribute their share to the revenue of the country. But for the excise and customs dues on beer, spirits, and tobacco, and some licenses, many persons would evade all share in the national burden. In England, in the year 1746, a duty of 20s. a gallon was laid on spirits, with the view of suppressing the vice of drunkenness, which, however, it greatly increased, for the law became a dead letter, and the smuggler fully supplied the market, although within the two years in which the law was in force no fewer than 12,000 persons were convicted of offences against the act. In Scotland, the duty, which was 5s. 6d. a gallon, had to be reduced in 1823 to 2s., on account of the prevalence of smuggling—half the consumption of the country, in fact, paying no duty. The duty has since then been gradually raised, until it now amounts to 10s. a gallon, forming a large source of revenue. The productiveness of the spirit duty, and a better understanding of the true principles of taxation, has led to the gradual removal of many excise duties, as, for instance, on salt, candles, leather, glass, soap, paper, &c. The malt-tax was transferred to beer in 1880.

In 1849 the excise department was amalgamated with that of stamps and taxes to form the Board of Inland Revenue; and many changes have been made, both as to the articles taxable and in the organisation of the excise system. The only items on which excise duties are now charged are spirits, beer, tobacco, chicory, and the passenger receipts of railway companies. But various taxes of the nature of license-duties for following particular pursuits are collected in the excise department; also several items chargeable before 1869 as assessed taxes. License-duties must be taken out yearly by auctioneers, appraisers, brewers, maltsters, distillers, makers of vinegar, victuallers, sellers of beer, spirits, and wine, sellers of playing-cards if also makers, hawkers, pedlars, horse-dealers, house-agents, tobacconists, pawnbrokers, dealers in sweets, and dealers in patent medicines. Game-licenses, gun-licenses, and licenses for male-servants, horses, dogs, carriages, and the use of armorial bearings come under the same department. The whole excise revenue of the United Kingdom in the fiscal year ending 31st March 1858 was £17,901,545; 1868, £20,190,338; 1878, £27,710,514; and 1888, £25,620,000, when the cost of collecting it was £1,771,785. The principal items of the receipts in the last-named year were: Beer, £8,711,532; spirits, £13,028,204; railway passengers' duty, £314,933; and licenses. Among the latter the chief contributors were beer and wine dealers, £186,574; dog-licenses, £354,278; carriages, £549,525; armorial bearings, £74,526; male-servants, £136,287; game, £179,143; gold and silver plate, £47,919; gun, £86,317; pawnbrokers, £35,722; hawkers and pedlars, £26,942; brewers, £19,280; auctioneers and appraisers, £79,300; spirits (distillers), £4242, (dealers), £121,194; publicans and grocers licensed to sell liquor, £1,485,936; tobacco, £84,855; wine and sweets, £67,366. The budget estimate of the

excise receipts for the fiscal year 1888–89 was £25,505,000, and the estimated cost of collection £1,807,629. In introducing this budget, Mr Goschen proposed a new scale of carriage-duties, to institute what was called a 'Wheel and Van Tax,' and to put a special impost on 'pleasure-horses.' This proposal, owing to the opposition it excited, was withdrawn, as was also a proposal to repeal the hawkers' license. That license, however, was in 1888 reduced from £4 to £2. According to the present organisation of the excise department, the United Kingdom is divided into collections, each under a collector; the collections are subdivided into districts, each under a supervisor; and these into divisions, each under division-officers and ride-officers. The efficiency with which these officials discharge their duties secures a very complete payment of taxes, and their manner of dealing with the tax-payers leaves a *minimum* of just ground for complaint. The old feeling of objection to the excise as a 'foreign system' has completely worn away, and the tax is now probably as popular as any impost is ever likely to be. To put it otherwise, the excise is not disliked so much as the income-tax. See the articles BEER, WHISKY, &c.

In the United States, the word excise is not officially used, the corresponding title being 'internal revenue.' This is raised mainly from whisky, tobacco, and malt liquors; other items being the tax on banks and bankers, and on oleo-margarine. Stamps ceased to be a source of revenue after 1883. The total internal revenue was $371,403,277 in 1887, $379,266,074 in 1888, $387,050,058 in 1889, $403,080,982 in 1890, $392,612,447 in 1891, $354,937,784 in 1892, $385,819,629 in 1893; ordinary expenditure in 1893, $383,477,955.

Excitants. See STIMULANTS.

Exclusion Bill, a measure brought forward by Shaftesbury in 1679 to exclude the Duke of York, afterwards James II., from the succession to the throne, on account of his avowed Catholicism. It thrice passed the Commons, and as often Charles II. resorted to a dissolution, till, after March 1681, he ruled without parliamentary control.

Excommunication. The word 'excommunication' denotes exclusion, whether temporary or permanent, from fellowship in religious rites, involving also, where participation in such rites is required in the civil order, privation of the rights of citizenship. It is not peculiar to the biblical religions, but is found in most of the systematised cults, whatever be their origin. Thus, Cæsar describes its operation amongst the Gauls, stating that contempt of the decisions of their judges was visited with interdiction from the sacrifices. 'This is a most severe penalty with them. For those so interdicted are counted as sinful and wicked; all keep aloof from them, and avoid approaching or addressing them, lest they should incur some injury by contact; they are granted no right which they claim, nor is any honour bestowed upon them' (*Bell. Gall.* vi. 13). The absence of any remark as to a corresponding usage amongst the Romans and Greeks of the time is enough to show that Cæsar was not familiar with the practice; but slight indications are discoverable of analogous usages, so far as regards exclusion from common acts of worship, amongst which the Latin word *profanus*—signifying that which is 'outside the temple'—may be specially cited. The clearest analogy, however, to the Christian discipline of excommunication is that furnished by the Rabbinical code. This is ultimately based on the legislation of the Pentateuch, which excluded the ceremonially unclean, as well as offenders of a graver kind, both from religious and civil fellowship (Lev. xiii. 46; Numb. v. 2, 3; xii. 14, 15); and the penalty is recorded in Ezra, x. 8, as enforced against such Jews of the captivity as disobeyed the proclamation to assemble at Jerusalem. The offender first received a public admonition, and seven days later, if he did not make satisfaction, the lesser excommunication, *Niddui*, was pronounced against him, whereby he was isolated during thirty days from contact with all save his wife and children, being obliged to keep at least 4 cubits' distance from all others; and although the sentence did not technically include expulsion from the synagogue, yet this provision practically enforced it. At the expiration of the 30 days, a second term of like duration was enjoined in case of continued impenitence; and the contumacious were then visited with the greater excommunication of *Cherem*, which excluded both from the synagogue and from all social intercourse, and the offender was treated as a leper. These two grades of excommunication were the only ones anciently in use; but the later Rabbins added a third and severer one, styled *Shammatha* or *Anathema Maranatha*, which was lifelong, attended with solemn imprecations, and sometimes entailing forfeiture of goods.

The Christian system of excommunication is based doctrinally on the precept of Christ (Matt. xviii. 15–18) and on the precepts and practice of St Paul (Rom. xvi. 17; 1 Cor. v. 3–5, 11; 2 Thess. iii. 14) and St John (2 John, 10, 11); while its practical method was borrowed from the synagogue, and formulated certainly by the 3d century, perhaps as early as the 2d. It was primarily, as the word denotes, exclusion from communion in the eucharist and the *agape* or love-feast, including also suspension from office in the case of clerical offenders; and it was distinguished as major and minor, each having various degrees of severity. Thus, the lightest form of excommunication permitted the offender to join in all acts of public worship except to make oblations and actual reception of the eucharist; the grade next below was not suffered to be present during the latter part of the liturgy, but only during the preliminary prayers and the remaining public offices; below this class again came those who were excluded entirely from the prayers, but permitted to enter church to hear the Scriptures read and sermons preached; while the lowest grade of all was refused permission to enter church, being obliged to remain outside the doors until the expiry of their term of penance. Similarly, the major excommunication, besides its exclusion of offenders as well from social intercourse as from all participation in church fellowship and ordinances, which applied in all cases, had also the graver form of anathema, fulminated against the most obstinate offenders, and chiefly such as taught or abetted heresy, or, at a somewhat earlier date, those who had lapsed in time of persecution, and had either sacrificed to idols or obtained certificates alleging them to have done so. The controversy as to the possibility of readmitting such persons to communion at all—denied by the Novatianist or rigorist school—was one of the most serious which agitated the church in the 3d century; and, though the milder course ultimately prevailed, yet even the moderate party insisted upon very severe and prolonged penalties, seldom pardoning the offender till the very close of life, unless at the personal intercession of a martyr. Notice of such greater excommunication was sent by circular to all churches in the case of clerical offenders or laics in official positions, to insure the universal incidence of the penalty; and intercourse with any one underlying it involved the same punishment as the original offence, the lesser excommunication being

incurred *ipso facto*, and the greater by persistence in such intercourse after admonition. At a very early date the aid of the civil power was invoked in support of the spiritual sentence, not only by preventing resistance thereto, but by superadding a temporal penalty. Thus, the fifth canon of the Council of Antioch in 341, after enacting that any cleric setting up a schismatical place of worship shall be deposed for life, adds: 'And if he persist in troubling and disturbing the church, let him be corrected by the civil power as a seditious person.' And in the third Council of Carthage in 397 a canon (xxxviii.) was passed to petition the governor of the province to remove an intruding bishop who had disregarded the ecclesiastical censures passed upon him; which was embodied later in the general code of the African Church, as well as two others of a like nature (lxvii. and xciii.) directed against the Donatists. In the Theodosian Code there is a law imposing a fine of ten pounds of gold upon all heretical persons conferring or receiving ordination, further confiscating the place where the act occurred, if done with the knowledge and assent of the owner; and many such enactments appear in later history, such as the decree of Childebert in 596, the Capitularies of Pepin in 755, and the Constitutions of Lothar I. in 825, whereby excommunicated persons were put to the ban of the empire; while a constitution of Frederick II. in 1220, alleging that the material sword is appointed for the aid of the spiritual sword, enacts that, in the event of excommunicated persons not making satisfaction within six weeks from the sentence, the civil ban is to issue thereupon, and not to be revoked until the previous removal of the excommunication. The theory that the spiritual sword might be turned against the civil power itself, and that excommunication deprived sovereigns and other magistrates of their authority, voiding, indeed, all civil rights, is peculiar to Latin Christianity, and is a development of the Hildebrandine era and policy (see ALLEGIANCE), first put into actual execution by Gregory VII. against the Emperor Henry IV. in 1076, and again in 1080, renewed in 1084 by Urban II., and in 1102 by Paschal II.; and later against the Emperor Philip of Swabia, and in favour of his competitor Otho IV. by Innocent III. in 1210. It is compendiously stated thus by Cardinal Francis de Toledo (1532–96) in his *Instructio Sacerdotum*, a work of much repute, recommended by Bossuet: 'An excommunicated person cannot exercise an act of jurisdiction without sin; nay, if the excommunication be publicly made, his sentences are null' (lib. i. chap. 3). The latest instances of the kind are the excommunication of Napoleon I. by Pius VII. in 1809, and that of Victor Emmanuel II. by Pius IX. in 1870. But the omission of their names in these documents, which are vaguely and indefinitely fulminated against enemies and oppressors of the holy see, barred the full operation of the sentences in canon law, and left the question of allegiance untouched.

In the actually current discipline of the Roman Catholic Church a distinction is drawn between such sentences of excommunication as are incurred *ipso facto* (technically known as *latæ sententiæ*) and such as do not take effect till after the formal sentence of an ecclesiastical court (called *ferendæ sententiæ*); and those subject to such sentences are distinguished as *tolerati* and *non-tolerati*, the former of whom are still eligible for social and civil intercourse, while the latter are absolutely excluded from all such communion, as well as from the ordinances of religion. In theory the right to pronounce the greater excommunication is limited to the pope solely, as also the power to absolve therefrom; but in practice this authority is conveyed to all bishops in their quinquennial faculties, for local exercise within their dioceses, and by them to the clergy under their jurisdiction, so far as regards absolution, but not for pronouncing sentence, which is never committed to any one below the rank of bishop or judge. In most Roman Catholic countries, if excommunication involves any civil disabilities, it cannot be published without the sanction of the civil power, and in some of them there is an appeal to the law-courts on the merits, to obtain fresh examination of the case at the hands of the ecclesiastical authorities. It is a mistake to ascribe to Roman Catholics the doctrine 'that excommunication may be pronounced against the dead.' The contrary is expressly laid down by all canonists (Liguori, *Theologia Moralis*, lib. vii. n. 13, 1). In the cases in which this is said to have been done, the supposed 'excommunication of the dead' was merely a declaration that the deceased individual had, *while living*, been guilty of some crime to which *excommunication is attached by the church laws*. Roman Catholic writers, moreover, explain that the civil effects of excommunication in the medieval period—such as incapacity to exercise political rights, and even forfeiture of the allegiance of subjects—were annexed thereto by the civil law itself, or at least by a common international understanding in that age. Examples are alleged in the law of Spain, as laid down in the Sixth Council of Toledo, a mixed civil and ecclesiastical congress (638); in the law of France, as admitted by Charles the Bald (859); in the Saxon and in the Swabian codes; and even in the English laws of Edward the Confessor; all which, and many similar laws, proceed on the great general principle of these medieval monarchies—viz. that orthodoxy and communion with the holy see were a necessary condition of the tenure of supreme civil power; just as by 1 Will. and Mary, sect. 2, chap. 2, profession of Protestantism is made the condition of succession to the throne of England. Hence, it is argued, the medieval popes, in excommunicating sovereigns, and declaring their subjects released from allegiance, did but declare what was, by the public law of the period, the *civil* effect of the exercise of what in them was a *spiritual* authority.

By the discipline of the Roman Catholic Church, kings or queens, and their children, are not included in any general sentence of excommunication, unless they be specially named.

Certain 'reserved cases' are limited to the pope alone, and are enumerated in the brief 'Apostolicæ Sedis,' promulgated by Pius IX. in 1869, which also contains a list of those sentences, *latæ sententiæ*, now in force within the Roman Church; but an ordinary priest is permitted to absolve those at the point of death from even the reserved excommunication.

The oriental discipline is much less elaborate, and more nearly accords with ancient practice; but the distinction between the greater and lesser excommunication is retained, and no fewer than 115 offences, involving various degrees of excommunication, are specified in the office-books, ranging from twenty years' exclusion, for such crimes as murder or magical practices, down to bigamy, with its penalty of one year and merely ceremonial disqualifications, yet briefer in effect. The greater anathema is fulminated yearly throughout the Eastern Church on Orthodoxy Sunday (first Sunday in Lent) against about sixty forms of heresy, for the most part extinct; but in the Russian Church they have been cut down to twelve still prevalent types of opinion.

In the Church of England the medieval practice conformed in the main to the current western usage, save in this one important respect, that an excommunication *ipso facto* was not really in

operation; for though the term occurs frequently, yet what it denotes is only that, given a certain offence, excommunication must follow as the penalty, but a declaratory sentence of a competent court must precede the actual excommunication.

Various civil disabilities attended excommunication, and were continued after the Reformation, such as inability to hold a benefice, to practise as an advocate or attorney in the courts, to be admitted as a witness, and to receive Christian burial. By a canon of 1597 the ordinaries were to provide for the public denunciation monthly in the cathedral of the diocese and the parish church of the offender, in all cases where an excommunicated person had not made satisfaction and obtained absolution within three months after incurring sentence; and this was embodied in the canons of 1604 (lxv.), with the alteration to a half-yearly denunciation, but with the further provision that those present should be induced to apply for a writ *De excommunicato capiendo*, 'thereby to reduce them to due order and obedience.' This writ was issued by the Court of Chancery on the application of the diocesan, and addressed to the sheriff or other officer, and warranted the imprisonment of those arrested under it. The disabilities attending excommunication were abolished for England by the Act 53 Geo. III. chap. 127, and for Ireland by the 54 Geo. III. chap. 68; while all remaining penalties against persons dissenting from the worship and doctrines of the Church of England were repealed by 7 and 8 Vict. chap. 2, and 9 and 10 Vict. chap. 59. The most notable exercise of the power of excommunication in the modern Anglican Church was when Bishop Gray, as Metropolitan of Capetown, deprived and excommunicated Bishop Colenso of Natal in 1863, which sentence, approved by the Convocations of Canterbury and York, the General Convention of the American Episcopal Church, the Episcopal Synod of Scotland, and the Provincial Council of Canada (as well as by a large majority of the bishops assembled at the first Lambeth Conference in 1867), was reversed by the Judicial Committee of Privy-council in 1865, on the ground that the crown had no power to erect the see of Capetown into a metropole, nor to give Bishop Gray the coercive jurisdiction on which he had relied as empowering him to try one of his suffragans and pass sentence upon him.

In the Established and other Presbyterian churches of Scotland, the lesser excommunication, involving deprivation of all 'sealing ordinances,' can be pronounced by the kirk-session. The greater excommunication can be pronounced by authority of the presbytery only; it is now very rarely heard of, and since 1690 it does not carry with it any civil consequences.

A very singular kind of excommunication is that connected with the usage of *tabu* amongst the islanders of Polynesia. Tabu is a species of interdict which may apply to persons or things; in the latter case making any use of the interdicted article, or even contact with it, unlawful and penal; in the former cutting off the interdicted person from all intercourse or contact with others, and even prohibiting him to use his hands to feed himself; a chief or noble being allowed a servant, also put under tabu, to feed him, and a man of lower rank being obliged to pick up his food with his mouth only, like a beast.

Islam forms an exception to the almost universal incidence of the practice of excommunication. Under the Moslem code every religious offence carries with it a temporal penalty, such as fines, scourging, stoning or other mode of death, and only in this last manner can an offender be cut off from the congregation. See BELL, BOOK, AND CANDLE; also INTERDICT.

Excretion. See SECRETION; and for the excretory organs, see RESPIRATION, SKIN, KIDNEYS, URINE, &c.

Exe, a river of Somerset and Devon, rising in Exmoor, and flowing 54 miles south-eastward and southward to the English Channel at Exmouth. The lower 5 miles form a tideway a mile broad at high-water, with wooded and picturesque shores, and navigable for large vessels. An ancient canal connects the estuary with Exeter (q.v.). The chief tributaries of the Exe are the Barle, which also rises in Exmoor, and is 24 miles long, Batham, Loman, Culm, and Creedy. The Exe passes Dulverton, Bampton, Exeter, and Topsham. The greater part of its course is through wooded and romantic vales.

Execution, in Law, is the act of completion or carrying into effect. Thus a writ is executed by obeying the instructions contained in it; a Deed (q.v.) is executed when it is signed, sealed, and delivered; a power is executed when it is exercised; a judgment of a court is executed when it is enforced. Judgments are usually enforced by writs of execution, which direct the officers of the law to do what is necessary, or to compel a defendant to perform some act. The term 'execution' is used now technically to denote execution to recover a debt—the kind that occurs most usually in practice. In Scotland, the term execution is also applied to the written attestation under the hand of the executive officer that he has carried his warrant into effect, as by serving a summons or giving a citation. It corresponds to the affidavit of service of writ in England.

Execution, in civil law. In civil cases the common law of England allows four different writs to issue against refractory debtors—viz. a *fieri facias* (called commonly a *fi. fa.*), a *capias ad satisfaciendum* (*ca. sa.*), *levari facias*, and *elegit*. These writs issue from the court of the Division in which the proceedings are grounded, and are addressed to the sheriff of the county. By a *fi. fa.* the goods and chattels of a debtor may be attached. This writ lies against all proprietors, peers, &c. A writ of *ca. sa.* is directed against the person of a debtor. It does not lie against privileged persons. Under this writ, the sheriff may imprison a debtor, and detain him until the debt has been satisfied. A writ so stringent in its effect is regarded by the law as the last remedy; hence, when a *ca. sa.* has been issued, no other writ can proceed against the debtor. But if a *fi. fa.* has been first issued for a part of the debt, a *ca. sa.* will still lie for the remainder. By recent statutes, a *ca. sa.* cannot be issued to imprison for debt unless fraud or contempt of court is involved. A *levari facias* is now seldom used. It is directed against a man's goods and the profits of his lands. The writ of *elegit* is of very ancient date (see ELEGIT). In the Chancery Division of Court, *execution* against the estate is effected by writ of *fieri facias* or writ of *elegit*. Execution against the person is by writ of attachment. Should this latter writ be returned *non est inventus*, the party prosecuting has it in his option to take out a writ of sequestration of the estate, with issues of course, or to obtain an order for the serjeant-at-arms. An attachment does not lie against a peer or other privileged person, but an order called a sequestration *nisi* is issued. In cases of contempt, the High Court in each division has also the power to order personal commitment. In all cases execution may issue immediately, each writ being renewable after a year, within six years; but the court or judge can stay execution to a time fixed—or subject to conditions.

In the United States, the law of execution is complicated by the rules which define the local jurisdiction of district and state courts and of the United States courts. The writs of execution in use are *fieri facias, levari facias*, &c.; the writ of *elegit* is now little used. In some states the homestead and other property of a debtor are exempted from execution; and congress has enacted that execution issuing out of United States courts must follow the provisions of these local laws.

In *Scotland*, execution for debt, or, as it is technically expressed, diligence in execution, is either real or personal; by the former, the debtor's lands may be attached; by the latter, his person and his movables. In order to entitle a creditor to use diligence against the person or estate of his debtor, the debt on which the diligence proceeds must be duly constituted by a liquid document, or by a decree, or by an action in which decree is sought. In this latter case, the law in peculiar circumstances allows diligence on the dependence, in order that a party may not be deprived of his remedy during the currency of the action, but such diligence depends for its effect upon the judgment in the cause. In the case of bonds and other instruments registered for execution (see REGISTRATION), the law allows summary diligence to proceed; that is to say, execution may proceed without the need of further application to the court. Diligence against heritage includes Inhibition, which is a writ passing under the signet, and prohibiting the debtor from contracting any debt which may become a burden on his heritage to the prejudice of the inhibitor's debt; Adjudication (q.v.); Ranking and Sale, a process of law by which the heritable property of an insolvent is judicially sold, and the proceeds divided among his creditors; and Poinding of the Ground, which is an action proceeding on a heritable security, and attaching all the goods on the lands over which the security extends. Personal diligence is (1) by Horning and Caption, where letters of horning—i.e. letters running in the sovereign's name, and passing the signet—are issued instructing messengers-at-arms to charge the debtor to pay, and on his failure a caption or warrant for his apprehension is granted; (2) by the simpler form of Warrant to Charge under the Personal Diligence Act, which replaces the old process of horning and caption; (3) by Arrestment (q.v.).

Execution, in criminal law, is the infliction on criminals of the punishment of death in conformity with legal decree (see CAPITAL PUNISHMENT). The modes of execution have varied greatly, both in the progress of time and in different countries. On the whole, the manner of executing the death-penalty, as of decreeing and inflicting punishment in general, has tended to grow more humane with the advance of civilisation. Among the Jews a frequent form of execution was stoning, while burning alive appears (Genesis, xxxviii. 24) to have been practised in their patriarchal history, and is sanctioned by Mosaic law. Casting from a rock was a mode recognised by the Jews and the Twelve Tables of the Romans. Under the Roman republic vestal virgins violating their vows of chastity were buried alive, and in the time of Paul crucifixion, burning, and decapitation were the chief modes of execution. Crucifixion (see CROSS) was in use likewise among the Assyrians, Persians, Egyptians, Carthaginians, and Greeks. Constantine, on his adoption of Christianity, abolished crucifixion in the Roman empire. The Italians of the middle ages, however, crucified some of their prisoners of war. Another revolting form of execution among the Romans was that of condemning the criminal to fight with wild beasts. Impalement, by thrusting a sharp stake through the body lengthwise, was one of Nero's cruelties, and is referred to by Juvenal. It is said to have been practised in the Balkan Peninsula so recently as 1876. Under Charles V. impalement was effected by driving a pointed stake through the heart while the criminal in open grave was being covered with earth. Other barbarous modes of execution were pouring melted lead on the criminal; sawing him asunder, a mode practised by the Jews against the conquered in Palestine; starvation in dungeons; pressing to death; breaking on the wheel; tearing to death with red-hot pincers. Boiling alive was occasionally practised on the Continent; and in England in Henry VIII.'s time poisoning was punishable by boiling to death, and 'it seems,' says Sir James Stephen, 'that three or four persons were so boiled.' In 1532 sentence of boiling alive was put in execution against a miscreant who attempted to poison Fisher, Bishop of Rochester, and actually poisoned some of his household. The act under which that sentence was carried out was repealed by 1 Edward VI. Drowning a parricide in a sack, in which were also a dog, cock, viper, and ape, was a Roman punishment, imitated in the middle ages, when quartering alive, tearing to pieces by horses, and disembowelling were likewise punishments known on the Continent. Among the severer forms of military execution were hunting and spearing the condemned to death by his fellow-soldiers, practised in Germany in the time of the Lanzknechts of the end of the 15th and during the 16th century; making him run the gantlet of rods till dead; flogging him to death with the knout. These last two modes of execution were practised in Russia till into the 19th century.

English law has in practice, according to Sir J. Stephen, been in a marked manner distinguished from the practice of the Continent by its aversion to execution by torture. The usual mode of execution in England has been for many centuries, and still is, hanging, though in early times decapitation was also known. Treason, however, was punished in the case of men by hanging, drawing (anciently dragging at the tail of a horse), and quartering; in the case of women by burning. A woman was burned alive for treason at Tyburn in 1685. Heresy was also punished by burning. In 1283 David, the last native Prince of Wales, was for treason sentenced to be hanged, drawn, and quartered, and to have his bowels burned. Pressing to death, or the *peine forte et dure*, is said to have been practised as late as 1741 at the Cambridge assizes. Burning continued till 1790 to be the punishment inflicted on women for treason, high or petty; at Ipswich a woman was burned in 1783 for murdering her husband. In practice, however, women were strangled before being burned. A woman was burned for witchcraft at Dornoch in Sutherland in 1722. By 25 Geo. II. any person convicted of murder was to be executed on the next day but one after sentence, but if sentenced on a Friday he was to be hanged the following Monday. In the interval he was to be fed on bread and water, and his body after death was to be either dissected or hung in chains. By laws passed in 1832–34 the bodies of murderers were no longer to be anatomised or hung in chains, but to be buried in the precincts of the prison in which they were last confined before execution. This regulation, repeated in 24 and 25 Vict., is now in force. On 21st February 1803 Edward M. Despard (q.v.) was drawn on a hurdle, hanged, and decapitated; and on 1st May 1820 Thistlewood and four of his fellow-conspirators were likewise hanged and decapitated. In this case—the last

execution for treason in England—the head was cut off with an amputating knife by a masked executioner, who then thrice held it up by the hair to three different points of the compass, with the words, 'This is the head of Arthur Thistlewood, a traitor.' The mode of execution now obtaining in England, North America, and Austria is hanging; in Spain, Garrotting (q.v.); in France, decapitation by the guillotine; in Germany, decapitation—by the axe in Prussia, elsewhere by the guillotine. In New York state it was enacted that after 1st January 1889 executions should be by electricity, a mode effecting instantaneous death. Lynching (see LYNCH LAW) sometimes takes the place of judicial execution in America. The Bowstring (q.v.) was an old Turkish institution; and the Hari-Kari (q.v.) was peculiar to old Japan. Shooting is the military form of execution. In India, during and after the mutiny of 1857-58, some of the rebels were blown from the mouth of cannons. Till 1868 executions in the United Kingdom were performed publicly, in London for the most part at Tyburn till 1783. At Edinburgh the place of execution was chiefly in the Grassmarket till 1784, when it was transferred to a platform at the west end of the Tolbooth, a building removed in 1817. The gallows at Tyburn was a permanent erection on three posts, 'Tyburn's triple tree,' and wooden galleries near it accommodated the crowds of spectators. The scandalous scenes, however, attending the procession of the criminal from Newgate to Tyburn caused the place of execution to be changed in 1783 to the area in front of Newgate prison, where on the 3d December 1783 ten were executed.

In 1868 an act was passed prohibiting public execution, and directing that all executions proceed inside the walls of the prison in presence of the sheriff, gaoler, chaplain, and surgeon of the prison, and such other officers of the prison as the sheriff requires or allows. The Act of 1868 further orders that execution take place at 8 A.M. on the first Monday after the intervention of three Sundays from the day on which sentence is passed. A black flag has to be hoisted at the moment of execution conspicuously above the prison, and remain displayed for an hour, while the bell of the prison or parish church tolls for fifteen minutes before and fifteen minutes after the execution. Till 1783 the mode of execution was by drawing away the cart from under the prisoner after the rope had been fastened round his neck. From 1783 the prisoner was placed not on a cart but on a platform, which on the withdrawal of a bolt suddenly fell from under him. In 1874 this method was improved upon by a plan whereby the length of the rope is proportioned to the weight of the body, so that the momentum of the fall suffices to rupture the ligatures of the spine, and thus cause instant death. Execution in England must in all cases be performed by the sheriff, or, as is invariably the practice, by his deputy called the executioner. In royal burghs in Scotland, the office is imposed on the civic magistracy, one of whom attends the execution, similarly as does the sheriff in England.

In several German states the office of headsman is said to have been hereditary, and in *Coriolanus* (act ii. scene 1) Menenius speaks of 'hereditary hangmen.' The last headsman of the Tower of London died in 1861. The office had grown to be a mere sinecure. In some parts of England the office was annexed to other posts; for instance, in the time of Henry II. and Henry III. the porter of the city of Canterbury was executioner for the county of Kent, and in receipt on account of that office of an allowance of 20 shillings per annum from the sheriff. Derrick was public executioner in the first part of the 17th century, and gave his name to a kind of crane; after him came Gregory Brandon, whose son, Richard Brandon, executed Strafford, Laud, and Charles I. John Ketch, public hangman from 1663 till 1686, executed William Lord Russell and the Duke of Monmouth, and bequeathed his name ('Jack Ketch') as a nickname to his successors in office for nearly two centuries. The family of Sanson for many generations gave Paris her executioners, the name 'M. de Paris' being first playfully given to the elegant and handsome Charles Henri Sanson, who in his old age executed Louis XVI. In recent times, Calcraft, employed as executioner down till 1874, was paid by the corporation of London £1, 1s. per week as a retaining fee, and an extra £1, 1s. for each execution. He had, besides, from the county of Surrey £5, 5s. annual retaining fee, and £1, 1s. for each execution, and £10 for an execution in the country. Calcraft was succeeded in 1874 by Marwood, who, in turn, in 1883, was succeeded by Berry, who, in the six years following his appointment, was engaged for over 200 executions, and carried over 100 sentences into effect.

Besides the references in the body of the article, and at the end of CAPITAL PUNISHMENT, see *Hanging and Scenes witnessed before the Gallows*, by F.L.A.T. (1868); *Hanging not Punishment enough for Murtherers, &c.* (1701); a collection of broadsides, containing an account of murders and executions (1794-1860; and another collection, 1830-55?); *Memoirs of the Sansons*, edited by Henri Sanson, late executioner of the Court of Justice of Paris (Eng. trans. 2 vols. 1875); *The Punishment and Prevention of Crime*, by Sir E. F. Ducane, in 'English Citizen' series (1885). See also the articles DROWNING, GUILLOTINE, MAIDEN, NEWGATE, PARRICIDE, PEINE FORTE ET DURE, TYBURN, and WHEEL (BREAKING ON THE).

Execution of Deed. See DEED.

Executive. See GOVERNMENT.

Executor, in England, the person to whom the execution of a last will and testament of personal estate is by testamentary appointment confided. The appointing by will of an executor, without giving any legacy or appointing anything to be done by him, is sufficient to make a will. The appointment of an executor can only be by a will, the person who takes charge of the estate of an intestate being called an Administrator (q.v.). The appointment may be either express or constructive—i.e. gathered from the general terms of the will. An early duty of an executor is to take Probate (q.v.) of the will. He derives his title solely from the will; the estate vests in him from the death of the testator, at which time his responsibility begins, and from which time he may enter upon all the duties of managing the estate. But his position will not be recognised as suitor in any court until he has taken probate. The whole personal estate vests in the executor, and, if the testator has made no disposition of the residue, it devolves, as trustee for the next of kin, upon the executor, unless it appears from the will or any codicil thereto that the executor was intended to take the residue beneficially. By 21 Henry VIII. chap. 5, an executor is bound to prepare an inventory of the personal estate. This, if required, must be produced. An executor may raise actions in respect to the estate in his charge; and generally it may be said that his powers, duties, and liabilities are commensurate with those of the deceased, except in regard to contracts and wrongs of a merely personal nature. He may enter the house of the deceased to remove the personal property. The first claims to be discharged are those of the funeral and the expenses of probate. He must then pay the debts; and he is responsible for paying them in due order, so that those having a legal preference shall first be

discharged. An executor is not bound to accept the office; but, if he administer, he cannot then renounce the executorship without cause. On the death of an executor, the office passes, as a general rule, to his executor. See Sir E. V. Williams's *Law of Executors and Administrators* (8th ed. 2 vols. 1879), or the shorter treatise of Walker and Elgood (1883).

An executor to a will in Scotland is called a testamentary executor, to distinguish him from the next of kin, who are styled executors. The term executor is given to all who manage the estate of a deceased, whether appointed by will or by authority of the court. The former are called executors nominate; the latter, executors dative. All executors must, before entering upon their duties, obtain *confirmation* from the Commissary Court. This is equivalent to probate in England. But in Scotland no right vests in the executor until after confirmation, except a title to sue, being exactly the reverse of the English rule. An executor acting without confirmation is called a *Vitious Intromitter* (see INTROMISSION). Executors must, on entering upon their office, exhibit a full inventory of the whole movable estate of the deceased. An executor is only liable to the extent of the inventory. He is not bound to pay interest on the funds in his hands unless they bore interest before confirmation, or unless he is guilty of undue delay in administering the estate. He is not bound to pay the debts for six months after the death of the deceased. But, as in England, the expenses of the funeral and confirmation are entitled to immediate payment. Servants' wages and a year's house-rent have also a preferable claim. An executor is entitled to claim one-third of the *Dead's Part* (q.v.), after deducting debts. But, should he receive a legacy, he is bound to impute that towards part payment of his claim.

In the United States, the rights and duties of an executor are analogous to those defined by English law; in this, as in other matters relating to property, each state has its own laws. See Stimson, *American Statute Law;* Schouler, *Treatise on Law of Executors and Administrators* (Boston, 1883).

Executory, in English law, is a term applied to contracts, &c. which are not executed—i.e. not completed with the forms required to make them legally operative. An executory limitation of property is one which gives an interest to come into existence at a future time or on the happening of an event. An executory trust directs trustees to make a proper conveyance in favour of the person beneficially entitled. Executory devises and other limitations form an important branch of the law of real property. In American law, the term executory is used as in England; executory gifts of property are subject to rules against Perpetuities similar to the rules which prevail in England. See PERPETUITY.

Exegesis, a Greek term meaning the exposition or interpretation of any writing, but almost exclusively used of the interpretation of the Holy Scriptures. The term *Hermeneutics* is frequently applied to the science of the interpretation of the Bible, and it is usual to distinguish it from exegesis as the interpretation proper or *discovery* of the true meaning of the text, while the latter is more strictly the *exposition* of the meaning so discovered and its practical doctrinal and moral applications. But it may be said that the term exegesis is now in pretty general use as applied at once to the science and the art of the elucidation of Scripture. It includes both the study of the text or form in which the scriptural revelation has reached us and also the scope and doctrinal bearings of that text and the conclusions that may reasonably be deduced from it. The materials for the critical study of the Old Testament are scanty as compared with the New, hence the difficulty of attaining to certain conclusions is correspondingly greater. Critical materials are mainly of three kinds: MSS., versions, and quotations. Of these the New Testament scholar has enough, but the student of the Old Testament is worse than slenderly equipped in all. For the present Hebrew consonantal text is hardly earlier than the 2d century of our era, the vowel signs being some centuries later; while, as for the versions, the Syriac, the Targum or Chaldee, and the Vulgate are substantially mere reproductions of the Hebrew text we possess, the difficulty in the case of the Septuagint being increased by the undoubted corruptness of its own text, as well as by the fact that it is itself a translation into Greek of an earlier Hebrew version now unknown to us. Nor can we supplement our knowledge to any extent from the source of early quotations, as the Fathers, with the exception of Jerome and to some extent of Origen, were ignorant of Hebrew, and, besides, were hopelessly given to quoting Scripture very loosely and inexactly.

Thus the task of the exegete is a labour of great and complicated difficulty, and he must needs be a scholar, competently equipped for grammatical and philological inquiries into the signification of words, the force and significance of idioms, the modification of the sense by the context and the comparison of parallel passages, no less than into the character of the writer and the persons he addressed, of the circumstances in which he wrote, and the immediate object to which his work was directed. To these linguistic and literary qualifications he must add adequate knowledge of contemporary external history, but above all he must have something of that spiritual sympathetic insight by which he can project his own imagination into the mind and feelings of an earlier age. Without some measure of this *inwardness* no scholar, however brilliant, can be a great exegete; but, when it is superinduced upon extensive and exact learning, we have an exegete of the first order—a Chrysostom, a Calvin, a Bengel, a De Wette, a Meyer, or an Ewald. Thus Schleiermacher's saying, that 'in a certain sense the interpreter has to educe more than the author introduced,' is true; for the exegete, exercising the synthetic as well as merely analytic faculty, reconstructs for himself the mental attitude of the writer in order to deduce much that influenced the latter half-unconsciously in his composition.

All exegesis of Scripture, however closely it follows the ordinary methods of literary and historical criticism, depends greatly upon the views entertained as to the nature and degree of inspiration, and the share of the conscious human element in the progressive revelation. The old theory of *dictation* or verbal inspiration is no longer held by any intelligent scholar, and it is the peculiar merit of our 19th-century exegetes to have been the first to establish a satisfactory critical *modus vivendi*—by their insisting upon the human element in the Scriptures without ceasing to uphold their divine authority.

It is hardly necessary to point out how absurd is the assumption of some sects that a scholarly interpretation of Scripture is superfluous to the Christian, whose sole aim is the shortest cut to salvation. For, not to speak of the inherent difficulty of Scripture itself as a series of compositions extending over hundreds of years, and treating intimately of many things long forgotten, and that often in figurative and symbolical phraseology unfamiliar to a modern ear, has not God in his providence seen fit to give his revelation in

languages which demand the exegetical praxis of translation? And do not the immense divergencies of honest opinion about the interpretation of Scripture give the individual such a wholesome distrust in the infallibility of his own opinion that he feels the need of every possible support that he can gain from scholarship to buttress it? For the sincerity of a conviction is no proof of its absolute truth, since honest men have been sincerely convinced of the truth of opinions the most opposite. At the same time it is true that the things of faith essential to salvation are perfectly plain to the reason and judgment of every man, and that Scripture is of necessity itself intelligible and sufficient, if studied with diligence and a candid mind. The precious right of private judgment is perfectly consistent with the need for a scientific exegesis, the interests involved in the correctness of the interpretation being so momentous.

The fundamental distinction between Roman Catholics and Protestants depends upon the extent to which the private judgment of the individual is to be controlled by external considerations, such as the authoritative interpretations of the Fathers, and the dogmatic definitions of councils and popes. The former, of course, do not consider the Scripture as containing the whole of God's revelation, and therefore, just as Protestants admit that one passage of Scripture may be modified by another, so they believe that the scriptural revelation itself may be modified by other revelations of God conveyed to us through other mediums, as by that of tradition. Unfortunately, tradition is far from consistent, and is not always even intelligent; and the traditionalist frequently finds himself under the necessity of bowing down his judgment to the exegetical conclusions of an age devoid of real scholarship, and slavishly subject to an allegorical or other fantastic method of interpretation.

The Jewish exegesis of the Old Testament is seen in the voluminous Talmudical writings, the *Mishna*, giving simplifications and explanations of the law, and the *Gemara*, giving further explanations of earlier explanations, the latter itself existing in the two forms of the *Jerusalem Talmud* and the *Babylonian Talmud*. The earliest Jewish Scripture interpretation was the *Midrash* ('study'), divided into legal and homiletical exposition. The legal, *Halacha* ('rule by which to walk'), was mostly confined to an amplification of points not explicitly set forth in the Pentateuch, from which it deduced the collection of precepts designated *Halachoth*; while the homiletical, *Hagada* ('opinion'), discussed the whole Old Testament, and aimed at applying it to ethical and social as well as to religious questions. It became so popular that it was styled distinctively the *Midrash*, and, with much practical value, contained many fantastic interpretations, the result of a distinction between the natural and the derivative or allegorical sense. Side by side with this, however, there grew up during the middle ages a more rational exegesis, which gave really sound results in the hands of such enlightened rabbis as Jarchi, Rashi, Kimchi, Maimonides, and Abarbanel.

The hermeneutics of the *Hellenistic* Jews had sought by thoroughgoing allegorical interpretation to make an arbitrary reconciliation between the traditions of Hebraism and the results of Greek philosophy. The greatest master of this perilous art was Philo, who formulated definitely the twofold teaching in the Pentateuch—the verbal sense for the illiterate, the figurative for those gifted with the insight to see it. The allegorical system of interpretation was adopted by the Alexandrian school, and carried far by Clement and the great Origen; yet the latter also established a basis for sound grammatical exegesis by his separation between the literal, the moral, and the mystical senses. The same influences, although to a less extent, show themselves in such western teachers as Hippolytus, Hilary, Ambrose, and Augustine; but, in marked contrast, the school of Antioch, as represented by Diodorus of Tarsus, Theodore of Mopsuestia, Chrysostom, and Theodoret, aimed rather at a grammatical and historical criticism, that at its worst degenerated into a bald and unspiritual interpretation. Basil of Cæsarea, Gregory Nazianzen, and Gregory of Nyssa show a similar preference for the objective reading of Scripture, as also the learned Jerome, who advocated the grammatical and historical sense as the fundamental, with the figurative interpretation where necessary, in opposition to the allegorical. Meantime, in the Western Church, theologians, in the face of the divergencies of heresies each based upon its own reading of Scripture—and that mostly always allegorical—had been finding the necessity of an authoritative exegesis of Scripture as an ultimate standard of appeal. Already, under this necessity, in Irenæus and Tertullian we see the growth of a simpler and more rational spiritualising of Scripture as a reaction against excessive abuse of arbitrary and fanciful allegorising; together with that increasing respect for authoritative explanation of the sense. This finally culminated in the conclusion of the Council of Trent, that the sole right to interpretation was inherent within the church herself, and in the assertion by the Vatican Council of the personal infallibility of the pontiff. The *Commonitorium* of Vincentius of Lerins established the doctrinal supremacy of Scripture, but, from its inherent difficulty and the vagaries of individual interpretation, maintained the necessity of the tradition of the church to supplement and expound it. His famous 'Quod ubique, quod semper, quod ab omnibus creditum est' may still be accepted as the axiom that dominates all Roman Catholic exegesis. Independent interpretation went gradually out of use, and was supplanted by the well-known *Catenæ*, consisting of expositions of books of Scripture strung together from the writings of such Church Fathers as Origen, Chrysostom, Jerome, and Augustine. These were themselves prepared by such divines as Procopius of Gaza, Cassiodorus, Hrabanus Maurus, Sedulius, Theophylact, and Aquinas. The middle ages gave its intellect to abstract theological speculation—in exegesis it bound itself voluntarily in the shackles of tradition. The *Postillæ*, or brief commentaries, of Nicolaus de Lyra was a symptom of a reaction towards the obvious and objective that soon showed itself also on the philological side in the Humanists, Laurentius Valla, Reuchlin, and Erasmus, and in the bolder spiritual applications of the Reformers. Their intense religious experiences supplied the real inwardness that was lacking to the Humanists, and accordingly in Luther, Melanchthon, Beza, Bucer, Œcolampadius, Zwingli, and Calvin we find a series of great exegetes whose influence is even now more visible in the recent biblical criticism of Germany than it was at the time of the Reformation itself. Among the greatest of their more immediate successors were Grotius, Calovius, Calixtus, and Cocceius. Little further progress, however, was made till about the middle of the 18th century, as scriptural exegesis was mostly allowed to degenerate into mere edification, which it was not given to every scholar to harmonise so happily with real science as Bengel did in his famous *Gnomon Novi Testamenti* (1742). The revival of a real exegesis is due mainly to Ernesti and Semler, whose inspiring impulse created a school of scholars who in a single generation contributed more to a sound

knowledge of the Scriptures than all the theologians of sixteen centuries. Such were, in the field of Hebrew scholarship, Gesenius, Ewald, Olshausen, and Böttcher; in that of Greek, Winer, Buttmann, Lachmann, and Griesbach; and on the purely philosophical and theological side, Herder, Baur, Rothe, Hofmann, Lücke, and Schleiermacher. Since these a continuous chain of illustrious and more or less orthodox scholars have laboured at the direct elucidation of Scripture on sound scientific lines, of whom it may here suffice merely to mention the names of De Wette, Bleek, Hitzig, Hupfeld, Hengstenberg, Keil, Oehler, Knobel, Kalisch, Rosenmüller, Dillmann, Meyer, Lange, Tischendorf, Lagarde, Delitzsch, Godet, Holtzmann, Ellicott, Lightfoot, Perowne, Scrivener, Westcott, and Cheyne. At the same time the horizons of our knowledge of ancient Egypt and Assyria have been vastly widened by the labours of scholars like Lenormant, Maspero, Rawlinson, Schrader, and Sayce, who have cast a flood of light and confirmation upon the ancient history contained in the Bible, which has also been elucidated more immediately from the history of the Jews themselves, by the work of Ewald, Stade, Grätz, Stanley, Kuenen, Wellhausen, and Renan. The study of the New Testament history and of the life of our Lord—so characteristic a feature of the more modern theology—has contributed no less to our knowledge of the scope and contents of the New Testament books, through the work of Strauss, Renan, Lange, Hase, Keim, Weissäcker, Lechler, Hausrath, Schürer, and Weiss. No less valuable side-light for exegesis proper has been afforded by works specially devoted to the history of theological dogma and its progressive development, such as those of Dorner, Martensen, Nitzsch, Hagenbach, Ritschl, Pfleiderer, and Harnack.

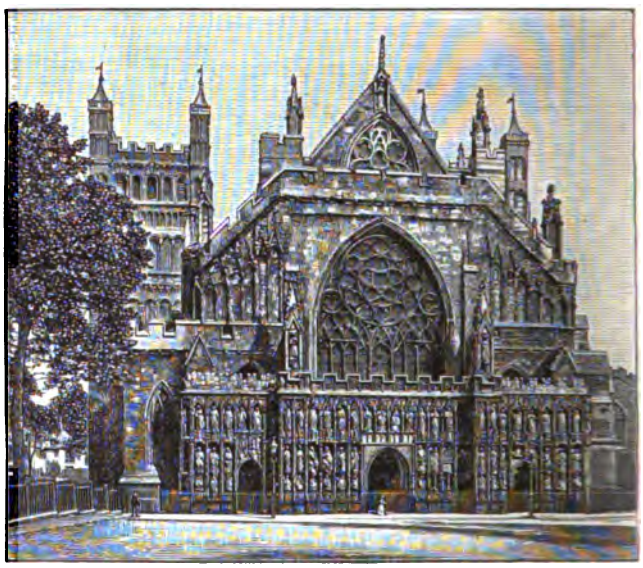
See the articles BIBLE, CODEX, GOSPELS, and SEPTUAGINT; also the separate articles on the various books included in the canon of Holy Scripture, as well as upon the great exegetes themselves.

Exelmans, REMY JOSEPH ISIDORE, COMTE, a distinguished French general, was born at Bar-le-duc, 13th November 1775. Entering the army in 1791, he served with distinction in the campaign of Naples under Championnet, was made general of brigade after Eylau, and followed Murat to Spain, where he was taken prisoner and sent to England. For his conduct in the disastrous Russian campaign Napoleon created him a general of division. Exelmans seems to have been equally esteemed under every successive government. On the fall of Napoleon, he was for some time banished from France, but was permitted to return in 1823. In 1831 Louis-Philippe restored his titles and rank. Louis Napoleon named him Grand Chancellor of the Legion of Honour, and in 1851 raised him to the dignity of Marshal. On the 21st July 1852 Exelmans had a bad fall from his horse, from the effects of which he expired on the following night.

Exemplar. See FABLE.

Exequatur. See CONSUL (MERCANTILE).

Exeter, the capital of Devonshire, 171 miles by rail WSW. of London, and 75 SW. of Bristol. Dominated by higher hills, it is built on the summit and slopes of a flat ridge, rising 150 feet from the left bank of the Exe; and, having been modernised chiefly in its suburbs, it is a pleasant antique city —'as good a specimen of an English county town, at once prosperous in business, and with a quiet air of aristocratic distinction, as can be found within the four seas' (Escott's *England*). The quaint old High and Fore Streets, crossed by North and South Streets, still follow the line of the Ickneld Way; and the walls in great part remain, though their four gateways were demolished between 1769 and 1819, and though Rougemont Castle (1068) was almost all swept away in 1774, to make room for an ugly assize-hall. In 932 Athelstan founded here a Benedictine monastery, and hither in 1050 Edward the Confessor translated the western



Exeter Cathedral: West Front.

bishopric from Crediton; but St Peter's Cathedral was not begun till sixty-two years afterwards. Measuring 408 feet by 76 (or 140 across the transepts), and 66 feet high, it is a long, low edifice, with massive transeptal towers—a feature imitated at Ottery St Mary, but otherwise unique. These towers, 140 feet high, are the original Norman ones, but the rest of the pile, rebuilt between 1280 and 1369, is mainly in the purest Geometrical Decorated. The most striking characteristics of the whole are its perfect bilateral symmetry and the grand unbroken line of vaulting. Special features are the exterior western screen (*circa* 1388), adorned with sixty-seven statues of saints and princes; the beautiful choir-screen (1324), surmounted by the fine organ (1665); the minstrels' gallery (1353); the misereres, sedilia, and bishop's throne; the modern reredos, stall-work, and pulpit; a clock, dating from 1317 or earlier; the Great Peter bell, brought from Llandaff in 1482, recast in 1616, and weighing 12,500 lb.; and the chapter-house (1420–78), containing 8000 MSS. and early books. In 1870–77 the cathedral was restored by Sir G. G. Scott at a cost of £40,000; in 1889 the cloisters and library. The picturesque guild-hall (1464) has a cinque-cento façade (1593); of modern buildings, the most noteworthy are the Devon and Exeter Hospital (1743), the Lunatic Asylum (1865), and the Albert Memorial Museum (1868). The chief public walk is Northernhay. A ship-canal (1563–1827) extends 5 miles to the tideway at Topsham; and Exeter has large nurseries and manufactures of gloves, agricultural implements, &c., besides being the chief mart of 'Honiton' lace. But its woollen trade, once second only to that of Leeds,

is a thing of the past; and as a seat of commerce and industry it has been outstripped by many a younger competitor. The 'ever loyal city' got its earliest charter from Henry II. some time prior to 1162; in 1537 was made a county of itself; and returned two members from about 1300 till 1885, when their number was cut down to one. Pop. (1851) 40,688; (1881) 47,154; (1891) 50,570, of whom 37,580 were within the municipal borough.

The Celtic *Caerwisc*, the Roman *Isca Damnoniorum*, and in 876 the *Exanceaster* of the West Saxons, who till 926 shared it with the Britons, Exeter, in Professor Freeman's words, 'is the one great city of the Roman and the Briton which did not pass into English hands till the strife of races had ceased to be a strife of creeds, till English conquest had come to mean simply conquest, and no longer meant havoc and extermination.' To Mr Freeman's pages reference must be made for its capture by the Danes (876 and 1003), by William the Conqueror (1068), and by Stephen (1136); for its siege by the Yorkists (1470), by Perkin Warbeck (1497), and by the Catholic rebels (1549); for its surrender to Prince Maurice (1642) and to Fairfax (1646); and for the entry of William of Orange (1688). Whereto must be added the tragic burning of the new theatre (5th September 1887), with a loss of 188 lives. Among the sixty bishops have been Leofric (1050–72), Bartholomew (1161–84), Stapledon (1308–26), Grandison (1327–69), Miles Coverdale (1551–53), Joseph Hall (1627–41), Seth Ward (1662–67), Trelawney (1689–1707), Phillpotts (1831–68), and Temple (1869–85). Natives were Archbishop Baldwin, Cardinal Langton (doubtfully), John Vowel or Hoker, the historian of Exeter (1525–1601), the Judicious Hooker, Sir Thomas Bodley, and Henrietta, Duchess of Orleans.

See Archdeacon P. Freeman's *Architectural History of Exeter Cathedral* (1873), and Professor E. Freeman's *Exeter* ('Historic Towns' series, 1887).

Exeter, PEERAGE OF. See BURGHLEY.

Exeter Hall, a large proprietary building, on the north side of the Strand, London, was completed in 1831, and can contain upwards of 5000 persons. It is let chiefly for religious assemblies, and is in great request during the 'May Meetings' of the several religious societies. It has also been the scene of many great musical fêtes. In 1880 it was purchased for £25,000 for the Young Men's Christian Association.

Exhibitions. The earlier beginnings of Industrial Exhibitions, like all great movements, are not particularly easy to define. The first exhibition of anything like national importance, however, seems to have been the one originated by the Marquis d'Avèze at Paris, 1798, though previous to this a show of agricultural and other machinery had been held by the Society of Arts in London (1756), and another exhibition had been given at Prague in 1791. A second exhibition of greatly improved kind was opened at Paris in 1802; a third in 1805; and hence arose the custom of holding such displays triennially, continued with slight interruption for half a century. It should be mentioned that the specimens exhibited on these occasions were essentially of French production, and care was taken to exclude any article of foreign character. The impetus given to the movement by the Paris displays was felt over Europe, and even reached the United States. Between the years 1820 and 1850 exhibitions were held at Vienna, Berlin, Brussels, St Petersburg, Stockholm, Moscow, Lisbon, Madrid, New York, Philadelphia, and numerous other towns. Nor did the United Kingdom escape the infection, though here the promoters of such undertakings had to struggle against much apathy and even opposition. To Ireland belongs the credit of the first display of noticeable merit. This was the Exhibition of Irish Industries, held by the Royal Dublin Society at their rooms in 1829, and the association continued the practice triennially for several years. The Society of Arts in London also held a number of exhibitions illustrative of the manufactures, commerce, and agriculture of the country, and the Cornwall Polytechnic Society energetically laboured in a similar direction by holding periodical exhibitions to illustrate the mineral wealth of that county, and the mechanical appliances necessary for mining. From this may be said to have originated the happy idea of holding in various large towns exhibitions descriptive of the industrial work carried on in the locality. Manchester led the way with a display of everything concerned in the manufacture of cotton; Liverpool followed with an exhibition of the raw produce brought to that seaport, and the shipbuilding that rendered such trade possible; Leeds held an exhibition of the material and processes involved in the flax and woollen trades; and Birmingham (1849) fairly surpassed them all with an excellently arranged show of the numerous useful and ornamental forms into which metals can be wrought. The Birmingham Exhibition may be said to have had an important influence in bringing about the first great exhibition of 1851.

For some time past the English government had been urged without success to organise an exhibition in London of a really national character, illustrating the arts of Great Britain and Ireland. In the spring months of 1849 the Society of Arts, being greatly influenced in the matter by Prince Albert, sketched the outline of a great exhibition of the industries of all nations, and proposed that such exhibition should be held at London in 1851. In July the prince in the name of the society applied to the government for the appointment of a Royal Commission to organise and manage such an exhibition. As a result of the agitation then set on foot, the Commission was appointed early in 1850, with the prince at its head; and the exhibition was opened by the Queen in Hyde Park, May 1, 1851. It was held in a vast structure of iron and glass, called the Crystal Palace (now located at Sydenham), and planned by Sir Joseph Paxton (q.v.). The building was 1851 feet long by 408 wide, with an additional width of 48 feet for half that length; the highest portion was a centre transept 108 feet high; the area covered was 19 acres, equal to seven times that of St Paul's. The exhibitors numbered nearly 15,000, about equally divided between British and foreign contributors. The cost of the structure was £170,000 (for use and waste, not for absolute ownership), which in addition to the other expenses down to the close of the exhibition made a total outlay of £292,795. The entire number of visitors was 6,039,195, averaging 41,938 per day. The total receipts from admission and other sources amounted to £505,107, leaving a surplus of £200,000.

The next exhibition of any importance was the one of art and industries held in a specially erected structure at Dublin, 1853, mainly through the enterprise and munificence of Mr Dargan. It resulted in a very heavy pecuniary loss, as did the New York International Exhibition of the same year, and the Paris Exhibition of 1855. Between 1853 and 1857 exhibitions of more or less interest and practical value were opened at New Brunswick, Madras, Munich, Edinburgh, and Manchester.

The second great international exhibition of 1862 was held in a building at South Kensington, occupying an area of about 24 acres. In its main building it was composed of massive brickwork, but the annexes and two cupolas of vast magnitude were chiefly of glass, iron, and wood. The total area of

covered space was nearly 1,300,000 feet, including corridors, staircases, &c. About 700,000 square feet were ground-floor space, the remainder galleries. So excellently were the arrangements carried out that the exhibitors had 1,032,352 square feet of horizontal flooring and 284,670 square feet of vertical wall-space. About one-half was allotted to the United Kingdom and its colonies, the other half to foreign countries. The total number of exhibitors was 28,653, of whom 26,348 were in one or other of thirty-six industrial classes, the remainder in one or other of four fine art classes. There were 3370 paintings in oil and water colours, 1275 etchings and engravings, 983 architectural drawings, &c., and 901 pieces of sculpture. The exhibition was open 171 days, nearly a month longer than that of 1851. The visitors numbered in all 6,211,103 persons, but though the number was greater than in 1851 the average per day was less. The receipts from all sources (admission at the doors, season tickets, refreshment contracting, &c.) amounted to the grand total of £448,632, but the cost of the building was so great (£320,000, virtually for six months' use only) that the receipts did not cover the outlay, and a deficit of about £10,000 was the result.

Passing over exhibitions held at Constantinople (1863) and Bayonne (1864), we next come to the Dublin Exhibition of 1865, produced under the auspices of a joint-stock company, which proved a great failure. During the few years that followed exhibitions of more or less national character were held at Cologne (1865), Oporto (1865), Stockholm (1866), Melbourne (1866), and Agra (1867). In 1867 came the Paris Exhibition, which in its general arrangement and magnitude of conception surpassed anything that had yet taken place. This was a really wonderful undertaking. The building was a vast oval, 1550 feet by 1250, with a series of twelve concentric galleries running round it, and a small garden in the centre. In each gallery a separate branch of science and art was illustrated, and the entire oval was divided into sections, one of which was devoted to each country. The oval covered 11 acres, and the complete exhibition, counting the various annexes and outside grounds, close upon 100. The number of exhibitors was 50,226, and the total expense £800,000, half of which was defrayed by the public attendance, half by the imperial government and the Paris municipality; visitors, 10,200,000. Britain, it may be mentioned, did not figure very favourably in this exhibition—probably by reason of the want of technical education—whereas Germany, France, and Belgium showed a marked advance. Following this, exhibitions were held at Havre (1868), Amsterdam (1869), Sydney (1870), Milan, Naples, Jersey, and Peru (1871), Dublin, Copenhagen, Lyons, and Moscow (1872), and a very fine one—the greatest in fact since that of Paris—at Vienna in 1873. The last exhibition, however, was most unfortunate, suffering not only from very bad management, but from a variety of detrimental causes over which the promoters had no control, and proved in the end a huge financial failure.

In 1871 the first of a series of annual London International Exhibitions was opened. The movement, however, never became popular, and after gradually declining in favour for four years was finally relinquished in 1874. The next most important display after Vienna was the Philadelphia Centennial Exhibition of 1876, held in commemoration of the hundredth anniversary of American Independence. The main building, in the form of a parallelogram, covered a floor-space of about 20 acres; its length was 1880 feet, and width 464. One centre and two side avenues ran along the inside of the edifice, the former being 1832 feet long by 120 feet wide—the longest avenue of that width ever known in an exhibition structure. The total area of floor-space in the various buildings amounted to about 50 acres; of this more than 1,000,000 square feet were allotted to the United States; 200,000 to Great Britain and its colonies; about 100,000 to France and French dependencies; and over 60,000 to Germany. The number of exhibitors fell below those of the preceding exhibitions at Paris and Vienna—in all about 40,000. The building was open to the public on 159 days, and the total attendance of visitors was 9,910,966; receipts, $4,300,000—a sum much below the expenditure. The Paris International Exhibition of 1878 again made an advance in magnificence and size upon all previous displays, and as a collection of fine art and literature was especially notable. The total area covered by the various buildings was about 80 acres, and the exhibitors numbered as many as 80,000. The visitors were 16,032,725, and the gross receipts £506,149.

On May 5, 1889, the Universal Exhibition of Paris, excelling all its predecessors in point of magnitude and comprehensiveness, was opened. With the included grounds it occupied an area of no less than 173 acres. The Eiffel Tower (q.v.) was one of the principal attractions of the exhibition. As a marvel of constructive skill it was rivalled by the Machinery Palace, which had a span of 377 feet, and was without pillars or other similar support. On the opening day of the exhibition the visitors, exclusive of official sightseers and *invités*, numbered 112,294, and for the first week 350,215. Minor exhibitions in 1889 were the Exhibition of Arts and Industries, Hamburg, the Accident Prevention Exhibition, Berlin, and the Goldsmiths' Exhibition, Vienna.

In 1893 the fourth centenary of the discovery of America by Columbus was celebrated by the World's Columbian Exposition, at Chicago. It excelled all predecessors in conception, scope, and grandeur. Every nationality contributed to the exhibits, and many countries possessed their own buildings. The 'White City,' as it was called, was opened by President Cleveland, May 1, and closed October 30. It occupied about 600 acres, at Jackson Park, on the shore of Lake Michigan, including the 'Midway Plaisance.' Nearly every State in the Union was represented by its own edifice. The principal buildings were Machinery Hall, the Art Palace, and those devoted to Transportation, Mining, Electricity, Agriculture, Manufactures and Liberal Arts (covering 44 acres), Government, Administration, Fisheries, Horticulture, and Anthropology. The total admissions for the period named were 27,539,521, and the receipts from this source $10,317,814. The largest attendance on any one day—Chicago day, October 9—was 716,881.

Ex-Libris. See BOOKPLATES.

Exmoor Forest, in the west of Somersetshire and north-east of Devon, is a wild, mostly uncultivated waste, consisting of long ranges of steep hills and lonely valleys, and bordered by deep wooded glens. Some of the hills are 1500 feet high. The 'forest' proper is about 25 miles in area, but with the adjacent commons Exmoor extends over 100, and though 'improvements' were attempted in 1818, and many trees planted by Mr J. Knight, who had purchased the forest from the crown, Exmoor is still in the main covered with grass (in some parts short and sweet, in others rank and sedgy), bracken, and heather, with dangerous bogs near the hill-tops. Where it ranges down to the coast near Lynton, the scenery is very bold and picturesque. The Exe, Barle, Mole, and the two Lyns are the chief streams rising here. Gold has been found in Northmolton parish, and

copper-mines have been worked there from time to time. There is a native breed of very small ponies, known as Exmoor ponies, stout and hardy, as well as a local breed of horned sheep of high quality. The most notable feature of the fauna of Exmoor is, however, that it is the only place in England where the red deer still run wild. A few years since the extinction of this noble race seemed imminent, but recently they have been preserved, and are now becoming numerous. Stag-hounds have been kept here and stag-hunting followed since at least 1598. Exmoor is the chief scene in Blackmore's *Lorna Doone*, which is based largely on local traditions, and which abounds with admirable descriptions of its most characteristic scenery. See also H. B. Hall's *Exmoor* (1849), and C. P. Collyns's *Chase of the Wild Red Deer* (1862).

Exmouth, a Devonshire watering-place, at the east side of the mouth of the Exe, 11 miles by rail SSE. of Exeter. A sheltered spot, with fine climate, good beach, and beautiful views, it had dwindled from a considerable seaport to a poor fishing-village, when, about the beginning of the 18th century, it rose into repute as a seaside resort; and now it has terraces, hotels, baths, promenades, and pleasure-grounds along the seashore, and docks, constructed in 1869. Pop. (1851) 5123; (1881) 6245; (1891) 8097. See Webb's *Memorials of Exmouth* (1873).

Exmouth, EDWARD PELLEW, VISCOUNT, an English admiral, was born at Dover, April 19, 1757. He entered the navy at the age of thirteen, and first attracted notice by his gallant conduct in the battle on Lake Champlain in 1776. In 1782 he attained the rank of post-captain. In 1793, having been appointed to the command of the *Nymphe*, a frigate of thirty-six guns, he encountered, and, after a hard-fought battle, captured *La Cléopâtre*, a superior French frigate. For this victory he was knighted; and in 1796, for acts of personal bravery, he was created a baronet. In 1798 he received the command of the *Impétueux*, and was sent to the French coast, where many of his most brilliant actions took place. In 1804 he was appointed rear-admiral of the Blue, and commander-in-chief in India, from whose seas he drove the French cruisers; he was afterwards made commander-in-chief in the North Sea and in the Mediterranean. In 1814 Pellew was created Baron Exmouth of Canonteign, in Devonshire, with a pension of £2000 a year. In 1816 he was sent to Algiers, to enforce the terms of a treaty regarding the abolition of Christian slavery, which the Dey had violated. With a combined fleet of twenty-five English and Dutch vessels, he bombarded the city for nine hours, and inflicted such immense damage, destroying all the Algerine fleet and many of the public buildings, that the Dey consented to every demand. For this service he was raised to the rank of viscount. He died 23d January 1833. See his Life by Osler (1835).

Exocœtus Volitans. See FLYING-FISH.

Exodus, the second book of the Pentateuch, takes its name from a Greek word which means 'a going out,' 'a departure.' It relates the events connected with the sojourn of the people of Israel in Egypt, their departure from that country, their wanderings in the peninsula of Sinai, the promulgation of the moral code on Mount Sinai, together with the Mosaic laws of social observance, and the instructions for the building of the Tabernacle. The authorship of this book was traditionally assigned to Moses, to whom indeed the Jews attribute the five books of the Torah, or Pentateuch; but since the 17th century biblical critics have seriously questioned the correctness of the tradition. The various views which have been held as to the composition of the book, the authorship of its different parts, and the dates at which they were probably written, will be found under BIBLE.

Exogamy, the usage by which in many primitive races a man is forbidden to marry a woman of his own stock or tribe. See MARRIAGE, and TRIBE.

Exogenous Plants, or EXOGENS, a term applied to dicotyledons by Lindley to express an erroneous view of the difference in the mode of stem-thickening from that of monocotyledons, and now wholly disused by botanists. See DICOTYLEDONS, also BARK, CAMBIUM, MONOCOTYLEDONS.

Exophagy. See CANNIBALISM.

Exorcism, the term used by the Fathers of the Church to denote the act of conjuring evil spirits, in the name of God or Christ, to depart out of the person possessed. The first Christians adjured evil spirits in the name of Jesus Christ, who had conquered the devil; but as the opinion was at the same time entertained that all idolaters belonged to the kingdom of Satan—who suffered himself to be worshipped under the form of idols—it was customary to exorcise heathens previous to their receiving Christian baptism. After Augustine's theory of original sin had found acceptance in the 5th century, and all infants were regarded as belonging to Satan's kingdom, exorcism became general at the baptism even of Christian children. Following the practice of the Roman Catholic Church, Luther retained it, and the baptismal office in the first prayer-book of Edward VI. (1549) contained a short form, omitted at Bucer's intervention in the 1552 revision. The seventy-second canon (1603) of the Church of England forbids any minister attempting to expel a devil or devils, without first obtaining the license of his bishop. Although abandoned by illustrious and orthodox Protestant theologians, such as Chemnitz and Gerhard, or deemed unessential, and in modern times done away with by the 'Protestant' Church, since 1822 baptismal exorcism has been revived by the Old Lutheran or High Church party.

In the Catholic Church the function of exorcism belongs peculiarly to the third of the so-called 'minor orders' (see ORDERS). Our Lord having not only himself in person (Matt. ix. 32; Mark, i. 25; Luke, iv. 35, viii. 29) cast out devils, but having also given the same power to his disciples, it is believed to be permanent in the church. Of its exercise in the early church, both in relation to 'energumens,' or persons possessed, and in the administration of baptism, there are numerous examples. Tertullian and Origen speak of it as of ordinary occurrence, and the Council of Carthage, in 255, alludes to its use in baptism. The rite of exorcism is used by the modern church in three different cases: in the case of actual or supposed demoniacal possession, in the administration of baptism, and in the blessing of the chrism or holy oil, and of holy water. This last practice is alluded to by Cyprian (Ep. 70). The use of exorcism in cases of possession is now extremely rare, and in many diseases is prohibited, unless with the special permission of the bishop. In baptism it precedes the ceremony of applying the water and the baptismal form. It is used equally in infant and in adult baptism, and Catholic writers appeal to the earliest examples of the administration of the sacrament as evidence of the use of exorcism in both alike. The rite of baptismal exorcism in the Roman Catholic Church follows closely the Scriptural model in Mark, viii. 33. The exorcisms in the blessing of the oil and water resemble very closely the baptismal form, but are more diffuse.

Exosmose. See ENDOSMOSE.

Exostemma, a West Indian genus nearly allied to Cinchona, for which its bark was formerly introduced as a substitute; it does not, however, contain the Cinchona alkaloids.

Exostosis, a term for a protuberance or morbid enlargement of a bone.

Exoteric. See ESOTERIC.

Exotic Plants, or EXOTICS (Gr., 'coming from abroad'), cultivated plants originally derived from foreign countries. The term is most frequently applied to those of which the native country differs so much in soil or climate from that into which they have been conveyed that their cultivation is attended with difficulty, requiring artificial heat or other means different from those requisite in the case of indigenous plants. See GARDENING.

Expansion. See HEAT, BRIDGE.

Expectation of Life. See PROBABILITIES.

Expectorants (Lat. *ex*, 'out of,' and *pectus*, 'the breast'), medicines given to carry off the expectorations—the mucus and other secretions of the air-tubes. The principal expectorants are antimony, ammonia, squill, ipecacuanha, senega, balsam of tolu, lobelia, gum ammoniac, asafœtida, galbanum, &c. The examination of the expectoration is of great value in the diagnosis of diseases of the chest (see BRONCHITIS, PNEUMONIA, CONSUMPTION). The word 'expectoration' has come by an abuse to be regarded as a mere elegant synonym for spitting. See SALIVA.

Expenses or **Costs of a Lawsuit.** In Scotland, the charges payable by the parties to a lawsuit are technically called expenses. The rules according to which they are awarded, apportioned between the parties, and taxed, do not differ materially from those applied in England to Costs, and explained under that head, *supra*. The Scottish official who discharges the functions of taxing master is the Auditor of Court. If the agent who has conducted the cause wish it, the decree for expenses will be pronounced in his favour; and the party found liable will not be allowed to plead a counter-claim against the client, as by that means he might prevent the agent from recovering what he very probably has disbursed.

Experiment. See SCIENCE.

Expert, a man of special practical experience or education in regard to a particular subject—a word commonly applied (after the French) to medical or scientific witnesses in a court of justice, when selected on account of special qualifications, as in the case of an analysis of the contents of the stomach in suspected poisoning. The term is similarly applied to a person professionally skilled in handwriting, for detection of forgery of deeds and signatures (see WRITING). It has been contended (see *Nature*, vol. xxxix. p. 589) that there should be experts specially retained to assist judges in cases where technical skill is necessary.

Exploration. See GEOGRAPHY.

Explosions. See MINING.

Explosives, a general term applicable to gunpowder, gun-cotton, dynamite, nitro-glycerine, and other explosive substances, treated in this work under their several heads (see also BLASTING, and FIRE-ARMS).

The law as to explosives is as follows: In general, whoever introduces explosives into a building is responsible for any damage they may cause. The tenant of a house is answerable for the damage caused by an explosion of gas on the premises, if gas escapes through the negligence of himself or his servants in attending to the stopcocks by which the supply of gas is regulated. Under the Explosives Act, 1875, any person throwing, casting, or firing any fireworks in or into any highway, street, thoroughfare, or public place, is liable to a penalty of £5. Any person unlawfully and maliciously causing, or attempting or conspiring to cause, an explosion likely to endanger life or seriously to injure property is guilty of felony. It is also felony to make, keep, or have in one's possession any such explosive substance, except under the regulations of the statutes concerning this matter. The chief enactments are the Explosives Act (which regulates the manufacture, storage, keeping, selling, and conveyance of nitro-glycerine, dynamite, gun-cotton, and other explosives), the Petroleum Acts, 1871 and 1875, and the Petroleum (Hawkers) Act, 1881. All factories and stores of gunpowder and other explosives must be licensed, and all places where explosives are kept must be registered. The sale of gunpowder to any child apparently under thirteen is prohibited. Government inspectors, officers of local authorities, and constables may search for and seize explosives unlawfully kept, in ordinary cases with a warrant, and in cases of emergency with a written order from a superintendent of police. The master of every ship which enters a British harbour must, if the ship carry petroleum, give notice of the fact to the harbour authority, which, under confirmation of the Board of Trade, makes bylaws regulating the landing of petroleum. Petroleum to the amount only of three gallons may be kept for private use or sale without a license, if it is kept in separate glass, metal, or earthen vessels, securely stopped, and each containing not more than a pint.

Exponents, or INDICES. The product $5 \times 5 \times 5 \times 5$ is expressed thus, 5^4, and the eighth power of a thus, a^8. The numbers 4 and 8 are the exponents of these respective powers. In general, a^n (where a is any number or expression) stands for the nth power of a—i.e. the product of n factors each $= a$, and there the value of this contracted notation is obvious. Introduced by Descartes, the theory of indices was speedily extended, and may now be said to affect algebraic operations of every conceivable kind. The two fundamental laws of indices are $a^m \times a^n = a^{m+n}$, and $(a^m)^n = a^{mn}$. These, with certain necessary conventions, apply to all possible values of the exponents m and n—integral or fractional, positive or negative, simple or complex, rational or surd, real or impossible, trigonometrical or logarithmic, &c. Minor results of the theory are such as these:

$a^0 = 1$, whatever a may be; $a^{-3} = \frac{1}{a^3}$, or a^{-n} is the reciprocal of a^n; $a^{\frac{1}{2}} = \sqrt{a}$, $a^{\frac{1}{3}} = \sqrt[3]{a}$, $a^{\frac{4}{5}} = \sqrt[5]{a^4} = (a^{\frac{1}{5}})^4$. An exponential equation is one in which the x or y occurs in the exponent of one or more terms, as $5^x = 800$. Its solution generally requires the use of logarithms. The exponential theorem gives a value of any number in terms of its natural logarithm, and from it can at once be derived a series determining the logarithm.

Express, in the United States, is specifically a system organised for the speedy transmission of parcels or merchandise of any kind, and their safe delivery in good condition. It originated in the trip made from Boston to New York by William Frederick Harnden (1813–45), the first 'express-package carrier,' on 4th March 1839. The project recommending itself to business men, competing companies sprang up rapidly, and express lines were established in all directions. Adams & Co.'s California express was started in 1849; Wells, Fargo, & Co.'s in 1852; the American-European company was created in 1855. As railways extended, the early 'pony express' disappeared, and individual companies now have

contracts with the several railway companies, their business over these routes being held to be entitled to the protection of the courts against any efforts to dispossess them. Many of the rival companies were amalgamated, and most of the successful concerns are now joint-stock institutions, the industry employing capital aggregating more than £10,000,000. A feature of the American express system is the 'collect on delivery' business, goods when sent to strange firms at a distance being marked C.O.D., with the amount to be collected on the outside of the package, and the payment being collected by the express company, which receives a slight compensation for this extra trouble. Also, the American Express Company issues, and has for sale at its 5500 offices throughout large sections of the East and West, money orders, which are payable at any of their offices, are received like cheques at all large banks (if handed in by depositors), and are generally preferred, as cheaper and safer than cheques or postal orders, for small remittances by mail. See A. L. Stimson's *History of the Express Business* (1883).

Extension, a term in Logic, opposed to *intension*, referring to the extent of the application of a term, or the number of objects included under it. The greater the extension of a term, the less is the intension; and the greater the intension or comprehension (the common characters included in a term), the less is the extension.

Extent. To extend is, in English law, to make a valuation of property by the oath of a jury. A writ of extent directs the sheriff to 'extend' and seize the property of a debtor. Such writs are now issued only for the recovery of debts of record due to the crown. In Scotland 'extent' (often shortened to 'stent') was used to denote the general valuation of lands for taxation, &c. For the old and new extent, see VALUATION OF LANDS. Writs of extent were formerly issued for the recovery of crown debts; and the English form of process was introduced, in revenue cases, by the Act of Union. In America extent is a process whereby the lands of a debtor are delivered to his creditor until the debt is paid out of the profits.

Extenuating Circumstances. When a crime is committed, those circumstances, in connection either with the position of the prisoner or with the act alone, which are taken into consideration by the court in mitigation of the punishment are popularly called extenuating circumstances. The previous good character of the person convicted may always be proved as a circumstance giving him some claim to leniency of punishment. Besides character, there are other circumstances, the presence of which in a case sometimes serves to mitigate the sentence, sometimes to take the act done out of the category of crime altogether. One is youth. Thus, no act done by any person under seven years of age is a crime. Defective mental power in the person convicted will always be considered in determining the severity of his sentence. Such disease of mind as prevents a man from knowing that the act he does is wrong will excuse him from the consequences of an act otherwise criminal. Thus, if one man kill another under the insane delusion that he is breaking a jar, the act is not a crime. Drunkenness, when voluntary, is not held an extenuating circumstance, but if a man is made drunk by the fraudulent administration of drugs, and while under their influence kills another, not knowing what he does, the act is not a crime. It is a good excuse for persons charged with crime that they have been compelled by others by threats of death or great violence to do the criminal act; and the acts of a married woman in presence of her husband are presumed to be done under his coercion, and so, unless the presumption is rebutted, will be excused. Ignorance of the law is no excuse for an offence. Thus, a foreigner, not knowing the law of England, might kill a man in a duel, and suppose that he had done nothing unlawful. But he would be guilty of murder. Nor, in general, will ignorance of facts be a good excuse, although in particular circumstances it might form a valid defence. Thus, if a man pretended in a joke to be a robber, presented a pistol at the head of a traveller, and demanded his money, and the traveller, believing himself to be attacked by a real robber, shot and killed the pretended robber, his act would be held as justified. Sir James Fitzjames Stephen (*Digest of the Criminal Law*, 1887) states, in language purposely vague, to represent the vagueness of the law, a principle under which the stress of necessity is held to excuse acts otherwise criminal. He says: 'An act which would otherwise be a crime may in some cases be excused if the person accused can show that it was done only in order to avoid consequences which could not otherwise be avoided, and which, if they had followed, would have inflicted upon him or upon others whom he was bound to protect inevitable and irreparable evil, that no more was done than was reasonably necessary for that purpose, and that the evil inflicted by it was not disproportionate to the evil avoided.' He gives as an illustration of the principle the case of a governor of Madras who acted towards his council in an arbitrary and illegal manner. The council deposed him and put him under arrest, and assumed the powers of government themselves. That was not an offence if the acts done by the council were the only means by which irreparable mischief to the establishment at Madras could be avoided. He also gives as a further illustration the often figured case of the plank. 'A and B, swimming in the sea after a shipwreck, get hold of a plank not large enough to support both; A pushes off B, who is drowned. This is not a crime.' The principle, however, was not held to cover the case of shipwrecked sailors who killed a boy in order to eat his body, without which they would probably not have survived.

Extincteur. See FIRE.

Extortion, in Law, is the offence or illegal act committed by a public officer who, under colour of his office, takes from any person any money or valuable thing which is not due from him at the time when it is taken. The act is a misdemeanour, and punishable as such. For example, if the governor-general of India wrongfully compel a native prince to pay sums of money to the Indian government (as was the charge against Warren Hastings), he commits extortion. The term has a special meaning in the criminal law of Scotland, in which it is also applied to the offence of compelling any one by force or fear to do any act which he would not have done of his own consent and inclination. For extortion in the sense of blackmailing, see THREATS.

Extractive Matter is the term applied to the soluble portions of any drug. The substances extracted from the same drug may vary according as the solvent is water, alcohol, ether, &c.; but, so long as the originally insoluble portions are not rendered soluble by the chemical action of the solvent, the term extractive matter is applicable to them.

Extracts, in a technical sense, are medicinal preparations of vegetable principles, got either by extracting these from the plants by means of a solvent or menstruum, and then evaporating the liquid down to about the consistency of honey, or by expressing the juice of the plants and evaporating; this last is properly *inspissated juice*. Extracts,

therefore, contain only those vegetable principles that are either held in solution in the juices of the plants themselves, or are soluble in the liquid employed in extracting them, and at the same time are not so volatile as to be lost during evaporation. Now, as many extractive matters are more or less volatile, it makes a great difference whether the operation is conducted at a low or at a high temperature. Besides the loss of volatile constituents by prolonged or excessive heating, extracts become more or less changed and inert owing to the readiness with which vegetable principles are destroyed when exposed to heat and air. On this account it is usual to avoid evaporation as much as possible, and, where this is impracticable, evaporation *in vacuo* is resorted to. Extracts are called *watery* or *alcoholic* according as the menstruum employed is water or alcohol. Ether is also used in extracting. Different plants, of course, afford different extracts, some being of the nature of bitters, others being used as pigments, tannin, &c.

Liquid extracts are those which are not evaporated so far as to form a paste, and it is usual to make them of such a strength that one fluid ounce contains the active ingredients of one ounce by weight of the drug.

EXTRACT OF MEAT is obtained by acting upon chopped meat by cold water, and gradually heating, when about one-eighth of the weight of the meat dissolves out, leaving an almost tasteless insoluble fibrin. The extract of meat contains the salts and savoury constituents of the meat, and is a light and stimulating article of food (see BEEF-TEA, and BROTH). It may be concentrated into small bulk, and, when desired, may be afterwards treated with water; being heated, it forms an agreeable light soup, though rather stimulating than nutritious. Of this nature is the well-known Liebig's Extract. In order to impart to extract of meat a nutritive as well as stimulant value, the fibrin is sometimes dried and powdered, and, when then incorporated with the extract itself, a product is obtained which represents the original meat in a readily digested form.

Extradition is the surrender of a person accused of crime to the government of a foreign country, within which the crime is alleged to have been committed. The duty of making such surrender has long been acknowledged by civilised nations; but some governments refuse to surrender their own subjects when accused of offences against a foreign law. In England it has been held that no executive officer has authority to surrender any person found within Her Majesty's dominions unless empowered to do so by act of parliament. Modern facilities for travelling have made extradition a subject of great importance. In 1843 the British government concluded an extradition treaty with France, and parliament passed an act giving the executive the necessary powers. Since that time treaties have been made by all, or almost all, civilised governments for the surrender of criminals. It is commonly supposed that some countries (Spain, for example) afford a safe refuge for criminals; but the British government concluded an extradition treaty with Spain in 1878, and even before the treaty offenders were given up to justice by the Spanish government. See the case of Bidwell, the bank-forger, in 1872. The practice of the British government is regulated by the Extradition Acts of 1870 and 1873. The extradition treaty between Britain and the United States was concluded in 1842, with France in 1843, and with Germany in 1872. Any police-magistrate may order the detention of a person accused of crime committed abroad on the same evidence which would justify committal of a person accused of crime committed in England. But the person detained is not surrendered until a demand has been addressed to a secretary of state by a diplomatic representative of the government making the demand. The secretary of state may direct a magistrate to inquire into the case; and on such inquiry the prisoner may show that the evidence against him is not sufficient to justify his committal and surrender for trial, or that the crime of which he is accused is not an 'extradition crime'—i.e. not within the treaties and acts which apply to the case. The list of extradition crimes, as fixed by the Act of 1870, includes murder, manslaughter, forgery, larceny, frauds by bankers, extortion by threats, and many other offences. If the magistrate certifies that he has committed the accused, the secretary of state gives a warrant for his surrender; but not until fifteen days have elapsed; during this interval the prisoner may, if so advised, apply to a superior court for a *habeas corpus*. Political offences are expressly excluded from the category of 'extradition crimes;' but it is to be observed that a political offence does not mean an offence committed from political motives, but an offence committed during a time of civil war or open insurrection (see POLITICAL OFFENCES, REFUGEE). A person surrendered on a specific charge may not be tried on any other charge. In 1877 a Royal Commission, appointed to consider the law of extradition, presented a report in which certain reforms were suggested, which have not yet been carried out. The Commission recommended that treaties should not be considered indispensable, and that British subjects should be surrendered as well as foreigners. It happens sometimes that the person whose surrender is demanded is not a subject of either government—a Spanish subject, for example, may commit crimes in Russia and take refuge in England. In this case the British government would probably not surrender the accused to Russia without obtaining the consent of Spain. In the United States offenders from one state taking refuge in another are usually surrendered by the governor thereof without question; but even in such cases constitutional points of considerable difficulty have sometimes arisen.

See E. Clarke's *Treatise on Extradition* (2d ed. 1874); Kirchner's *Law and Practice relative to Fugitive Offenders* (1882), and *Recueil de tous les Traités*, &c. (1883); and Hertslet's *Treaties and Laws relating to Commerce, Extradition*, &c. (1885).

Extravasation is the escape of any of the fluids of the living body from their proper vessels (*vas*) through a rupture or injury in their walls. Excrementitious matter thus sometimes escapes into the abdomen through a wound or ulceration of the bowels. But the term is oftenest used in speaking of the escape of blood from injured blood-vessels. Extravasation is distinguished from exudation by this, that in the last the vessels remain entire, and the effusion takes place by filtration through their walls; nor does more than a part of the blood so escape, the coloured blood-corpuscles being retained, while in extravasation perfect blood is effused. Many kinds of extravasation are rapidly fatal, such as that of urine or of the contents of the intestines into the abdomen, or of blood from the vessels of the brain in cases of apoplexy. The dark colour resulting from a bruise is owing to extravasated blood from ruptured capillary or larger vessels.

Extreme Unction, a sacrament of the Roman Catholic Church, which, as the other sacraments supply spiritual aid in the various circumstances of life, is believed to impart to the Christian in death grace and strength to encounter the struggle, as well spiritual as bodily, of the dying hour. The rite of unction in different forms is common to several of the sacraments; the name 'extreme' is

given to that of the present sacrament, because it is reserved for the last act of the Christian career. The Council of Trent declares this sacrament, although 'promulgated' in the well-known passage of James, v. 14, 15 (which Protestants regard as having more to do with the general belief in the sanative properties of oil), to have been 'instituted' by Christ. The Fathers frequently allude to the rite of unction, and although many of these allusions certainly refer to the unctions of baptism and confirmation, yet Catholics rely on several passages of Origen, Chrysostom, Cæsarius of Arles, and Pope Innocent I. as decisive regarding the unction of the dying, as also upon the fact that in the various separated churches of oriental Christians—Greek, Coptic, Armenian, and Nestorian—the rite is found, although with many ceremonial variations. In the Roman Catholic Church the sacrament is administered by the priest, who, 'dipping his thumb in the holy oil, anoints the sick person, in the form of the cross, upon the eyes, ears, nose, mouth, hands, and feet; at each anointing making use of this form of prayer: "Through this holy unction, and His most tender mercy, may the Lord pardon thee whatever sins thou hast committed by seeing. Amen." And so of hearing, smelling, taste and speech, touch, and walking, adapting the form to the several senses.' Extreme unction is reputed by Catholics one of the sacraments 'of the living;' —i.e. it ordinarily requires that the recipient should have previously obtained remission of his sins by absolution or by perfect contrition; but it is held to remit, *indirectly*, actual sins not previously remitted, and also (although not infallibly, but according to the merciful designs of Providence) to alleviate, and even to dispel, the pains of bodily disease. The holy oil which forms the 'matter' of this sacrament must be blessed by the bishop—a ceremony which is performed with great solemnity once each year by the bishop, attended by a number of priests, on Maundy-Thursday. The oil so blessed is reserved for use during the year. In the Greek Church the sacrament is administered by several priests conjointly. The Greeks call this sacrament 'The Holy Oil,' and sometimes 'The Oil of Prayer.'

Exumas, comprising Great Exuma, Little Exuma, and the Exuma Keys, form part of the group of the Bahama Islands. See BAHAMAS.

Exuviæ, a term applied to organic remains, now seldom employed, but frequently used by the older geologists.

Eyam (pronounced as if *Eem*), a village in North Derbyshire, 5 miles N. of Bakewell, with a population of 1038, chiefly engaged in lead-mining. Here broke out in September 1665, in its most virulent form, the plague which was then raging in London, and which had been carried hither in a box of clothes and tailor's patterns. William Mompesson, the rector of the parish, aided by Thomas Stanley, who had been ejected in 1662, devoted himself to the care of the dying with the most heroic courage. The plague lingered till the middle of October 1666, and as many as 260 out of a population of 350 perished. Another rector of Eyam achieved a less honourable eminence by living in his vestry for years to evade the consequences of a breach of promise case. Here he defied the law until his death in 1705. See W. Wood's *History of Eyam* (4th ed. 1865).

Eyck, HUBERT and JAN VAN, two illustrious painters of the early Flemish school. They were probably born at Alden Eyck or Maas Eyck on the Maas. The date of their birth is uncertain; but Hubert is supposed to have been born about 1370, and Jan about 1389. The distinction of being the inventors of oil-painting is claimed for them, though sufficient evidence has been adduced to show that the method was practised previously. Before their time, however, the custom, particularly in Italy, was to paint with gums or other substances of an adhesive nature dissolved in water, and they were the first who brought into notice and perfected the mode of mixing colours with oil or some medium in which oil was the chief ingredient; while for transparent and brilliant colouring and minute finish their works have never been surpassed. Jan appears to have been instructed in art by his elder brother, and to have painted in conjunction with him as court-painter to Philip of Charolais till 1422, when he entered the service of John of Bavaria, Count of Holland, at the Hague; and in 1425 he was appointed painter and varlet-de-chambre to Philip the Good, Duke of Burgundy, and practised his art chiefly at Bruges. Hubert continued to reside at Ghent, and at the time of his death, on 18th September 1426, was engaged upon a very important altarpiece, with folding-doors, the only work which we can certainly assign to him, and which was completed by his brother. Its subject was 'The Adoration of the Lamb,' and it was painted for Jodocus Vydts, who presented it to the cathedral of St Bavon in Ghent. The two central divisions of this picture are all that now remain in the church at Ghent, the wings being in the Gallery at Berlin, with the exception of those representing Adam and Eve, which are in the Brussels Museum. The masterpieces of the brothers are for the most part in the cities of Ghent, Bruges, Antwerp, Berlin, Munich, and Paris. In the National Gallery, London, there are three pictures of Jan van Eyck, which well exemplify the high qualities of his art. These are portraits of Jean Arnolfini and Jeanne de Chenany, his wife, standing in the middle of an apartment, with their hands joined—signed and dated 1434; the portrait of a man in a cloak and fur collar, with a red handkerchief twisted round the head as a turban—painted, according to an inscription on the lower part of the frame, October 21, 1433; and the portrait of a man with a dark-red dress and a green head-covering—signed and dated 10th October 1432. In the Louvre is his exquisitely finished little picture of 'Chancellor Rollin kneeling before the Virgin.' Jan died at Bruges, 9th July 1440.

MARGARET VAN EYCK, a sister of the two above painters, is mentioned as an excellent artist by Lucas de Heere and Van Manden. A 'Virgin and Child,' in the National Gallery, London, was formerly assigned to her, but in the catalogue of 1889 is attributed to an unknown painter of the Early Flemish school; and she is believed to have executed the miniatures in the missal of the Duke of Bedford. She died before 1431. See Crowe and Cavalcaselle, *Early Flemish Painters* (3d ed. 1879).

Eye (A.S. *ig*, 'an island'), a market-town and municipal borough in Suffolk, 20 miles N. of Ipswich. It has a fine Perpendicular flint-work church (restored 1869), with a tower 101 feet high, a corn exchange and town-hall (1857), a grammar-school (restored and enlarged, 1876–82), and a station at the terminus of a short branch-railway. Till 1885 it returned a member to parliament. Pop. (1851) 2587; (1881) 2296; (1891) 2064.

Eye. In this article we shall consider: (1) The structure of the human eyeball, and of certain accessory parts or appendages which serve to protect that organ, and are essential to the due performance of its functions. (2) The most striking modifications which this organ presents in some of the lower animals. (3) The eye considered as an optical instrument. (4) The action of the retina. (5)

The movements of the eyeballs, and binocular vision.

(1) The *globe of the eye* is placed in the anterior part of the cavity of the orbit, in which it is held in position by its connection with the optic nerve posteriorly, by the muscles which surround it, and by the eyelids in front. It is further supported behind and on the sides by a quantity of loose fat, which fills up all the interstices of the orbit, and facilitates the various movements of which the eye is capable.

The form of the eyeball is nearly spherical; but on viewing the organ in profile we see that it is composed of segments of two spheres of different diameters. Of these, the anterior, formed by the transparent cornea, is more curved, and therefore more prominent. The horizontal transverse diameter

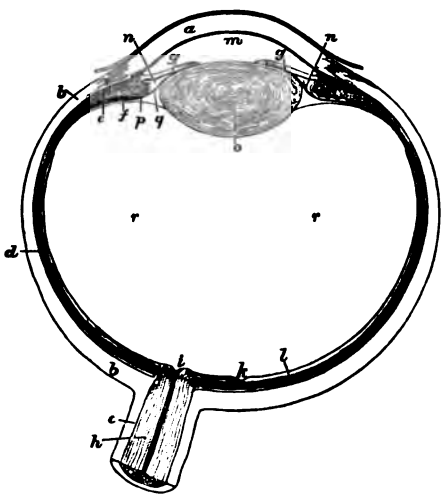


Fig. 1.—View of lower half of right Human Eye, divided horizontally:

a, cornea; *b*, sclerotic; *c*, sheath of optic nerve passing into sclerotic; *d*, choroid: *e*, ciliary muscle; *f*, ciliary process; *g*, *g*, iris; *h*, optic nerve with artery in centre; *i*, passage of nerve into retina, called optic disc or papilla; *k*, fovea centralis; *l*, retina; *m*, anterior chamber of aqueous humour; *n*, posterior chamber of aqueous humour; *o*, crystalline lens; *p*, zonule of Zinn; *q*, suspensory ligament of lens; *r*, vitreous humour.

is almost exactly an inch; the antero-posterior and vertical each about $\frac{1}{10}$ less. The radius of the posterior or sclerotic segment is about half, and that of the anterior segment about three-tenths of an inch.

When the eyes are in a state of repose, their antero-posterior axes are parallel; the optic nerves, on the other hand, diverge considerably from their commissure within the cavity of the skull to the point where they enter the globe; consequently their direction does not coincide with that of the eye. Each nerve enters the back of the globe at a distance of about one-eighth of an inch on the inner side of the antero-posterior axis of the eye.

The eyeball is composed of three concentric membranes, and of certain transparent structures, which are inclosed within them, and which, together with the cornea, transmit and refract the rays of light which enter the eye.

The outer (fibrous or protective) membrane consists of the sclerotic and cornea; the middle (vascular or nutrient) of the choroid and iris; the inner (nervous or percipient) of the retina. The transparent contents are (from before backwards) aqueous humour, crystalline lens, and vitreous humour. We shall consider these structures in order.

The *sclerotic* (from *skleros*, 'hard'), or 'white of the eye,' is a strong, dense, fibrous structure, covering about five-sixths of the eyeball, and continuous, anteriorly, with the cornea. Posteriorly, it is perforated by the optic nerve, and it is there continuous with the sheath which that nerve derives from the dura mater, the fibrous investment of the brain and spinal cord. Near the entrance of the nerve, its thickness is about $\frac{1}{20}$th of an inch; from this it diminishes to about $\frac{1}{40}$th; but in front it again becomes thicker, from the tendinous insertions of the straight muscles which blend with it.

The *cornea* (so called from its horny appearance) is a transparent structure, continuous with the sclerotic, from which it differs more in appearance than in texture, and completing the fibrous tunic of the eye anteriorly. Its circumference is overlaid by the free edge of the sclerotic, as 'a watch-glass by the edge of the groove into which it is received.' Its thickness is from $\frac{1}{16}$th to $\frac{1}{20}$th of an inch. It is covered in front by a layer of conjunctival epithelium, which is exquisitely sensitive.

The cornea, in consequence of its greater convexity, projects beyond the line of the sclerotic; the degree of convexity, however, varies slightly in different persons, and at different periods of life. It is so strong as to be able to resist a force capable of rupturing the sclerotic. The fibrous coat, by its great strength and comparatively unyielding structure, maintains the inclosed parts in their proper form, and serves to protect them from external injuries.

The *choroid coat* is a dark-coloured vascular membrane, which is brought into view on the removal of the sclerotic. Its outer surface, which is nearly black, is loosely connected with the sclerotic by connective tissue, in which are contained certain nerves and vessels—termed the ciliary nerves and vessels—some of which go forward to the iris. Its inner surface is smooth and dark-coloured. In front, it terminates in the *ciliary processes* (figs. 1 and 3), which consist of about sixty or seventy radiating folds or thickenings of the membrane, each of them terminated by a small free interior extremity, and lodged in a corresponding fold in the suspensory ligament of the lens. In other parts, it is covered by the

Fig. 2.—Choroid and Iris, exposed by turning aside the sclerotic:

c, *c*, ciliary nerves going to be distributed in iris; *d*, *d*, smaller ciliary nerves; *e*, *e*, veins known as vasa vorticosa; *h*, ciliary muscle; *k*, *l*, converging fibres of iris; *o*, optic nerve.

hexagonal pigment-cells of the retina. The choroid is composed of minute ramifications of vessels—

especially of veins, which, from their whirl-like arrangement, are termed *vasa vorticosa*—of connective tissue, and of large branching pigment-cells. Between the sclerotic and choroid at its anterior part lies a small but important structure, the *ciliary muscle*, which arises from the inner surface of the sclerotic near the cornea, and passes backwards to be inserted into the choroid opposite the ciliary processes.

The *iris* may be regarded as a process of the choroid, with which it is continuous, although there are differences of structure in the two membranes. It is a thin flat membranous curtain, hanging nearly vertically in the aqueous humour in front of the lens, and perforated by the pupil for the transmission of light. Its anterior surface is variously coloured, and covered by fine irregularly-radiating projections; its posterior surface is smooth, and covered by a uniform layer of dark pigment, continuous with the pigment-cells of the retina. The posterior surface near the pupil is in contact with the anterior capsule of the lens. It divides the space between the cornea and the lens into an anterior (the larger) and a posterior (the smaller) chamber, these two chambers freely communicating through the pupil (see fig. 1). The outer and larger border is attached all round near the line of junction of the sclerotic and cornea, to the cornea, choroid, and ciliary muscle, while the inner edge forms the boundary of the pupil, which is nearly circular, lies a little to the side of the centre of the iris, and varies in size according to the action of the muscular fibres of the iris, so as to admit more or less light into the interior of the eyeball; its diameter varying, under these circumstances, from about $\frac{1}{4}$d to $\frac{1}{10}$th of an inch. It is muscular in its structure, one set of fibres being arranged circularly round the pupil, and, when necessary, effecting its contraction, while another set lie in a radiating direction from within outwards, and by their action dilate the pupil. These fibres are of the unstriped or involuntary variety. The nerves which are concerned in these movements will be presently noticed. The iris is richly supplied with blood-vessels; and pigment-cells like those of the choroid are scattered through its substance.

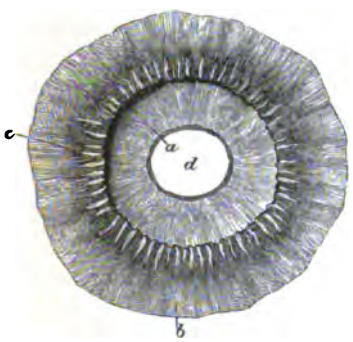


Fig. 3.—Iris and Ciliary Processes from behind:
a, posterior surface of the iris, with the sphincter muscle of the pupil; *b*, anterior part of the choroid coat; *c*, one of the ciliary processes, of which about seventy are represented; *d*, the pupil.

The varieties of colour in the eyes of different individuals, and of different kinds of animals, mainly depend upon the colour and amount of the pigment in these cells. In blue eyes, this pigment is scanty or absent, and the colour is due to the dark pigment of the posterior surface partly seen through the vascular membrane; in brown and black eyes, it is abundant, and is the cause of the colour. In albinos, this pigment is absent from iris, retina, and choroid, and hence their eyes have a pink appearance, which is due to the unconcealed blood in the capillaries of the choroid and iris.

Within the choroid is the *retina*, which, although continuous with the optic nerve—of which it is usually regarded as a cuplike expansion—differs very materially from it in structure. Before noticing the elaborate composition of this part of the eye, which has only been revealed by microscopical investigation, we shall briefly mention those points regarding it which can be established by ordinary examination. It is a delicate semi-transparent sheet of nervous matter, lying immediately behind the vitreous humour, and extending from the optic nerve nearly as far as the lens. On examining the concave inner surface of the retina at the back of the eye (see fig. 4), we observe, directly in a line with the axis of the globe, a circular yellow spot (*macula lutea*), of about $\frac{1}{20}$th of an inch in diameter, called, after its discoverer, the *yellow spot of Sömmering*, with a depression in its centre, the *fovea centralis*. About $\frac{1}{8}$th of an inch internal to this is the entrance of the optic nerve, called the *optic disc* or *papilla*, from which the central artery and vein of the retina may be seen branching as they pass to their distribution.

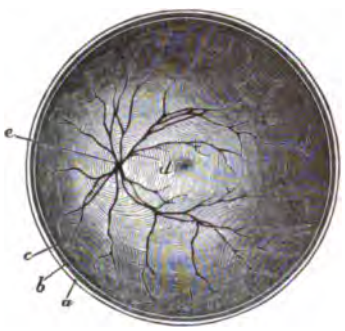


Fig. 4.—Posterior half of left Eye from the front:
a, cut edge of sclerotic; *b*, of choroid; *c*, of retina; *d*, macula lutea; *e*, optic disc or papilla.

The structure of the retina, as revealed by the microscope, is in the highest degree remarkable (see fig. 5). Although its greatest thickness (at the entrance of the optic nerve) is only about $\frac{1}{50}$th of an inch, and as it extends anteriorly, it soon diminishes to $\frac{1}{100}$th of an inch, the following layers from without inwards can be distinguished in most parts of it: (*a*) The pigmentary layer, consisting of a single layer of flat hexagonal cells, regularly arranged; its outer surface closely connected with the choroid, its inner in contact with the extremities of the rods and cones. Though its development shows that it really belongs to the retina, its mechanical connection with the choroid is firmer; and to this it adheres when the retina is stripped off. (*b*) The layer of rods and cones, frequently termed, from its discoverer, the *membrane of Jacob;* (*c*) outer granular layer; (*d*) outer molecular; (*e*) inner granular; (*f*) inner molecular; (*g*) layer of nerve-cells; (*h*) layer of nerve-fibres, in which the blood-vessels lie.

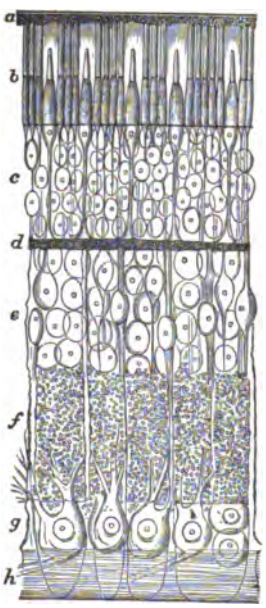


Fig. 5.—Diagrammatic Section of Human Retina.

The layer of rods and cones, the portion of the eye which receives the impressions of light, deserves special attention. The rods are thinner but longer than the cones, and in most parts of the retina far more numerous. At the yellow spot, however, only cones are found. Each rod or cone consists of a thicker inner portion, connected with the outer granular layer, and ultimately with the optic nerve by a fine fibril; and an outer thinner part, directed towards and connected with the pigmentary layer. The percipient elements are thus directed away from, not towards the light. 'In fact, we do not look outwards at the actual object, but we see the object as reflected from the base of our own eye.' Of the cones there are several, of the rods many millions in each human eye, and they are closely packed together over the whole extent of the retina.

It now remains for us to describe the *transparent media* which occupy the interior of the globe, and through which the rays of light must pass before they can reach the retina, and form on it the images of external objects. We shall consider them in the order in which the rays of light strike them.

Immediately behind the transparent cornea is the *aqueous humour*, which fills up the anterior and posterior chambers which lie between the cornea and the lens. As its name implies, it is very nearly pure water, with a mere trace of albumen and chloride of sodium. It is believed to be secreted by the choroid and to pass forward from it through minute lymphatic channels.

The *crystalline lens* lies opposite to and behind the pupil, in contact with the inner part of the iris, and its posterior surface is received into a corresponding depression on the forepart of the vitreous humour (see fig. 1). In form, it is a double-convex lens, with surfaces of unequal curvature, the posterior being the most convex. It is inclosed in a transparent capsule, of which the part covering the anterior surface is nearly four times thicker than that at the posterior aspect. The microscopic examination of the substance or body of the lens reveals a structure of wonderful beauty. Its whole mass is composed of extremely minute elongated ribbon-like structures, commonly called the *fibres of the lens*. These fibres are arranged side by side in lamellæ, of which many hundred exist in every lens, and which are so placed as to give to the anterior and posterior surfaces the appearance of a central star, with meridian lines. The lens gradually increases in density, and at the same time in refracting power, towards the centre; by this means, the refracting power is made greater than it would be even if the lens had throughout the same index of refraction as the nucleus. (According to the latest measurements, the index of refraction of the outer layer is 1·393; of the nucleus, 1·431; the total refractive power corresponds to that of a homogeneous body of the same size and shape with index 1·448.) This arrangement besides corrects to a certain extent the spherical aberration of the eye. According to Berzelius, the lens contains 58 per cent. of water, 36 of albumen, with minute quantities of salts, membrane, &c. In consequence of the albumen, it becomes hard and opaque on boiling, as we familiarly see in the case of the eyes of boiled fish. In the adult, its diameter transversely is about ½d, and its thickness antero-posteriorly about ⅓th of an inch; and it weighs three or four grains. The lens is held in position by the *suspensory ligament* of the lens and *zonule of Zinn*, a fine transparent fibrous structure, attached outwardly to the choroid between the ciliary processes, and passing inwards to blend with the anterior and posterior capsule of the lens near its margin (see fig. 1).

The *vitreous humour* lies in the concavity of the retina, and occupies about four-fifths of the eye posteriorly. Its form is shown in fig. 1. It is inclosed, except in front, in the hyaloid membrane, which blends anteriorly with the zonule of Zinn; and its anterior surface is in contact with the posterior capsule of the lens. It is quite transparent, and of a soft gelatinous consistence. Its outer part at least is laminated, like the coats of an onion. But the exact arrangement of the framework which gives it its consistence has not been determined. Between the anterior border of the retina and the border of the lens, we have a series of radiating folds or plaitings termed the *ciliary processes of the vitreous body*, into which the *ciliary processes of the choroid* dovetail. The vitreous humour contains, according to Berzelius, 98·4 per cent. of water with a trace of albumen and salts, and hence, as might be expected, its refractive index is almost identical with that of water.

The appendages of the eye now claim our notice. The most important of these appendages are the *muscles within the orbit*, the *eyelids*, the *lachrymal apparatus*, and the *conjunctiva*, to which (although less important) we may add the *eyebrows*.

The *muscles* by which the eye is moved are four straight (or *recti*) muscles, and two oblique (the superior and inferior). The former arise from the margin of the optic foramen at the apex of the orbit, and are inserted into the sclerotic near the cornea, above, below, and on either side. The superior oblique arises with the straight muscles; but after running to the upper edge of the orbit, has its

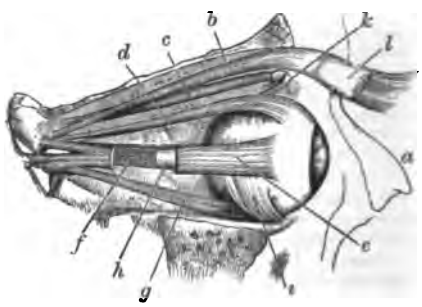


Fig. 6.—Muscles of Right Eyeball:
The external rectus muscle divided to show the optic nerve, which has also been cut to show the internal rectus muscle.
a, nasal bone; *b*, levator palpebræ superioris; *c*, superior oblique; *d*, superior rectus; *e*, external rectus; *f*, internal rectus; *g*, inferior rectus; *h*, optic nerve; *i*, inferior oblique; *k*, pulley; *l*, tarsal cartilage.

direction changed by a pulley, and proceeds backwards, outwards, and downwards (see fig. 6). The inferior oblique arises from the lower part of the orbit, and passes backwards, outwards, and upwards. The action of the straight muscles is sufficiently obvious from their direction: when acting collectively, they fix and retract the eye; and when acting singly, they turn it towards their respective sides. The oblique muscles antagonise the recti, and draw the eye forwards; the superior, acting above, directs the front of the eye downwards and outwards, and the inferior upwards and inwards. By the duly associated action of these muscles, the eye is enabled to move (within definite limits) in every direction.

The *eyelids* are two thin movable folds placed in front of the eye, to shield it from too strong light, and to protect its anterior surface. They are composed of (1) skin, with a layer of muscle (part of the *orbicularis*, see below) closely adherent to it; (2) of a thin plate of fibro-cartilage, termed

the *tarsal cartilage*, the inner surface of which is grooved by thirty or forty parallel vertical lines, in which the Meibomian glands are imbedded; and (3) of a layer of mucous membrane (*conjunctiva*), continuous, as we shall presently see, with that which lines the nostrils, and joining the skin at the margin of the lids, in which the eyelashes (*cilia*) are arranged in two or more rows. The upper lid is much the larger; and to the posterior border of its cartilage a special muscle is attached, termed the *levator palpebræ superioris*, whose object is to elevate the lid, and thus open the eye; while there is another muscle, the *orbicularis palpebrarum*, which surrounds the orbit and eyelids, and by its contraction closes the eye. The Meibomian glands secrete a sebaceous matter, which facilitates the free motion of the lids, and prevents their adhesion. The eyelashes intercept the entrance of foreign particles directed against the eye, and assist in shading that organ from an excess of light.

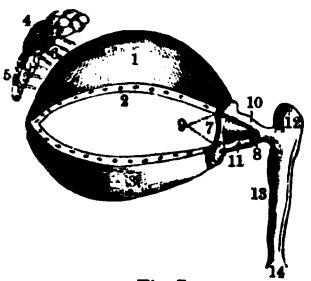


Fig. 7.
The Appendages of the Eye:

1, the cartilage of the upper eyelid; 2, its lower border, showing the openings of the Meibomian glands; 3, the cartilage of the lower eyelid, also showing on its border the openings of the Meibomian glands; 4, 5, the lachrymal gland; 6, its ducts; 7, the plica semilunaris; 8, the caruncula lachrymalis; 9, the puncta lachrymalia, opening into the lachrymal canals; 10, 11, the superior and inferior lachrymal canals; 12, the lachrymal sac; 13, the nasal duct, terminating at 14 in the lower meatus of the nose.

The *lachrymal apparatus* consists of the lachrymal gland, by which the tears are secreted; two canals, into which the tears are received near the inner angle of the eye; the sac, into which these canals open; and the duct, through which the tears pass from the sac into the nose. The gland is an oblong body, about the size of a small almond, lying in a depression in the upper and outer part of the orbit. The fluid secreted by it reaches the surface of the eye by twelve or fourteen ducts, which open on the conjunctiva at its upper and outer part. The constant motion of the upper eyelid induces a continuous gentle current of tears over the surface, which carry away any foreign particle that may have been deposited on it. The fluid then passes through two small openings, termed the *puncta lachrymalia* (see 9 in fig. 7), into the canals; whence its further course into the lower portion of the nose is sufficiently obvious from the figure. The conjunctiva (or mucous coat) which covers the front of the eyeball, and lines the inner surface of the lids, passes down and lines the canals, sac, and duct; and is thus seen to be continuous with the nasal mucous membrane, of which it may be regarded as an offshoot or digital prolongation.

We shall conclude this sketch of the anatomy of the human eye by a brief notice of the *nerves* going to this organ and its appendages. Into each orbit there enters a nerve of *special sense*—viz. the optic nerve; a nerve of *ordinary sensation*—viz. the ophthalmic branch of the fifth nerve; and certain nerves of *motion* going to the muscular tissues, and regulating the movements of the various parts—viz. the third, fourth, and sixth nerves.

As the optic tracts from which the *optic nerves* originate are noticed in the article BRAIN, we shall merely trace these nerves from their *chiasma* or commissure forwards. This commissure results from the junction of the optic tracts of the two sides; and it is especially remarkable for the fact that it presents a partial decussation of the nervous fibres; the central fibres of each tract passing into the nerve of the *opposite* side, and crossing the corresponding fibres of the other tract, while the outermost fibres, which are much fewer in number than the central ones, pass to the optic nerve of the *same* side. In front of the commissure, the nerves enter the optic foramen at the apex of the orbit, receive a sheath or investment from the *dura mater*, acquire increased firmness, and finally terminate in the retina. The peculiar mode of termination of the optic nerves in the cuplike expansion of the retina, the impairment or loss of vision which follows any morbid affection of them, and the constant relation in size which is observed in comparative anatomy between them and the organs of vision, afford sufficient evidence that they are the proper conductors of visual impressions to the sensorium.

The first or ophthalmic division of the fifth or trifacial nerve sends branches to the eyeball (ciliary nerves), to the skin of the eyelids, and to the conjunctiva. That it is the nerve of ordinary sensation of the eye is sufficiently obvious from the following facts: (1) That in disease of this nerve in the human subject, it is not uncommon to find the surface of the eyeball totally insensible to every kind of stimulus (particles of dust, pungent vapours, &c.); and (2) that if the nerve be divided in the cranium (in one of the lower animals), similar insensibility results.

The most important of the nerves of motion of the eye is the third nerve, or *motor oculi*. It supplies with motor power the elevator of the upper eyelid, and all the muscles of the globe, except the superior oblique and the external straight muscle, and, in addition to this, it sends filaments to the iris and ciliary muscle within the eye. The application of an irritant (in vivisection experiments) to its trunk induces convulsive contraction of the principal muscles of the ball and of the iris; while paralysis or division of the trunk occasions an external squint, with palsy of the upper eyelid and fixed dilatation of the pupil. The squint is caused by the action of the external straight and the superior oblique muscles, while the other muscles are paralysed by the operation. The normal motor action of the nerve upon the iris, in causing contraction of the pupil, is excited through the optic nerve, and affords a good illustration of *Reflex Action* (q.v.); the stimulus of light falling upon the retina, and, through it, exciting that portion of the brain from which the third nerve takes its origin. This nerve clearly exerts a double influence in relation to vision: (1) it mainly controls the movements of the eyeball and the upper eyelid; and (2) from its connection with the muscular structures in the interior, it regulates the amount of light that can enter the pupil, and the adjustment of the eye to various distances. The fourth nerve supplies the superior oblique muscle with motor power, while the sixth nerve similarly regulates the movements of the external straight muscle—the only two muscles in the orbit which are not supplied by the third pair. Although not entitled to be termed a nerve of the orbit, the facial nerve deserves mention as sending a motor branch to the *orbicularis* muscle, by which the eyelids are closed.

(2) *Comparative Anatomy of the Eye.*—In *mammals*, the structure of the eye is usually almost identical with that of man. The organ is, however, occasionally modified, so as to meet the peculiar wants of the animal. Thus, in the Cetacea, and in some amphibious Carnivora that catch their prey in the water, the shape of the lens

is nearly spherical, as in fishes, and there is a similar thickening of the posterior part of the sclerotic, so as to thrust the retina sufficiently forward to receive the image formed by such a lens. (See the subsequent remarks on the eyes of fishes.) Again, instead of the dark-brown or black pigment which lines the human choroid, a pigment of a brilliant metallic lustre is secreted in many of the mammalia, forming the so-called *tapetum lucidum* at the bottom of the eyeball, which seems (according to Bowman) to act as a concave reflector, causing the rays of light to traverse the retina a second time, and thus probably increasing the visual power, particularly where only a feeble light is admitted to the eye. The pupil, moreover, varies in form, being transversely oblong in the Ruminants and many other Herbivora, and vertically oblong in the smaller genera of Cats. These shapes are apparently connected with the positions in which the different animals look for their food. Lastly, in some mammals (e.g. the horse) there is a rudimentary third eyelid corresponding to the *membrana nictitans* of birds.

In *birds*, the eye, though presenting the same general composition as in man, differs from the mammalian eye in several important points. From our knowledge of the habits of birds (especially birds of prey), we should naturally expect that in their rapid movements they would be able readily to alter the focus between the extremes of long and short sighted vision, and the modifications we shall now proceed to notice clearly have this object in view.

In reference to fig. 8, which represents a section of the eye of the owl, we see (1) that the shape of the organ is not spherical, as in mammals, nor flattened anteriorly, as in fishes and aquatic reptiles, but that the cornea is very prominent, and the antero-posterior diameter lengthened; the consequence of this arrangement being to allow room for a large quantity of aqueous humour, and to increase the distance between the lens and the posterior part of the retina, and thus to produce a greater convergence of the rays of light, by which the animal is enabled to discern near objects. In order to retain this elongated form, we find a series of bony plates, forming a broad zone, extending backwards from the margin of the cornea, and lying imbedded in the sclerotic. The edges of the pieces forming this bony zone overlap each other, and are slightly movable, and hence, when they are compressed by the action of the muscles of the ball, there is protrusion of the aqueous humour and of the cornea, adapting the eye for near vision; while relaxation of the muscles induces a corresponding recession of the humour and flattening of the cornea, and fits the eye for distant vision. The focal distance is further regulated by a highly vascular organ called the *marsupium*, or *pecten*, which is lodged in the posterior part of the vitreous humour (fig. 8, *a*). It is attached to the optic nerve at the point where it expands into the retina, and seems to be endowed with a power of dilatation and contraction; as it enlarges, from distension of its blood-vessels, it causes the vitreous humour to push the lens forwards, while, as it collapses, the lens falls backwards again towards the retina.

Fig. 8.—Eye of Bird.

In addition to an upper and lower eyelid, birds have an elastic fold of conjunctiva, which, in a state of repose, lies in the inner angle of the eye, but is movable by two distinct muscles, which draw it over the cornea. It is termed the *membrana nictitans*; it is to a certain degree transparent, for (according to Cuvier) birds sometimes look through it, as, for example, the eagle when looking at the sun. The lachrymal gland is situated as in mammals, but there is here a second gland, the *glandula Harderi*, which yields a lubricating secretion.

There are no very special peculiarities in the eyes of *reptiles*, and we therefore proceed to notice the most remarkable points presented by the eye in *fishes*. From the comparatively great density of the medium (water) through which the rays of light pass before they impinge upon the transparent structure of the eye of the fish, it is obvious that this organ must act as a very powerful refractive apparatus. The main peculiarity in the eye of the fish is the size, extreme density, and spherical shape of the lens, which give it such an extraordinary magnifying power that it has been employed as a simple microscope. See Brewster's *Treatise on the Microscope*, p. 31. But its focus being shortened in proportion as its power is increased, it is necessary that the retina should be brought near its posterior surface. For this purpose the eyeball is flattened by diminishing the quantity of vitreous humour; and this flattened form is maintained by the existence of two cartilaginous plates in the tissue of the sclerotic, which in some of the larger fishes is actually converted into a bony cup. The aqueous humour, as the cornea has here hardly any refractive power and is also flattened, is barely sufficient to allow the free suspension of the iris. The pupil is very large, so as to take in as much light as possible, but is generally motionless. Their eyes being constantly washed by the water in which they live, no lachrymal apparatus is necessary, nor does any exist; and the same remark applies to the *cetacea* amongst the mammals. We thus see that throughout the sub-kingdom of the *vertebrata* the eye is constructed according to one general scheme, with modifications to suit the mode of life of individual classes.

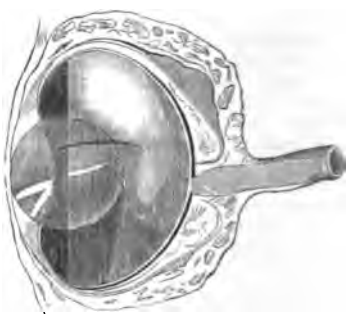


Fig. 9.—Eye of Fish.

There is another organ present in most vertebrate animals which seems, from recent investigations, to represent an eye, though it is very doubtful whether it has the power of sight in any living animal. This is represented in mammals and birds by the pineal gland (see BRAIN); but in some lizards is placed upon the top of the head, and has the appearance of a rudimentary eye, similar in structure to that of some of the Invertebrata.

In the Invertebrata there is an immense variety in the structure of the eye where such an organ is present. There are two main types, *simple* and *compound* eyes. In *simple* eyes (of which the human eye itself is the most highly organised form), every degree of complexity is present, from a mere pigmented spot, with or without a rudimentary lens, to an organ nearly as complicated as that of the Vertebrata (e.g. in some of the Cuttle-fishes), with a cornea, iris, lens, and retina all well

developed. In these eyes, however, almost without exception, the nerve expands behind the retina, and the percipient elements are directed towards the light; while in the vertebrate eye the opposite arrangement obtains.

Some of these organs are so rudimentary that they can have no function beyond mere perception of light; but in cases where they are sufficiently developed to admit of the perception of objects, they see, roughly speaking, as our eyes do—that is to say, a more or less accurate picture of external objects is thrown on the expansion of nerve-endings corresponding to the retina, and its direction is reversed (see below).

In the *compound* eyes the whole principle of the structure and perception is different. They are best developed in Insects (q.v.), and in the higher Crustaceans; but occur in a rudimentary condition in some molluscs. The surface of such an eye is divided into a number of hexagonal facets, the cuticle of each generally forming a minute lens. Beneath each facet is a transparent rod, surrounded and separated from those adjacent to it by pigment, and leading inwards to the retinula, a group of cells in connection with the terminal fibrils of the optic nerve. In most familiar insects they form two hemispherical masses on the sides of the head. In some ants there are only fifty facets in each eye; in the house-fly about 4000; in some beetles as many as 25,000. It is probable that in these eyes only the rays of light which fall upon a particular facet exactly, or very nearly, in the direction of the transparent rod beneath it can reach the corresponding nerve-fibre, and that other rays are absorbed by the pigment around the rod. Each percipient element therefore receives light only from a very small portion of the field of vision, and the picture is a mosaic, each element of which is furnished by a different facet of the eye. The picture has obviously the same position as the objects it represents, instead of being inverted as in a simple eye. Most insects have simple as well as compound eyes; but the latter have by far the most perfect vision.

(3) We may now proceed to the consideration of the uses of the various parts of the eye. Assuming a general knowledge of the ordinary laws of geometrical optics (see OPTICS, LENSES), we shall trace the course of the rays of light proceeding from any luminous body through the different media on which they impinge. If a luminous object, as, for example, a lighted candle, be placed in front of the eye, some of its rays fall upon the cornea, and are in part reflected, giving to the surface of the eye its beautiful glistening appearance; in part refracted or converged by it, to enter the aqueous humour, which exerts no perceptible effect on their direction. Those which fall on and pass through the outer or circumferential part of the cornea are stopped by the iris, and are either scattered or absorbed by it; while those which fall upon its more central part pass through the pupil, and are concerned in vision. In consequence of its refractive power, the rays passing through a somewhat larger surface of the cornea than the pupil are converged so as to pass through it and impinge upon the lens, which, as its refractive index is much greater than that of the aqueous and vitreous humours, by the convexity of both its surfaces very much increases the convergence of the rays passing through it. They then traverse the vitreous humour, whose principal use appears to be to afford support to the expanded retina, and are brought to a focus upon that tunic, forming there, if the eye be adjusted for the distance from which the rays proceed, an exact but inverted image of the object.

This inversion of the image may be easily exhibited in the eye of a white rabbit or other albino animal, after removing the muscles, &c. from the back part of the globe. The flame of a candle (A, B, C, fig. 10) held before the cornea may be seen inverted at the back of the eye (*a*, *b*, *c*), increasing in size as the candle is brought near, diminishing as it retires, and always moving in a direction opposite to that of the flame.

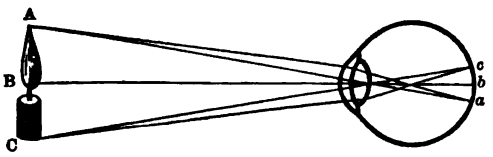


Fig. 10.

The adjustment of the eye for distinct vision at different distances, or *accommodation*, must next be considered. The normal eye in the position of rest is adjusted to see objects at a distance (practically all objects at 20 feet or more are seen with equal clearness): to see a near object (at 10 inches, say) a distinct effort is required, and when the effort ceases the object at once appears blurred. Careful observations and measurements by means of a suitable instrument (Ophthalmometer) of images reflected from the three principal refracting surfaces of the eye (cornea, anterior and posterior surfaces of crystalline lens) have shown that during

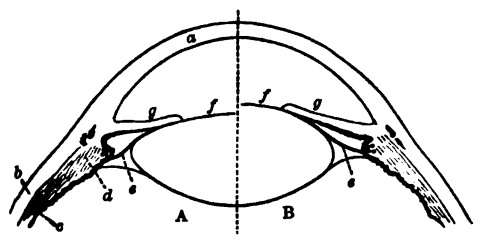


Fig. 11.—Action of Ciliary Muscle and Iris in accommodation:

A, (right or left) half; eye at rest, or focused for a distant object. B, (left or right) half; eye focused for a near object. *a*, cornea; *b*, sclerotic; *c*, anterior part of choroid; *d*, ciliary muscle; *e*, suspensory ligament of lens; *f*, anterior capsule of lens; *g*, iris.

accommodation for a near object (1) the position and curvature of the cornea remains unchanged; (2) the anterior surface of the crystalline lens approaches the cornea and becomes much more convex; (3) the posterior surface does not change its position, but becomes very slightly more concave. Accommodation, then, depends upon change of shape of the crystalline lens. The true explanation of the mechanism by which this is effected was first given by Helmholtz. The ciliary muscle, as already stated, has its fixed attachment all round within the sclerotic close to the margin of the cornea; and passes outwards and backwards to the anterior part of the choroid, close to the ciliary processes. When it contracts, therefore, it draws these structures inward; and with them the outer attachment of the suspensory ligament of the lens. The tension of this membrane is thus relaxed, and the elastic lens, whose form as well as position is controlled by it, is allowed to assume a more spherical shape. When the ciliary muscle ceases to contract, the converse takes place, and the lens is again flattened as the suspensory ligament and lens capsule become more tense. With the contraction of the ciliary muscle is always associated a contraction of the circular fibres of the iris, diminishing the size of the pupil; and when the ciliary muscle relaxes, the pupil enlarges again. This

change, though of much less importance than the change in shape of the lens, is much more easy to observe.

Change of adjustment requires a short but measurable time; that from distant to near vision requires a little longer time than the converse; the former from a little over one to two seconds, the latter about one second.

As age advances, the power of accommodation steadily and quickly diminishes, not because the ciliary muscle gets weaker, but because the lens becomes less elastic. This change begins during youth, but is not commonly noticed before middle life. At ten years of age an object can be seen distinctly at less than 3 inches; at twenty, not nearer than 4 inches; at about forty-five, not nearer than 10 inches; at sixty, not nearer than 3 feet. After seventy-five, the lens is so unyielding that accommodation is altogether lost. When the shortest distance at which distinct vision is possible approaches that at which reading or work is usually attempted, the failure of accommodation begins to attract attention, and spectacles have to be resorted to to compensate for it. This condition has received the name of *presbyopia* or old sight, but must be clearly understood to be perfectly natural after the age of forty-five, and in no way to imply defect or weakness of the eyes.

The eye, regarded as an optical instrument, has numerous imperfections: the more important of these must be mentioned.

Spherical aberration (see LENS) is in part avoided by the iris, which, acting as a diaphragm, cuts off all but the central pencil of rays; in part by the forms of the refracting surfaces, which are not truly spherical, but ellipsoidal or hyperbolical —i.e. more curved at the centre than elsewhere; in part by the constitution of the lens (see above). What remains is, like *chromatic aberration*, for which no correction seems to exist, too slight to be perceptible.

Regular *Astigmatism* (q.v.) is present in almost all eyes, but is generally so small in amount as to be of no importance.

Imperfect Transparency of Media.—The stellate arrangement of the lamellæ of the lens is the cause of the rayed (or, as we say, star-shaped) appearance of a point of light. *Muscæ volitantes*, the clear threads or strings of beads often seen in looking at a bright surface flitting about when the eye is moved, are due to the shadows of the minute fibres and corpuscles naturally present in the vitreous humour.

(4) We must now consider how the image formed in the back of the eye by the dioptric media gives rise to vision. It is the retina, and only that part of it known as the layer of rods and cones (see fig. 5), which is directly affected by light.

Let two marks be made on a sheet of paper about 3 inches apart horizontally (a cross and a round mark to the right of it). Close the left eye, and holding the paper about a foot from the face, look steadily at the cross; the circle is also visible. Now bring the paper gradually nearer, keeping the right eye fixed upon the cross. The circle soon disappears; but becomes visible again when the paper is brought still nearer the eye. The *blind spot* in which the circle becomes invisible is the entrance of the optic nerve; hence we know that the nerve-fibres themselves are not sensitive to light. Further proof of this is given by *Purkinje's figure*, which is easily perceived as follows: Take a candle in a room otherwise dark, and holding it a short distance in front and to the outer side of one eye, move it from side to side, looking straight forward. A set of branching dark lines, the shadows of the retinal blood-vessels, will be seen (see fig. 4). These could not be perceived unless the sensitive portion of the retina lay behind the blood-vessels, which the nerve-fibre layer of the retina does not.

Stimulation of the retina, however it may be caused, gives rise to the sensation of light. Thus, slight pressure on one side of the eyeball causes an appearance of flashes of light towards the opposite side. A sudden blow on the eye, or the indirect shock to it of a fall on the head, makes one 'see stars.' Electric currents passed through the eye similarly cause a sensation of bright light. But true vision is only caused by rays of light falling upon the retina.

In what way light affects the layer of rods and cones we do not know. Probably it produces some chemical change, which leads to stimulation of the nervous elements. A substance called *visual purple* or *rhodopsin* has been found in the outer segments of the rods of some mammals, which is bleached on exposure to light, and restored in darkness. Photographic pictures of bright objects have even been obtained in eyes of rabbits, &c. by means of it. But as it is absent in the most sensitive portion of the human retina, it cannot be the chief factor in the production of vision.

The *fovea centralis* (see fig. 1) is the part of the retina where vision is most acute: as cones only are present here, it is clear that they are more delicately adjusted for their function than the rods, which greatly preponderate at other parts of the retina. When the eye looks straight at an object (or in technical language *fixes* it), its image falls upon this part of the retina. In *direct* vision, as this is called, two black marks on a white ground are distinguished as separate when the interval between them subtends an angle of about one minute at the eye. It is found by calculation that this angle, prolonged to the back of the eye, pretty nearly corresponds to the distance between two adjacent cones at the fovea centralis. The vision at other parts of the retina (*indirect* vision) is very much less acute, and less capable of accurate measurement. We have only to fix steadily one letter in a page of ordinary print to satisfy ourselves in how small an area we can see sufficiently distinctly to make out words without moving the eyes. The *field of vision*, or whole space within which objects are perceived by an eye while it is fixed upon one point, is very much wider, extending in each eye to more than 90 degrees from the fixation point or centre to the outer side, and rather less in other directions. Colour-vision is also most distinct at the centre of the field: and it is found that it diminishes more rapidly towards the outer portions than light-vision, so that near the limits of the field colours cannot be recognised.

There must be a certain amount of light for the purpose of vision. Every one knows that it is difficult and painful to discern objects in a very faint light; and, on the other hand, that on suddenly entering a brilliantly lighted room from the dark, everything appears confused for one or two seconds. There is, however, a gradual adaptation of the retina to different amounts of light. Persons long immured in dark dungeons acquire the power of distinctly seeing surrounding objects; while those who suddenly encounter a strong light are unable to see distinctly until the shock which the retina has experienced has subsided, and the iris has duly contracted. In protecting the retina from the sudden effects of too strong a light, the iris is assisted by the eyelids, the orbicular muscle, and to a certain extent by the eyebrows. Moreover, the dark pigment of the choroid coat acts as a permanent guard to the retina, and where it is deficient, as in albinos, an ordinary light becomes painful, and the protective appendages, especially the eyelids, are in constant use.

The persistence during a certain time of impressions made on the retina facilitates the exercise of sight. Such persistent impressions are called *after-images*. A momentary impression of moderate intensity continues for a fraction of a second; but if the impression be made for a considerable time, or be very intense, it endures for a longer period after the removal of the object. Thus, a burning stick, moved rapidly in a circle before the eyes, gives the appearance of a continuous ribbon of light, because the impression made by it at any one point of its course remains on the retina until it again reaches that point. It is owing to this property that the rapid and involuntary act of winking does not interfere with the continuous vision of surrounding objects; and, to give another illustration of its use, if we did not possess it, the act of reading would be a far more difficult performance than it now is, for we should require to keep the eye fixed on each word for a longer period, otherwise the mind would fail fully to perceive it. However great may be the velocity of a luminous body, it can always be seen; but if an opaque body move with such rapidity as to pass through a space equal to its own diameter in a less time than that of the duration of the retinal impression, it is altogether invisible; and hence it is, for example, that we cannot see bullets, &c. in the rapid part of their flight. In these cases the after-image is of similar brightness and colour to the original impression, and is known as a *positive* after-image. When the stimulation of the retina is very strong, or the retina itself in a very sensitive condition—e.g. in certain morbid states of the system and in twilight, a *negative* after-image appears, in which the bright parts of the original impression appear dark and *vice versâ*. An image of this kind may persist for some seconds or minutes or even longer. This physiological phenomenon has probably given origin to many stories of ghosts and visions. Thus, if a person has unconsciously fixed his eyes, especially in the dusk, on a dark post or stump of a tree, he may, on looking towards the gray sky, see projected there a gigantic white image of the object, which may readily be mistaken for a supernatural appearance. The phenomenon is easily seen on looking away from a bright window after directing the eyes to it for some time, when the bars appear as bright lines on a dark ground. Negative after-images are always of the complementary colour to that of the object. Thus, the image left by a red spot is green; by a violet spot, yellow; and by a blue spot, orange.

(5) Each eye can be moved from its ordinary position, looking straight forward, through an angle of nearly 60 degrees downwards, and of 35 to 45 degrees in other directions. But one eye never moves without the other. Two series of associated movements have to be distinguished: movements of both eyes in the same direction, and movements which *converge* the eyes, or bring the corneæ of both eyes towards each other. When a near object is looked at, the movement of accommodation is associated with a proportionate contraction of the internal recti of both eyes, so as to direct the visual axis, or in other words the fovea centralis, of each towards the object.

If we suppose the retinæ of the two eyes to be placed in contact, so that the foveæ centrales and the vertical meridians correspond, then all points which lie together in the two retinæ are called *corresponding points*, and have the property that simultaneous stimulation of both gives rise only to a single impression. An object whose image falls upon corresponding points thus appears single; otherwise it appears double. Hold up two fingers in line in front of the face. When the nearer one is looked at, it is seen single, but the farther appears double and somewhat out of focus; when the farther is looked at, it appears single, and the nearer is similarly doubled and blurred. Generally speaking, images of the great majority of the objects in the field of vision of both eyes must fall on non-corresponding points of the two retinæ; but as the attention is generally directed to the images of the object for which the eyes are accommodated, and as these, falling upon the foveæ centrales, are much the most distinct, the double vision of other objects is seldom noticed.

In the case of near objects, however, something more is needed to explain single vision. For example, take the case of a solid object. The two eyes, looking from different points of view, receive quite different images; the right eye sees more of the right side, the left eye more of the left. It is impossible that the images of each point of the object can fall upon accurately corresponding points of the two retinæ. Yet the appearance presented is that of a single object clearly defined. In this case then there must be in the brain-centres a power of combining in a single picture images which do not accurately correspond.

Various topics which the reader might perhaps have expected to find noticed, such, for instance, as 'the appreciation of solid forms by the sense of vision,' 'correct vision with an inverted image on the retina,' &c., which belong fully as much to metaphysics as to physiology, are discussed in the article on VISION. We may also refer those who desire information on these points to Professor Bain's treatise on *The Senses and the Intellect*.

For the anatomy of the eye, see Quain or other standard work. Lubbock in *The Senses of Animals* gives a concise account of the chief types of eyes in the Invertebrata. Helmholtz's *Physiological Optics* is the classical work on the optical aspects of the eye. The larger works on human physiology—e.g. Foster, Landois and Stirling—may also be consulted.

DISEASES AND INJURIES OF THE EYE, as might be expected from the delicate and complicated structure of the organ, are very numerous. But as the position of the eye and the transparency of its dioptric media give exceptional facilities for their detection and study, they are more thoroughly understood than those of any other organ. Only the most common and important can be referred to here.

Diseases of Conjunctiva are mainly different forms of inflammation, or *conjunctivitis*.

(*a*) *Simple* or *Catarrhal Conjunctivitis* may be acute or chronic. In the former case, it is commonly called 'cold in the eye.' The white of the eye is more or less reddened, and there is an increased discharge of gummy substance, causing the lids to cohere during sleep; a sensation is experienced as of sand or dust in the eyes, and there is a little increased sensitiveness to light. The acute form generally subsides in a few days without leaving any ill effects, unless improperly treated; the chronic form is often obstinate. The common popular treatment—viz. tying wet cloths or poultices over the eye, cannot be too strongly condemned; it may produce temporary relief of irritation, but aggravates the inflammation, and is very apt to lead to ulceration of the cornea. A mild astringent lotion should be used thrice or oftener in the day (cold tea; boracic acid 10 grains, alum 3 grains, to the ounce of water); and a little simple ointment or fresh butter applied to the lids at bedtime to prevent their becoming glued together. The chronic form often requires stronger remedies, but they should not be used except under medical advice.

(*b*) *Purulent Conjunctivitis* resembles the last, but is very much more severe, and highly dangerous. In its most characteristic forms it is known as *gonorrheal ophthalmia*, and *ophthalmia neonatorum* (eye inflammation of new-born children). To the latter variety about one-third of the blind persons in Europe owe their loss of sight. It is produced by inoculation of the eye with certain irritating discharges; and the discharge from an affected eye will infect any other eye with which it comes in contact. The conjunctiva becomes intensely red and swollen, and the lids partake in the swelling so that they cannot be opened; there is severe burning pain, and after two days or more a profuse discharge of matter. The danger to sight is due to the fact that the cornea is extremely apt to be destroyed, wholly or in part, before the inflammation subsides. In infants the disease usually begins on the third day after birth, and is, as a rule, less severe than in the adult, but unfortunately is often overlooked, or regarded as of no importance till irreparable mischief has been done. Scrupulous cleansing of the eyes immediately after birth, preferably with corrosive sublimate lotion (1 grain to 8 ounces) is the best preventive. When the disease has commenced, very frequent removal of discharge and hourly washing with boracic or corrosive sublimate lotion should be resorted to. But all such cases should at once be put under the charge of a medical man.

(*c*) *Pustular* or *Phlyctenular Conjunctivitis* is a form of inflammation very frequent in children, much less so in adults. It is an indication of a lowered state of the general health, and its treatment must include fresh air and light, good food, and cod-liver oil or some other strengthening medicine. The inflammation does not extend all over the white of the eye, but is localised in one or more sections of it, and is most intense near the margin of the cornea, where one or more small rounded blebs or pimples may be seen. It is often accompanied in children by extreme tenderness to light; but the tendency to this is aggravated by a bandage or darkness. The local treatment should be bathing with boracic acid or some other mild astringent lotion; but, unless the case be very mild, a medical man should be consulted.

(*d*) *Granular Conjunctivitis*, or *trachoma*, is an exceedingly chronic and intractable disease. It is sometimes called Egyptian ophthalmia, having been extremely prevalent in the French army in Egypt in 1798. In Europe it is most common among the Jews and the Irish, but is often troublesome in industrial schools and similar institutions. It is encouraged by overcrowding, bad ventilation, and other unfavourable hygienic conditions, and is undoubtedly somewhat contagious. It is characterised by numerous distinct semi-transparent elevations on the conjunctiva of the lids, chiefly the upper. It often lasts for months or years, and is chiefly dangerous on account of the shrinking of the conjunctiva produced by it, which leads to trichiasis, Ectropion (q.v.), and opacity of the cornea. It should always be treated by a skilled medical man.

(*e*) In *Diphtheritic Conjunctivitis* there is a 'false membrane' formed on the conjunctiva, as in Diphtheria (q.v.) in other situations. It is happily rare in Britain.

Diseases of the Cornea.—The most common and important are inflammations associated with ulceration—i.e. destruction of some of the corneal substance. This is replaced when healing takes place by imperfectly transparent tissue, and results very frequently in great impairment of vision (irregular Astigmatism, q.v.), even where no obvious mark remains. The appearances, symptoms, and appropriate treatment of different forms and stages of corneal ulceration are extremely various, and cannot profitably be discussed here. Skilled medical advice should always be obtained. It must suffice to say that the eyes should be rested, shaded from light, and bathed, generally with boracic or corrosive sublimate lotion. Poulticing or tying up the eyes should never be resorted to unless under a doctor's orders, as it is usually still more mischievous than in conjunctivitis.

In one form of inflammation of the cornea, called *interstitial*, there is an appearance all over it of great haziness or even complete opacity, but without breach of surface. It occurs usually in boyhood or girlhood, and though alarming in appearance and tedious, generally results in complete recovery. Mr Jonathan Hutchison first pointed out that it is usually a manifestation of congenital syphilis.

The *sclerotic* is comparatively seldom affected by disease, probably on account of its slight vascularity and comparatively low vitality.

The *iris* is liable to inflammation (*iritis*), characterised by severe deep-seated pain, redness of the white of the eye, contracted pupil, and much dimness of sight. The inflammation, if unchecked, produces adhesion between the posterior surface of the iris and the anterior capsule of the lens, which may permanently interfere with vision, or even lead ultimately to complete loss of sight. Local treatment at the early stage by Atropia (q.v.) dilates the pupil and prevents the formation of adhesions. Unless the result of injury, iritis usually depends on constitutional causes, especially syphilis and rheumatism, and treatment of these is of prime importance for its cure. Medical aid should be sought at once; for atropia, which is most beneficial in iritis, is disastrous in glaucoma, a disease which sometimes resembles it in many of its symptoms.

The chief disease of the *lens* is opacity, or Cataract (q.v.); it may also be displaced or dislocated, either from an anomaly in its development, or as the result of injury.

Diseases of the deeper structures of the eye (choroid, vitreous humour, retina and optic nerve) usually require for their recognition the use of the Ophthalmoscope (q.v.). Generally speaking, they are associated with little or no pain, and attract the patient's attention in consequence of the dimness of vision they produce. They are much less amenable to treatment in most cases than affections of the more superficial parts.

Inflammation and atrophy of the *choroid* occur in several forms; the most distinct are those occurring in syphilis, in old age, and in connection with high degrees of short-sightedness (progressive myopia, see below).

The *vitreous humour* rarely if ever becomes diseased, except in consequence of changes in the ciliary body or choroid. The abnormal condition generally manifests itself in more or less opaque threads or films, which move with the movements of the eye, and appear to the patient as clouds or dark lines interfering with vision, much more large and distinct than the 'muscæ volitantes' present in the normal eye.

The *retina* may be the seat of hemorrhage or of inflammation in many forms of disease. The most common and characteristic retinitis is that associated with Bright's disease (q.v.), which is almost always of very serious import. Its main artery may become blocked by a plug carried into it from the heart or elsewhere (*Embolism*; see ARTERIES, DISEASES OF), an accident which causes sudden and usually almost complete loss of sight. Not unfrequently, too, the retina becomes detached from the choroid, either as the result of disease or injury, and floats in the

vitreous chamber in front of its normal position, a condition greatly interfering with sight, and most difficult to improve.

The *optic nerve* may become inflamed (*optic neuritis*), most commonly in consequence of an inflammation or tumour of the brain or its membranes. It may degenerate (*optic atrophy*) either after inflammation or independently of it. In the latter case, however, as well as the former, there is in the great majority of instances some disease of other parts of the nervous system (brain or spinal cord).

There are two diseases chiefly affecting the deeper parts of the eye which it is desirable to describe at some length, as their course is often insidious, and their results when not recognised early, most disastrous, while timely interference is often signally successful in preserving the sight. These are *glaucoma* and *sympathetic ophthalmia*.

Glaucoma occurs most commonly during or after middle life, frequently in persons whose eyes are hypermetropic (see below). It may come on with such suddenness and intensity that vision is lost in a few hours, or its course may extend over years. Always, however, if unchecked, it tends to progress till sight is destroyed. Both eyes are usually affected, but often one long before the other. In many cases there are *premonitory* symptoms, consisting in temporary attacks of cloudiness of vision, during which the patient, when looking at a light (e.g. a gas or candle flame), sees it surrounded by coloured rings or halos. During this 'premonitory stage,' the vision is perfectly normal between the attacks; but they become more frequent and prolonged, till it is permanently impaired. Variability of the symptoms is usually a characteristic feature in all stages of the disease. Often in the later phases, and always in acute and severe cases, much pain is experienced in and around the eye affected. The pupil is large and immobile; the iris and lens farther forward than normal; the cornea more or less hazy; and some of the blood-vessels of the white of the eye larger and more visible than they should be. The most important sign of the disease, and the feature on which many of its characteristics depend, is increased hardness of the eyeball, owing to increase of its contents. The exact cause of this increased hardness is not fully understood, nor the way in which some of the symptoms observed depend upon it; but it varies with the symptoms, being always more marked when the pain and dimness are at their worst. Chronic insidious cases are often mistaken for cataract, though the use of the ophthalmoscope readily distinguishes between the two conditions; in the most acute cases, the headache, sickness, and general disturbance of the system is sometimes so severe that the condition of the eyes is overlooked, and the disease is looked upon as a 'bilious attack' till the vision is hopelessly destroyed.

The disease was regarded as absolutely hopeless till Von Graefe, in 1857, proved that the removal by operation of a portion of the iris of a glaucomatous eye might arrest the process. This proceeding (*iridectomy*), though by no means uniformly successful, does good in the majority of cases, and has been of enormous benefit. But if too long delayed, it is of no avail for the restoration of vision.

It is of great importance that atropin or belladonna should not be applied to an eye with any tendency to glaucoma, as they aggravate the disease, and sometimes even produce it. Eserin, the active principle of the Calabar bean, has an action on the eye antagonistic to atropin, and can often keep glaucoma in check, though it rarely cures it. Pilocarpin, the active principle of Jaborandi, has a similar action.

Sympathetic Ophthalmia is the name given to a form of inflammation, chiefly of the iris and ciliary body, occurring in an eye previously healthy in consequence of disease or injury of the other. Almost, if not quite, invariably the eye first affected has had its coats (cornea or sclerotic) perforated; and the process in the second eye may begin at any time, from a fortnight to many years after this occurrence. It is an extremely insidious disease, sometimes quite painless; but also extremely dangerous, for it often leads to total loss of sight. The early symptoms are watering, tenderness to light, and dimness of sight, especially of near objects. When it begins, there is almost invariably irritability and tenderness to touch in the eye which is the origin of the disease. It can be absolutely prevented by early removal of the eye first affected; but if this be delayed till the inflammation has begun in the second eye, it may be useless. An eye which has received a perforating wound, particularly in the 'ciliary region'—i.e. just outside the cornea—may therefore at any subsequent period become a source of danger to the other eye; and if its vision is destroyed there can be no doubt that it should be removed. Even if some useful sight is retained, this may sometimes be desirable; but at all events, every one who has suffered from such an injury to one eye should know that the slightest symptoms of irritation or failure of sight in the other should at once lead him to seek skilled advice. Recent researches have rendered it probable that this form of inflammation is caused by micro-organisms, though this is not quite definitely established.

Errors of refraction are those defects in the dioptric media of the eye which, without diminishing their transparency, interfere with the formation of a retinal image in the normal way. Astigmatism (q.v.) has already been noticed; presbyopia is the failure of accommodation natural to age (see above). It remains to describe *myopia*, or short-sightedness, and *hypermetropia*, or long-sightedness. In most cases the condition of both eyes is alike, or nearly so; but exceptionally there is a considerable difference between them (*anisometropia*).

The knowledge of this branch of the subject was first systematised and placed on a satisfactory basis by Donders (1818–89), a distinguished Dutch physician and physiologist, professor of Physiology at Utrecht, in his work on *Anomalies of Accommodation and Refraction of the Eye* (Eng. trans. pub. by Sydenham Society, 1866).

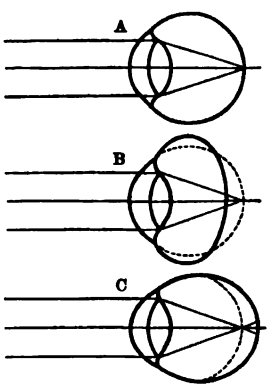


Fig. 12.

A, Normal eye: parallel rays brought to a focus at retina. B, Hypermetropic eye: globe shortened; parallel rays not yet brought to a focus when they reach retina. C, Myopic eye: globe lengthened; parallel rays brought to a focus in front of retina.

The normal eye in the position of rest is adjusted for parallel rays—i.e. for a distant object, and by means of the accommodation can be focused for a near object. The short-sighted eye at rest is adjusted for divergent rays—i.e. for a near object; accommodation enables it to focus for a still nearer object, but it can make no change enabling it to see clearly beyond its 'far point'—i.e. that for which it is adjusted at rest. The long-sighted eye at

rest is adjusted for convergent rays, which do not occur in nature; accommodation enables it to focus parallel rays (from distant objects), or divergent rays (from near objects), but not to see so near as a normal eye of the same age.

These defects generally depend on an abnormality in the length of the antero-posterior diameter of the eyeball; in short-sighted eyes it is greater, in long-sighted less than the normal (see fig. 12). They can be corrected by the use of suitable glasses; in short-sighted eyes concave lenses are used, which render the rays of light falling upon them more divergent; in long-sighted eyes convex lenses, which render the rays less divergent or convergent.

Loss of accommodation occurs with the progress of years in such eyes, just as in normal ones, though the effects are somewhat different. The short-sighted eye continues to be able to see near at hand without spectacles; but, contrary to the popular belief, has no other advantage over the normal eye as age advances, for vision of distant objects does not improve. The long-sighted eye in time loses the power of seeing even distant objects without spectacles; and the higher the degree of long-sightedness the earlier the age at which this occurs.

An abnormal shape of the eye, on which these 'errors of refraction' usually depend, is frequently hereditary, and is incurable; it usually remains stationary after early adult life, but in some cases of myopia, where it is associated with disease of the choroid, tends to become worse (*progressive* or *malignant* myopia). The object of treatment must be to counteract, so far as possible, the inconvenience resulting; and this can generally be done by the use of spectacles or eyeglasses. No general rules can be laid down as to their use, as much depends not only on the degree of the abnormality, but on the age and occupation of the individual. If glasses conduce to comfort and to the preservation of the sight, no mere regard for appearance should prevent their being worn.

Diseases of the Eyelids.—A *stye* is practically a minute Boil (q.v.) formed in the eyelid, and discharging at its margin. It should be fomented frequently with hot water till it bursts. Constitutional treatment is often desirable, as styes often occur, like boils, in groups or series.

Small rounded swellings (*tarsal cysts*) often form under the skin of the lids, owing to obstruction of the duct of a Meibomian gland. They are usually painless, but require for their cure the evacuation of their contents through a puncture on the inner surface of the lid.

A form of Eczema (q.v.) often occurs at the margin of the lids, called *blepharitis*, most commonly in delicate children. It can usually be readily cured if attended to in time; but if neglected, as it too often is, leads to destruction (blear eyes) or misdirection (trichiasis) of the eyelashes, and much subsequent trouble. It is characterised by redness and ulceration of the edges of the lids, usually masked by crusts adhering to the lashes. Frequent removal of these, with the daily application of a stimulant ointment (e.g. yellow oxide of mercury, 8 grains to the ounce of simple ointment), and the use of tonics generally effect a cure. Inversion (Entropion, q.v.) and eversion (Ectropion, q.v.) of the margins of the lids, and misdirection of the eyelashes (trichiasis), so that they rub against and irritate the cornea, are troublesome affections, usually requiring operation for their removal.

Diseases of the Lachrymal Apparatus.—A "watery eye' (*epiphora*), when no irritating affection of the eye itself is present, usually proceeds from stricture of the nasal duct, or some other cause, which prevents the tears from discharging by their natural channel into the nose. The condition can be remedied in most cases by slitting up the canalic-ulus (see fig. 7), and passing graduated probes through the duct to restore its patency. If unattended to, it generally leads sooner or later to abscess of the lachrymal sac, with much swelling and pain.

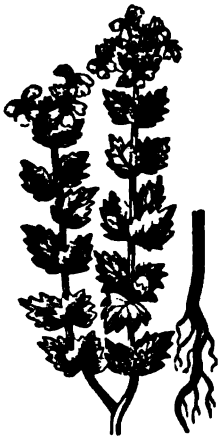
Injuries.—In no part of the body is there so often great disproportion between the severity of an injury and the amount of pain and irritation it occasions. A penetrating wound sometimes causes less discomfort than a mere particle of sand beneath the eyelid. Any wound or blow affecting the eye, therefore, particularly if it interfere at all with the sight, should be seen by a doctor as speedily as possible. Substances thrown against the eye may injure it. Quicklime is rapidly destructive to the eye, slaked lime and mortar less so. When one of these, or any other alkaline caustic, has got into the eye, diluted vinegar should at once be used to neutralise it. If it is oil of vitriol (sulphuric acid) or another acid that has been the cause of the injury, a weak solution of soda may be used in the first place to neutralise the acid. After this, sweet oil is the best thing to introduce, until the surgeon arrives. In gunpowder explosions near the eye, besides the burn, the particles are driven into the surface of it, and will cause permanent bluish stains over the white of the eye, unless they are carefully removed at the time. When chips of glass, stone, &c. are driven into the interior of the eye, there is little hope of its being saved from destructive inflammation, though fragments of iron and steel are sometimes removed by means of a strong electro-magnet, with a successful result. In these and all other *penetrating* wounds—i.e. those where the cornea or sclerotic is broken through, the possibility of subsequent sympathetic ophthalmia in the other eye must be borne in mind. When only partially sunk into the cornea, as is often the case with sparks of cinder or iron, &c., or 'fires,' as they are called, the rubbing of the projecting part on the eyelid causes great pain, and the surgeon has not much difficulty in removing them. Most commonly these, or other 'foreign bodies,' as particles of dust, sand, seeds, flies, &c., when not speedily washed away by the tears, merely get into the space between the eyeball and the lids, almost always concealed under the upper, as it is the larger, and sweeps the eye. They cause great pain, from the sensitiveness of the papillary surface of the lid, and of the cornea over which they are rubbed by its movements, soon excite inflammation, and their presence, as the cause, is apt to be overlooked. The lid must be turned round to find them. To do this, pull the front or edge of the lid forward by the eyelashes, held with the finger and thumb, and at the same time press down the back part of the lid with a small pencil or key, directing the patient to look downwards. The lid will readily turn round, when the body may be seen about its middle, and may be removed with the corner of a handkerchief. Another plan, which the person himself may try, is to pull forward the upper lid by the eyelashes, and push the lashes of the lower lid up behind it, when the foreign body may be brushed out. After the bodies are removed, a feeling as if they were still there may remain for some time. See BLIND, COLOUR-BLINDNESS.

ARTIFICIAL EYES are worn for the sake of appearance in cases where, as the result of disease or injury, an eye has either been totally lost, or rendered unsightly. They are, moreover, distinctly advantageous in cases where a gaping socket is liable to irritation by dust, cold winds, &c. They cannot be used unless the size and prominence of the eyeball is at least somewhat diminished. Few surgeons in Britain recommend them to be worn unless the eyeball is either entirely removed (enucleation), or has the front part removed

(abscission), or all the contents extracted (evisceration); for the artificial eye is apt to cause irritation of the sensitive anterior portion of the globe, and may lead to the development of sympathetic ophthalmia (see p. 515). Enucleation is the most certain means of preventing this; but the other operations named above allow of better movement, and give a more natural appearance to the eye.

An artificial eye consists of a thin shell, usually of enamelled glass, coloured to present as nearly as possible the same appearance as the visible part of the normal eye. Quite recently Celluloid (q.v.) has been used instead of glass, and is said to last better, as its surface is not affected by the secretions; while it has the advantages that it is not brittle, and can easily be pared to fit the socket accurately. To obtain a satisfactory result, it is necessary either to have the eye specially made, or to be able to select from a very large stock; as colour of iris, size of pupil, tinge of sclerotic, as well as curvature of surface and form of margin, must be adapted to the particular case. They are therefore to be got to most advantage in large cities, such as London or Paris.

The eye must not be worn continuously, but removed each night and replaced in the morning. It is slipped in under the lids, which hold it in position. Even when the globe has been entirely removed, the muscles, by their attachment to the tissues remaining in the orbit, usually effect movements in the same direction, though not of the same extent, as those of the normal eye; and it is often difficult for any but a practised observer to detect to what the difference between the two is due. A single glass eye can rarely be worn more than a year without being polished, for the surface becomes roughened by the action of the tears, &c., and irritates the lids as they rub over it. The wearing of a glass eye therefore means an expenditure of at least one or two pounds a year, and is thus out of the power of many poor people to whom it would otherwise be an advantage.



Common Eyebright (*Euphrasia officinalis*).

Eyebright (*Euphrasia*), a genus of Scrophulariaceæ. The British species (*E. officinalis*) is a root-parasite common in pastures and grassy uplands, which at the end of summer are gemmed abundantly with its bright little flowers. From this general aspect and spotted corolla the popular name is derived; hence, too, the doctrine of signatures ascribed it an efficacy in the treatment of eye-diseases, which a mild astringency long aided it to maintain. It is the *Euphrasy* of Milton.

Eylau, a town of 3546 inhabitants, 23 miles S. of Königsberg by rail. Here Napoleon encountered the allies—Russians and Prussians—under Bennigsen, February 8, 1807. Darkness came on while the contest was still undecided; but as Napoleon had a considerable force of fresh troops close at hand, the allies retired during the night upon Königsberg. Their loss is estimated at about 20,000; that of the French is set down at 10,000, but must have been considerably greater. The place is called Preussisch-Eylau, to distinguish it from Deutsch-Eylau, a town of 4574 inhabitants, 89 miles NE. of Bromberg.

Eyot (A.S. *igoth*), a little island in a river, especially one overgrown with willows, as in the Thames.

Eyre, Edward John, an Australian explorer and colonial governor, the son of a Yorkshire clergyman, was born in August 1815. Emigrating to Australia at the age of seventeen, he prospered as a squatter on the Lower Murray, and was appointed a resident magistrate and protector of the aborigines. In 1840 he failed in an attempt to explore the region between South and Western Australia, though he discovered Lake Torrens. The task which he had set himself, however, he accomplished, in spite of enormous difficulties, in 1841 (*Discoveries in Central Australia*, 1845). In 1846 he became lieutenant-governor of New Zealand, and in 1852 of St Vincent in the West Indies. In 1862 he was appointed governor of Jamaica, where in 1865 negro disturbances broke out. The outbreak was suppressed with sharp, stern severity, martial law being proclaimed in the disaffected district; a wealthy mulatto named Gordon, a Baptist and member of the Jamaica House of Assembly, who had taken a leading part in instigating the rising, was hurriedly tried by court-martial, and hanged two days after, the sentence having been confirmed by Eyre. A commission sent to inquire into this case found that Gordon had been condemned on insufficient evidence, and Eyre was recalled. On his return he was prosecuted by a committee of whom John Stuart Mill was the most prominent; Thomas Carlyle, Charles Kingsley, and Sir R. Murchison promoted the Eyre defence fund. The prosecutions could not, however, be sustained; and eventually in 1872 the government refunded to Eyre the costs of his defence. Since his recall he has lived in retirement.

Eyre, Lake, a salt lake of South Australia, lying due N. of Spencer Gulf, at an altitude of 79 feet, and with an area of 3706 sq. m. Except in the season of rains, this lake is generally a mere salt marsh. It was discovered in 1840 by Eyre.

Eyre, Justices in. See Assize.

Eyria Peninsula, on the south coast of South Australia, triangular in shape, its base being formed by the Gawler Range, whilst its sides are washed on the SE. by Spencer Gulf, and on the SW. by the Great Australian Bight. It constitutes a rich pastoral country.

Ezekiel (meaning 'God will strengthen,' or 'strength of God'), one of the Hebrew prophets, was the son of the priest Buzi, and along with Jehoiachin, king of Judah, was carried captive, when still a young man, to Mesopotamia, by order of Nebuchadnezzar, about 599 B.C. He was a member of the Jewish community which settled on the banks of the river Chebar, and first appeared as a prophet about the year 594, after the remarkable vision described in his opening chapters. His prophetic career extended over a period of twenty-two years. The date of his death is not recorded. —The Book of Ezekiel consists of three great parts, dating respectively from before, during, and after the siege of Jerusalem: the *first* (chapters i.–xxiv.), composed before the final conquest of Jerusalem by Nebuchadnezzar, announces the complete overthrow of the kingdom of Judah, on account of its increasing unfaithfulness to God, and especially its perjury in forming an alliance with Egypt after accepting vassalage under Babylon; the *second* (chapters xxv.–xxxii.) threatens the seven surrounding nations, which were exulting maliciously over the ruin of Judah, with divine punishment; and the *third* (chapters xxxiii.–xlviii.) prophesies the future deliverance of the Hebrew nation, the rebuilding of Jerusalem, and the vision of the temple and its measurement, a symbol of the

restored theocracy. This last portion contains certain predictions, usually interpreted as directly Messianic, the future deliverer being conceived under the form of 'David, the Good Shepherd' (xxxiv. 23; xxxvii. 24), who shall reign gloriously over Israel. The book is full of magnificent but artificial symbolism, and of allegories difficult to understand; whence St Jerome calls it 'a labyrinth of the mysteries of God,' and the Jews themselves placed it among 'the Treasures'—not to be read before the age of thirty. Some passages, as the first and second chapters, reveal a vivid and sublime imagination. The authorship of the book has not been seriously assailed, although the Talmud asserts that it was written by the Great Synagogue, of which Ezekiel was not a member; and Zunz dated it about the year 400 B.C. Keil and Kuenen make Ezekiel both its author and editor; Ewald detects obvious traces of later elaboration, and suggests that the collection and combination of the various prophecies into a book may not have been the prophet's own doing. Graf believed Ezekiel also the author of part of Leviticus (chaps. xviii.–xxiii., xxv., xxvi.), and has been followed by many supporters. 'Ezekiel,' according to Wellhausen, 'is the connecting link between the prophets and the Law. He claims to be a prophet, and starts from prophetic ideas; but they are not his own ideas—they are those of his predecessors, which he turns into dogmas. He is by nature a priest, and his peculiar merit is that he inclosed the soul of prophecy in the body of a community which was not political, but founded on the temple and the cultus. . . . Thus arose that artificial product, the sacred constitution of Judaism.' The text of Ezekiel is far from being in a perfect condition. It is partly corrupted by glosses, has partly been retouched by later hands, and may often be amended by the Septuagint version. A splendid example of Hebrew scholarship is the Hebrew text reconstructed from the Septuagint by Dr Carl Heinrich Cornill (Leip. 1886). See Duhm, *Die Theologie der Propheten* (1875); and the commentaries by Hävernick (1843), Hitzig (1847; 2d ed. by Smend, 1880), Fairbairn (1851), Kliefoth (1864 *et seq.*), Hengstenberg (2 vols. 1867 *et seq.*), Keil (1868; 2d. ed. 1882), Schröder (1873); and Ewald, *Die Propheten des Alten Bundes* (2d ed. 1868).

Ezra ('help,' Gr. and Lat. form *Esdras*), the Scribe, the descendant of the high-priest Seraiah (who was put to death after the destruction of Jerusalem by Nebuchadnezzar), first becomes known to us as living with the Jewish exiles in Babylon during the reign of Artaxerxes Longimanus. With this king he stood so high in favour that he was commissioned to lead a band of his fellow-countrymen from Babylon to Jerusalem (458 B.C.), there to reorganise the Jews, the descendants of those who returned in the reign of Cyrus, and to teach them the Law. By the same decree the priests, Levites, and temple servants generally were exempted from all taxation. Ezra's first care, after his arrival at Jerusalem, with the Law of God in his hand (vii. 14), was to annul the marriages that the Jews had contracted with the women of the surrounding nations. After this nothing more is heard of him for thirteen years. In 445 Nehemiah came to Judæa as Persian governor. He quickly delivered the struggling community from external pressure, and set all things in order for the work of Ezra. At a great public meeting convened by Nehemiah (Neh. viii.–x.) the Law was solemnly read in the ears of the people; and this was followed by a second renunciation of their foreign wives on the part of those who in the interval had lapsed into their old habits, by the institution of the feast of tabernacles—which had not been observed according to the Law since the days of Joshua (Neh. viii. 17)—by a solemn pledge to keep Sabbaths and holy days and to duly observe the Sabbatical year, and by the promulgation of ordinances whereby the expenses connected with the temple and its services might be defrayed. It was a solemn national covenant subscribed by the secular and spiritual leaders, eighty-five in number, and the rest of the people 'clave unto their brethren, their nobles, and entered into a curse, and into an oath, to walk in God's Law.' After this we read no more of Ezra the scribe.

It was probably during the interval between his first and his second appearance that Ezra arranged in one collection the books of the Mosaic law (the Pentateuch) as we have it now. The book which bears his name was anciently and justly regarded as forming one book with Nehemiah; and in their present shape Ezra and Nehemiah are simply the continuation of Chronicles (q.v.). The Book of Ezra consists of two portions. Chapters i.–vi. inclusive narrate the story of the first band of exiles who returned to Jerusalem in the reign of Cyrus about the year 538; the remainder (chapters vii.–x. inclusive) relates the events attendant upon Ezra's leadership of the second band of returning Jewish exiles. Not all of this book is written in Hebrew: iv. 8 to vi. 18 are written in Aramaic, the *lingua franca* of the Semitic world at that epoch of history. The work of Ezra began the transition from the religion of the living Word to the written letter. His services in fixing the text of the Law led in later times to the legend that he had restored from direct inspiration not only the Pentateuch (supposed to have been burned in the destruction of Jerusalem), but all the rest of the Old Testament, and other holy books besides; and they also formed the foundation of the equally fabulous legend of the 'Great Synagogue.' He had humbly distinguished himself from the prophets (ix. 11), and though the greatest man in the later spiritual history of Israel, he was no prophet in the true sense, but a priest and scribe, whose whole heart was set on the sacred ordinances, as set down in the 'book of Moses' written by God's servants the prophets. Yet in later times he was even identified with the prophet Malachi (Targum to Mal. i. 1), and Mohammed, in the 9th Surâ of the Koran, speaks of Jews of his time who in opposition to the Christians held Ezra to be the Son of God. See BIBLE, ESDRAS, and the commentaries by Bertheau (1862), Keil (1870; Eng. trans. 1873), F. W. Schultz (1876), and Neteler (1877), and the introductions by Rosenzweig (1876) and Sayce (2d ed. 1887); also Robertson Smith, *The Old Testament in the Jewish Church* (1881), and Wellhausen, *Prolegomena to the History of Israel* (Eng. trans. 1885).

F

is the sixth letter in the English and Latin alphabets. The original symbol in the Egyptian hieroglyphs was the picture of a cerastes or horned asp; the horns being represented by the two horizontal bars in our F, and the body by the vertical stroke (see ALPHABET). When the Egyptian sign was adopted by the Phœnicians it received the name of *Vau*, from the resemblance to a nail or peg. From the Phœnicians it passed into the early Greek alphabet as a semivowel, but at some time previous to the oldest extant Greek inscriptions it was differentiated into two characters, one of which, F, had the sound of *w*, and the other, Υ, with the name *upsilon*, became a vowel. As early as the 7th century B.C. the character F became obsolete as a letter in the Eastern Greek alphabet, being retained only as the numeral for six (see DIGAMMA). It must, however, as Bentley proved, have been in use when the earlier portions of the Homeric poems were written. In the Western alphabet, which was used chiefly in the Peloponnesus, F was retained as a letter till the 5th century B.C. From the Chalcidian alphabet it was transmitted to Italy, retaining its position as the sixth letter, but acquiring in Latin the sound of *f* instead of *v* or *w*.

This sound *f* is called a labio-dental fricative, and is formed by bringing the lower lip into contact with the upper teeth. Hence it is one of the easiest of the consonants to pronounce, and may take the place, under certain circumstances, of any of the mutes. Thus, a primitive *bh*, *gh*, and *dh*, which respectively become *b*, *g*, *d* in English, may be represented by *f* in Latin. For instance, the Sanskrit *bhar* corresponds to the English *bear* and the Latin *fero;* while the Sanskrit *bhratar* is the English *brother* and the Latin *frater*. The Sanskrit *dhuma* corresponds to the Greek *thumos* and the Latin *fumus;* the Sanskrit *dvara* to the Greek *thura*, the Latin *fores*, and the English *door;* the Greek *thēr* to the Latin *fera* and the English *deer*. The Greek *cholē* is the English *gall* and the Latin *fel*. Other correspondences are exhibited in the Latin *fremo*, which answers to the Greek *bremo;* and in *frango*, where the *f* answers to the aspirate in the Greek *rhēgnumi*. An *f* easily lapses into *h*, as is seen in the Italic equivalences *faba* and *haba*, *fircus* and *hircus*. So the Spanish *hembra* represents the Latin *femina*. An English *f* usually represents a primitive *p*, as is seen by comparing *father* with *pater*, *fish* with *piscis*, or *foot* with *pes*. In *four* and *five* the English *f* corresponds to a guttural in the Latin *quatuor* and *quinque*. The words *enough*, *cough*, and *laugh*, in which *gh* is pronounced as *f*, exemplify the tendency of gutturals to lapse into the easier sound. The Russians regularly change the difficult sound of *th* into *f*, the name *Theodore*, for instance, becoming *Feodor*. In like manner children sometimes say *free* and *fum* for *three* and *thumb*.

An Anglo-Saxon *f* is sometimes lost in modern English. Thus, *hlaford*, *hafoc*, *wif-man*, and *hus-wife* have become *lord*, *hawk*, *woman*, and *hussy*. Or *f* may become *v*, as in *vixen*, which is merely the feminine of *fox*.

The Greek letter *φ* was not equivalent in sound to the Latin *f*, but was rather a *p* followed by an aspiration, as in our word *up-hill*. Thus, though a primitive *bh* becomes *φ* in Greek and *f* in Latin, the Romans, when transliterating Greek names, were careful to represent *φ* by *ph* and not by *f*, and this distinction is very properly followed in English when we write *Philip* and *phonetic*, instead of *Filip* or *fonetic*. From erroneous analogy, *ph* is sometimes used in words not derived from the Greek, as in the case of *Adolphus*, which represents the Teutonic *Adolf*, and is correctly written *Adolfe* by the French.

F, in Music, is the fourth note of the natural diatonic scale of C. See MUSIC, SCALE, KEY.

Faam, or FAHAM (*Angræcum fragrans*), an orchid, native of Madagascar, &c., prized for the fragrance of its leaves, which is owing to the presence of *Coumarin* (q.v.), and resembles that of the Tonka Bean and of Vernal Grass. In Mauritius an infusion of faam leaves is in great repute as a cure for pulmonary consumption and as a stomachic. It has also been imported into France as Isle of Bourbon Tea (*folia faham*), and used in infusion and as a source of perfume.

Fabaceæ. See LEGUMINOSÆ.

Faber, CECILIA. See CABALLERO (FERNAN).

Faber, FREDERICK WILLIAM, hymn-writer, was born at the Yorkshire vicarage of Calverley, 28th June 1814, passed from Shrewsbury School to Harrow, and thence to Balliol College, Oxford, and in 1834 was elected a scholar of University College. He carried off the 'Newdigate' in 1836 with his poem, 'The Knights of St John,' graduated with a second class the same year, and was elected to a fellowship in University College the year after. Already he had come under the potent spell of Newman, and in November 1845, after three years' tenure of the rectory of Elton in Huntingdonshire, he followed his master into the fold of Rome. He next founded a community of converts at Birmingham as Brothers of the Will of God, but called commonly Wilfridians, as he himself was Brother Wilfrid, from his *Life of St Wilfrid*, published in 1844. Together with his companions he joined in 1848 the Oratory of St Philip Neri, and next year a branch under his care was established in London, which was finally located at Brompton in 1854. He was created D.D. by Pius IX. in 1854, and died at the Brompton Oratory, 26th September 1863. Faber wrote many theological works, stamped by profound learning and lightened by unusual grace of style. But his lasting fame will rest upon his hymns, which have warmed the piety of thousands of English-speaking Christians beyond their writer's own communion. 'The Pilgrims of the Night,' and 'The Land beyond the Sea,' have been among the most popular hymns of the 19th century. A complete collection, containing 150 hymns, was published in 1862. See the Lives by J. E. Bowden (1869), and his brother, F. A. Faber (1869).

Faber, GEORGE STANLEY, Anglican divine, was the eldest son of the Rev. Thomas Faber, and was born at Calverley vicarage, near Bradford, 25th October 1773. He entered University College, Oxford, in 1789, and four years later was elected Fellow and Tutor of Lincoln College. As Bampton Lecturer for 1801, he delivered the lectures subsequently published under the title of *Horæ Mosaicæ* (1801). In 1805 he became vicar of Stockton-on-Tees, and, after several changes, received in 1832 the mastership of Sherburn Hospital, near Durham. He died at Sherburn on 27th January 1854. Of Faber's numerous theological works, those upon prophecy have enjoyed the greatest popularity. All his writings are marked by 'strong masculine sense, extensive classical erudition, and a love of hypothesis.'

Faber, JOHN, mezzotint engraver (1684–1756). See ENGRAVING (*Mezzotint*), Vol. IV., page 381.

Fabius, the name of one of the oldest and most illustrious patrician families of Rome. Three brothers of this name successively held the office of consul during the seven years 485–479 B.C. In 481 the Fabii were decoyed into an ambuscade near Rome by the Veientes, with whom they had been at war, and, with the exception of one member (through whom the race was perpetuated), the entire *gens*, consisting of 306 men, was put to the sword. The most eminent of the *gens* were QUINTUS FABIUS RULLIANUS and QUINTUS FABIUS MAXIMUS VERRUCOSUS. The former was the most eminent of the Roman generals in the second Samnite war, and was dictator (315), censor (304), and six times consul. The latter, who was five times consul and twice censor, was elected dictator (221) immediately after the defeat of the Romans at Trasimenus. The peculiar line of tactics which he observed in the second Punic war obtained for him the surname of Cunctator ('Delayer'). Hanging on the heights like a thundercloud, to which Hannibal himself compared him, and avoiding a direct engagement, he tantalised the enemy by the favourite devices of guerilla warfare; he harassed them by marches and countermarches, and cut off their stragglers and foragers; and at the same time his delay allowed Rome to assemble her forces in greater strength. But this 'Fabian policy' was neither appreciated in the camp nor at home; and shortly afterwards, Marcus Minucius Rufus, Master of the Horse, was raised to an equal share in the dictatorship. During his fifth consulship Fabius recovered Tarentum (209 B.C.), which had long been one of Hannibal's important strongholds. He died in 203 B.C.—CUNCTATOR FABIUS, surnamed Pictor, executed in 302 upon the walls of the temple of Salus the earliest Roman painting of which we have any record. His grandson, QUINTUS FABIUS PICTOR, was the first writer of a Roman history in prose.

Fable, as defined by Dr Johnson in his Life of Gay, is, 'in its genuine state, a narrative in which beings irrational, and sometimes inanimate—*arbores loquuntur, non tantum feræ*—are, for the purpose of moral instruction, feigned to act and speak with human interests and passions.' It is thus almost synonymous with the apologue, and closely allied to the allegory and the parable, but it need not be at all probable in its incidents, its essential motive being merely a moral or didactic end effected by any means, while its composition is due to more or less conscious literary art. In earlier times the name was frequently used as synonymous with myth, but this sense was dropped when a deeper insight into the mental condition of primitive man had revealed how small a factor conscious fiction was in the making of so composite a product as the mythology of a people. It is usual again to differentiate the parable from the fable as especially conveying spiritual truths, and not transgressing possibility and the actual order of nature; but, leaving out of sight the special examples in the New Testament, it is impossible to make so sharp a distinction between moral and religious truths. In the earlier stages of the history of every people the human intellect has employed itself in rudimentary metaphysical speculations, and hence a host of myths have arisen everywhere of themselves to account for natural phenomena, the origin of man, and the like, which in many cases have been preserved. These myths are of course quite innocent of moral, and, indeed, in the hopeless confusion of a composite mythology, are usually strangely inconsistent with considerations of morality, being survivals of an irrational state of mind to which they seemed natural enough. Side by side with this process in the mind of many peoples, a rudimentary literary faculty early began to exercise itself, giving rise to real fables. One large class, indeed the most important, whether from the point of view of quality or of quantity, takes the form of fables about beasts, with whom primitive man has no difficulty in feeling a sense of affinity. These again develop with progressive culture and a growing moral sense into the didactic apologue, and thus reach the class of fables proper, as being essentially due to conscious literary art. These, unlike the myths that have grown spontaneously as an attempt to find concrete expression for those ideas and impressions about the relations between man and the physical world that lie at the basis of religion, lend themselves early to transmission, and have actually, as we shall see, travelled round the world. The folklore of even the rudest people contains many complex elements, but it is only as culture begins to advance that we find the beginning of the literary fable proper, although it remains true that a large number of the folk-tales are more or less perfect fables. While this is true, it is no less so that it is merely in half-civilised communities that the fable attains its greatest perfection. We find the moral apologues so dear to the oriental mind ranging in a thousand forms, from the scriptural example of Jotham to the elaborate and involved examples in the *Arabian Nights*.

The old French Fabliaux have little in common with fables beyond a name of similar origin, being short tales in verse, essentially satirical, or rather representing human things under the light of a ludicrous or only half-serious mockery. Of the genuine fables of medieval times the greater number were associated with the name of Æsop, whom it is usual for classical scholars to place in the 6th century B.C. Certainly his name occurs frequently in classical literature as that of a fabulist, but the so-called Æsopic fables that have come down to us are far from being Greek in character, to any great extent at least. The collection formed by Planudes of Constantinople in the first half of the 14th century has much in common with the metrical Greek fables of Babrius, who lived most likely in the 1st century B.C., and again with the Latin fables of Phædrus, a freedman of Augustus, because the ultimate source of many fables of these and other fabulists was the same—the Buddhist birth-stories and other Indian tales, which had long before been gradually finding their way westwards through Arab or still more obscure channels. Many of our Greek fables are substantially identical with the Buddhist Jātakas, and can be explained on no theory but that of simple transmission, often within even historical times. This much at least is certain, that a considerable part of the Æsopic fable reached the Greeks from the East, however obscure our knowledge of the methods of transmission may yet be. The medieval examples of the fable follow

closely the two Latin versions (1) of Avianus, comprising fables in distichs, rendered at a later period into prose, and almost all borrowed from the immediate Greek originals bearing the name of Æsop; and (2) to a still greater extent a prose version of the fables of Phædrus, represented in the prologue as a translation into Latin of the Greek fables of Æsop by a certain Emperor Romulus for his son Tiberinus. The Latin *Romulus* was enlarged about the 11th century by a number of fables of quite a different character, bearing in the highest degree the stamp of the middle ages, and often of Christianity (as in that of the wolf who learns to read), coming in great part from India, by way of Byzantium, most frequently badly told, usually very obscure, but often original, well invented, and of a very popular character, as in that of the cat that has put on a stole in order to baptise a rat which wishes to remain a Pagan. The collection as thus increased originated without doubt in England, and at an early date was rendered in English, and associated without reason with the name of Alfred. It was from this lost English version that it was translated, in the reign of Henry II., by Marie de France, into elegant but somewhat dry French verses. She gave her work the name of *Isopet*, the title of all medieval collections of fables, itself really a mere familiar diminutive of the name of Æsop, to whom all apologues were always attributed. About the same time an author whose name is unknown rendered into Latin distichs the first three books of *Romulus*, comprising fifty-eight fables, to which he added two stories, one from an unknown source, the other borrowed from the *Disciplina Clericalis* of Petrus Alphonsus, a converted Jew, whose work—a book of moral instruction, filled with stories of Arab (and ultimately Indian) origin—must have been put together about the close of the 12th century. According to custom, this collection of fables was connected with the name of Æsop; its pretentious style brought it great success, and we have extant two verse translations of the 13th and 14th centuries, the *Isopet de Lyons* and the *Isopet II. de Paris*—the last called also the *Isopet-Avionnet*, because the translation of Æsop therein follows that of Avianus. Another redaction, by Alexander Neckam (12th century), in Latin distichs, was twice translated into verse in the *Isopet de Chartres* and the *Isopet I. de Paris*. Of these translations the most interesting, because the freest, is the *Isopet de Lyons;* all alike abound in misconstructions, to which the obscure language of their models lent itself too easily, and from which the rhymers extricate themselves as best they can.

Besides these special collections of fables, the best and most original examples, whether in French or Latin, are often to be found in the works of the moralists, the preachers, and even the historians, as, for example, in the *Récits du Ménestrel de Reims* (1260), a collection of semi-popular and current hearsay traditions, having for its point of departure the first Crusade, and loosely connected with the Holy Land, France, England, and Flanders. From the 12th century there were often inserted in sermons *Exempla*, or short tales, sometimes edifying in themselves, sometimes having the character of parables or even merry stories, from which the preacher at the end extorted a moral. These were stories merely Christianised for the ends of edification, and were very frequently nothing more or less than time-honoured fables. The collection in French by the English Franciscan Nicole Bozon (13th century) is particularly rich in such fables told in a lively and popular manner. Side by side with these fables transmitted by the clergy there circulated among the people many beast-fables, which, like the primitive examples of African and other savage peoples, are destitute of any moral aim, but unlike these are due to conscious literary art in depending mainly upon a sympathetic and humorous observation of certain animals, whose adventures conform to their supposed character and their known habits. A great many of these stories have for their theme the struggles between the wolf, the stronger, and the fox, the more cunning, which ends always in the former being worsted. The great innovation which developed out of these a kind of beast-epic was the individualising of the heroes and giving to them proper names; the figures with which we are concerned are no longer a wolf and a fox, but Isengrim and Raganhard, with their wives Richild and Hersind (later Isengrin, Renard, Richeut, Hersent). Around these principal personages the action centres, and beside them we find a crowd of secondary actors: Noble the lion, Grimbert the badger, Belin the ram, Chanteclair the cock, Couard the hare, Tibert the cat, and Bernard the ass, who throughout preserve their characters and play consistent parts. This ingenious and artistic transformation may have originated in the north of France about the 11th century, but quickly spread over western Europe in Latin, German, and Flemish versions, and, both from the intrinsic interest of the theme, and its adaptability to satirical purposes, as well as its admirable artistic treatment, exercised a powerful influence over the popular imagination from the dark ages to the age of Goethe.

The pure fable of medieval times followed closely its venerable originals, as we find them still in our *Panchatantra*, *Hitopadesa*, and *Kalilah wa Dimnah;* but our modern examples have little beyond what is external in common with these, for the fable has long ceased to be a natural form for literary expression in prose or verse. The fables of Prior, Moore, and Gay are lively and often graceful poems, but they have usurped a name to which they really possess no claim. Nor are Dryden's so-called *Fables* fables at all, however effective as poems they may be. Quite different is the case of the great master of fabulists, the inimitable La Fontaine, who possessed one merit rarer even than his exquisite blending of humour and pathos and his matchless perfection of form, in that 'infantine familiar clasp of things divine' in which lies hid the real essence of the fable. No successor has discovered the secret of that exquisite naïveté on which depends his charm, although the imitators of this new form in literature have been countless in number. Gellert's German fables (1746) were among the most popular of these, and first attracted the great Lessing into imitation. The latter published his famous *Fabeln* in 1759, together with a striking essay on the history and meaning of the fable in literature, the conclusions of which were mostly much more subtle than always sound. Of more recent fables the best are a few examples among the exquisite prose fairy-tales of Hans Christian Andersen and the examples in verse of the Russian Krilof: everywhere else the making of fables would appear to be an art that is lost without hope of recovery.

See the articles ÆSOP, BEAST-FABLES, BIDPAI, FABLIAUX, FOLKLORE, MYTHOLOGY, and REYNARD; also Max Müller's essay 'On the Migration of Fables,' in vol. iv. (1880) of *Chips from a German Workshop;* W. G. Rutherford's dissertation on 'The History of Greek Fable,' in his edition of *Babrius* (1883), which is good so far as it goes; but especially O. Keller's 'Untersuchungen über die Geschichte der Griechischen Fabel,' in the *Jahrbücher für classische Philologie* (1861–67); Leopold Hervieux, *Les Fabulistes Latins depuis le Siècle d'Auguste jusqu'à la fin du Moyen Age* (2 vols. 1884); and the admirable chapter by Gaston Paris, in *La Littérature Française au Moyen Aye* (1888).

Fabliaux, a group of over a hundred compositions peculiar to the literature of France, consisting of metrical tales, usually satirical in quality, written

in octosyllabic couplets, the epoch of the production of which covers about a century and a half. The oldest preserved appears to be *Richeut* (about 1156); the greater number belong to the end of the 12th and the commencement of the 13th century; the most modern are those of Jean de Condé and of Watriquet, at the beginning of the 14th century. Society and literature then underwent a considerable change, and henceforward fabliaux proper disappear, being represented during the 15th century on one side by the prose tale, on the other by the farce, whence sprung in the fullness of time the modern novel and the comedy. Many of the French rhymed stories of the 12th and 13th centuries reappear later in the literature of other peoples, chiefly in Italy and England. It is certain that Boccaccio and Chaucer, for example, have sometimes imitated the French fabliaux, but this need not have been necessarily the case, as these stories circulated freely orally over all Europe, not to speak of their admission into sermons and books of edification,

Undoubtedly most of the stories were of oriental and especially Indian origin, many bearing distinctly the imprint of Buddhism, which has ever favoured the method of teaching by parable. These stories reached Europe by two main channels: from Byzantium, which received them from Syria or from Persia, whence they had been carried direct from India; and secondly, from the Arabs. The Arab importation took place at two widely different points: in Spain, largely by the mediation of the Jews; and in Syria, at the time of the Crusades. In Spain the transmission was mainly literary (through such media as the *Disciplina Clericalis*); in the East, on the contrary, the Crusaders, who lived in intimate contact with the Mussulman population, received many stories orally. Some of these being of Buddhistic origin were already moral and ascetic in character, and therefore easily Christianised; others, under cover of the final moral, related adventures that were dubious enough, but which were remembered while the tedious and not always relevant moral was forgotten; while others again were retained and transmitted simply for their wit. The fabliaux were, however, without exception, strangers to those great collections transmitted entire from one language to another; they spring from oral transmission and not from books. A few even are due to the native invention of their authors.

Their most general characteristic is their humorous and comic quality, too often involved in obscenity, and not infrequently falling into the most vapid platitude. Many of them are satirical, girding especially at certain classes, as villeins and clerics, who are made the heroes of amorous adventures, now happy, now unhappy. A few are concerned with religion, and these are incongruous and irreverent enough. The fabliaux were not written for women, no doubt being usually recited by the *jongleurs* when the women had left the room; hence women are usually presented in the most unfavourable colours, whether as abandoned in character, or merely as peevish and jealous. They abound in gross sallies, the aim of which was but a moment's laugh; yet many are sweet little stories, very well told, and usually very moral or very sentimental. All have the great merit of painting the real life of their time; not at all of set purpose, but without effort they enable us to penetrate into the hearths of nobles, clergy, citizens, or peasants, and they speak to us in the familiar tongue of diverse classes of society in France about seven centuries ago. Their authors are seldom known. One or two names are Huon le Roi, author of *Vair Palefroi;* Jean Bedel, author of *Barat et Haimet;* Gautier le Long; Jacques de Baisieu; Henri d'Andeli; Rustebeuf; Garin; Jean le Galois d'Aubepierre, author of *La Bourse pleine de sens;* and Jean de Condé.

All the fabliaux are printed by A. de Montaiglon and G. Raynaud in their great *Recueil général et complet des Fabliaux des XIII^e^ et XIV^e^ Siècles* (Paris, 9 vols. 1872-90). See also Gaston Paris, *Les Contes orientaux dans la Littérature Française du Moyen Age* (Paris, 1877), and pp. 110–116 of *La Littérature Française au Moyen Age* (Paris, 1888); also Landau, *Die Quellen des Dekameron* (2d ed. Stutt. 1884).

Fabretti, RAFFAELE, Italian antiquary and archæologist, was born at Urbino in 1618. Although he devoted himself to law, he was also attracted at an early period to antiquarian studies by the classical remains of Rome. Under Pope Alexander VII. he became papal treasurer, and subsequently was appointed chancellor to the papal embassy at Madrid. After a residence of thirteen years in Spain he accompanied the legate Bonelli to Rome, where shortly afterwards he became keeper of the papal archives of the castle of St Angelo. His principal works, *De Aquis et Aquæductibus Veteris Romæ* (4 vols. 1680, reprinted with notes and additions in 1688), *Syntagma de Columnâ Trajani* (Rome, 1683), works on the aqueducts of Rome and the column of Trajan, preceded his *Inscriptionum Antiquarum Explicatio* (1699). His collection of inscriptions, &c. is deposited in the ducal palace of Urbino. Fabretti died at Rome in 1700.

Fabriano, a city of Italy, at the eastern base of the Apennines, 44 miles by rail SW. of Ancona. It has a cathedral and the Rossenti museum, but is chiefly noteworthy for its paper and parchment manufactories, established in 1564. The churches and private houses contain many specimens of the Fabriano school of painting. Pop. 5593.

Fabriano, GENTILE DA, an Italian painter, was born at Fabriano about 1348. His first teacher in art was, according to one account, Allegretto de Nuzio, according to another, Fra Angelico. His earliest work was perhaps the decoration of a chapel for Pandolfo Malatesta at Brescia. In 1423 he painted one of his best extant pictures, an 'Adoration of the Kings,' for the church of the Holy Trinity in Florence. To the same period belongs a Madonna with Saints (now in the Berlin Museum). A picture of the naval engagement between the fleet of Venice and that of the Emperor Barbarossa, which Fabriano painted for the Venetian senate, so pleased them that they conferred on him the dignity of a patrician and a pension of a ducat *per diem* for life. This picture perished in the fire which destroyed the ducal palace in 1574. Fabriano next worked at Orvieto, but was called thence by Pope Martin V., who employed him in adorning the church of St John Lateran with frescoes from the life of John the Baptist. He died at Rome about the year 1428. Fabriano's pictures indicate a cheerful and joyous nature. He had a childlike love of splendour and rich ornamentation, but his colouring is never extravagant or meretricious. See an article by W. J. Stillman in the *Century* for July 1889.

Fabricius, or FABRIZIO, GIROLAMO, commonly called of Acquapendente, from the place of his birth, near Orvieto, a celebrated anatomist and surgeon, was born in 1537. He was the son of humble parents, who notwithstanding their poverty sent him to the university of Padua, where he studied anatomy and surgery under Fallopius. On the death of the latter in 1562 Fabricius was appointed to the vacant professorship, a post which he continued to hold for nearly half a century. Harvey, the discoverer of the circulation of the blood, was one of his pupils. Fabricius died at Padua, 21st May 1619. He was a laborious

investigator of nature, studying the structures of animals by the comparative method. In this way he treated the eye, the larynx, the ear, the intestinal canal, the development of the fœtus, and many other subjects. His chief contribution to anatomy was, however, the discovery of the valves of the veins in 1574. His *Opera Chirurgica* (1617), which embraced every complaint curable by manual operation, passed through seventeen editions. Albinus published a complete edition of his anatomical and physiological works (Leyden, 1738).

Fabricius, JOHANNES CHRISTIAN, one of the founders of scientific entomology, was born at Tondern, in Sleswick, January 7, 1745, and died at Kiel, 3d March 1808. After studying at various universities he went to Upsala to work under Linnæus, whose ideas and methods he made his own. In 1775 he was appointed to the chair of Natural History at Kiel, and from that time he devoted himself to the development of his system of classification of insects, based upon the structure of the mouth. His views are expounded in his *Systema Entomologiæ* (1775), *Genera Insectorum* (1776), *Philosophia Entomologica* (1778), *Mantissa Insectorum* (1787), and *Entomologia Systematica* (1792). A complete list of his entomological writings is given in Hagen's *Bibliotheca Entomologiæ*, and an account of his life in *Trans. Entomol. Soc.*, vol. iv. (London, 1845).

Fabroni, ANGELO, biographical writer, was born at Marradi, in Tuscany, 25th September 1732, educated at Faenza and Rome, and in 1773 appointed tutor to the sons of Leopold, Grand-duke of Tuscany. He died 22d September 1803. His *Vitæ Italorum Doctrina Excellentium* (20 vols. 1778–1805) contains quite a treasure of information; while his *Laurentii Medicei Vita* (2 vols. 1784) and *Vita Magni Cosmi Medicei* (2 vols. 1788–89) were reckoned model biographies.

Fabulous Animals. See BESTIARY, GRIFFIN, UNICORN, &c.

Fabyan, ROBERT, an English chronicler under Henry VII., was descended from an Essex family, and followed his father's trade as a clothier in London, where he was sheriff in 1493, and seems to have died in 1513. Three years later was printed by Pynson the first edition of his history, *The New Chronicles of England and France*. It begins with the arrival of Brutus, and comes down to the battle of Bosworth, reaching in its second edition (1533) the death of Henry VII. From the accession of Richard I. it takes the form of a London chronicle, and indeed the whole work has little value save for some points in the history of the city. The best edition is that by Ellis (1811).

Façade (Fr.), the exterior front or face of a building. This term, although frequently restricted to classic architecture, may be applied to the front elevation of a building in any style. It is, however, generally used with reference to buildings of some magnitude and pretensions; thus, we speak of the *front* of a house, and the façade of a palace. The back elevation of an important building is called the rear façade, and a side elevation the lateral façade. The sides of a court or cortile are also called façades, and are distinguished as north, south, &c. façades.

Facciolati, JACOPO, lexicographer, was born in 1682 at Torreglia, near Padua, and educated in the religious seminary at Padua, where he subsequently became professor of Theology and rector. He held at the same time the chair of Logic in the university. Facciolati directed his attention chiefly to the revival of the study of ancient literature, and brought out (1715–19) a new edition of the *Lexicon Undecim Linguarum* or the *Calepine Lexicon*. In this work he was assisted by his pupil and brother-professor, EGIDIO FORCELLINI (1688–1768), to whom is mainly owing the conception of a totally new Latin dictionary. This Facciolati continued till his death on 27th August 1769, and it finally appeared in 1771 (new ed. by De Vit, Prato, 1858–87; Eng. ed. 2 vols. 1826). Facciolati's Latin epistles and orations are remarkable for the Ciceronian purity and elegance of their style, and his remarks on Cicero's writings for their solidity, clearness, and taste. See Lives by Ferrari (1799) and Gennari (1818).

Facial Angle. See SKULL, Vol. IX., p. 493.

Facility, in the legal terminology of Scotland, is a condition of mental weakness short of idiocy, but such as makes a person easily imposed upon, and easily persuaded to do deeds to his own prejudice. The remedy is Interdiction, which may be granted by the Court of Session of its own motion, or at the instance of the heir or next of kin of the facile person. This is judicial interdiction. When a person conscious of mental infirmity places himself under the control of trustees, the case is one of voluntary interdiction. This interdiction generally takes the form of a bond granted by the facile person to the persons therein named, who are called the interdictors. The object of interdiction is to prevent the facile person from granting deeds to his own prejudice, and after it has taken place he cannot contract without the consent of his interdictors. Even without interdiction the deeds of a facile person, if to his prejudice, may be set aside if there be proof of his having been circumvented or imposed on. There is no corresponding term in English law.

Fac-simile (Lat. *factum simile*, 'made like'), an exact copy, as of handwriting. See COPYING.

Factor, in its most general sense, is the term applied to any one who is employed to do business for another. In its most frequent use the name is applied to an Agent (q.v.) employed to sell goods consigned to him by his principal. His remuneration is called factorage or commission, and such an agent a commission-agent or consignee. A broker is also an agent of this kind, rewarded by a commission; but a factor differs from a broker in this, that a factor may buy and sell in his own name, and has the possession and apparent ownership of the goods consigned, and a lien over them. A factor is not entitled to delegate his powers, although he may employ a third person in any ministerial capacity which he cannot himself fulfil. The duty of a factor is to procure intelligence of the markets at his residence, of the course of exchange, and of the price of goods and the probability of a rise or fall; and to account to his principal for his transactions. A factor may pledge the goods of his principal for advances made upon the principal's account, or for the duties on the goods, but not for advances made upon the factor's account. The Factors Acts, the earliest of which was passed in the reign of George IV., enact that under certain circumstances factors having goods in their possession, or having possession of bills of lading, dock warrants, and similar documents referring to goods, shall be deemed owners of such goods, to the effect of giving validity to contracts with persons dealing *bonâ fide* on the faith of that ownership. Factory may be revoked, and falls by the death of the principal. The appointment of a new factor to do the same act implies revocation of the old factory. These general principles are common to both English and Scotch law. In Scotland, however, there are special uses of the term factor not known to English practice. There the term is applied to an agent managing heritable

estates for another, letting farms, drawing rents, and the like, in which sense it is nearly synonymous with the English *steward*. In Scotland, too, the class of factors appointed by the courts for the management of the estates of persons under some incapacity, where the English courts appoint receivers or trustees, has increased so largely in recent times as to call into existence a whole department of law dealing with their powers and duties. Such are called Judicial Factors.

Factor, in Mathematics. The numbers 6 and 4 multiplied together *make* 24; hence 6 and 4 are called *factors* of the product 24. All numbers except prime numbers are products of two or more factors; thus, $10 = 2 \times 5$; $12 = 3 \times 4$, or 2×6, or $2 \times 2 \times 3$. Every product can be divided by any of its factors without remainder; a factor, therefore, is often called a *divisor*, or measure. 2, 3, 4, 6, 8, 12 are all factors or divisors of 24. Numbers that have no factor or divisor above unity, such as 2, 3, 5, 7, 11, . . . 23, &c., are called *prime* numbers. See NUMBERS (THEORY OF).

Factory Acts. The development of the textile industries in Great Britain towards the end of the 18th century led to the employment of a great many children, sent by the poor-law authorities from the southern agricultural counties to the water-abounding districts of Derbyshire, Nottinghamshire, and Lancashire. These children were so ill looked after, and the mills generally so overcrowded, that a Board of Health appointed in 1796 attributed the prevalence of epidemic fevers about Manchester to this cause. The subject was taken up by the elder Sir Robert Peel, who in 1802 passed the Morals and Health Act. The introduction of steam led to the Cotton Mills Act of 1819, which fixed the working age of children at nine, and the working week for them at 72 hours. The Saturday half-holiday did not come until Sir John Hobhouse's Act of 1825. Richard Oastler, the 'Factory King,' was now spreading through the woollen districts of Yorkshire the agitation for the Ten Hours Bill. The Cotton Industry Act of 1831 may be called the first Factory Act; but it was carried out very imperfectly, the men being often compelled to support a fund out of which the employers' fines were paid. Tom Sadler's Ten Hours Bill of 1832 was lost through the opposition of the manufacturers; and Lord Ashley's Bill, which restricted the working hours of adults, was met by the appointment, under Whig auspices, of a Royal Commission. The report of this Commission (1833–34) took the view of the capitalists, that such a restriction would so diminish production as to put them at the mercy of foreign competition. On its recommendations was based Lord Althorp's Act of 1834, which first made the distinction between children and young persons, and began the system of working children in relays, so as to permit of daily education. The alternate day system (with an extension of the hours for schooling) was further developed in the important Factory Act of 1844. A uniform working day from 6 A.M. to 6 P.M., with a fixed 1½ hour for meals, was at last established for all protected persons by the Act of 1850. Manual work had been diminishing in many trades; and in 1861 several restrictions were placed on lace-factories and on bakehouses. The Report of Lord Shaftesbury's Commission of Inquiry was in 1861 well received by the employers, who were now more alive to the advantages connected with sound sanitary conditions for labour. The pottery trade was first dealt with in 1864. The Commission also made thorough inquiry into the question of small shops and workrooms used in connection with larger establishments. The legislation which resulted from the Commission's labours took the double form of a Factory Act Extension Act, 1867, and a Workshops Regulation Act, 1867, which for the first time declared that all work done for wages by young persons and women should be placed under supervision and be subject to distinct regulations. Further provisions were made in 1870 and 1874, but the local authorities did not properly enforce the law.

Hence the necessity arose in 1876 for the Royal Commission on Factory and Workshop Acts, which reported that previous legislation had been to a large extent successful, and that, while some occupations were still undoubtedly unhealthy in spite of the sanitary regulations of these acts, the cases in which young children were employed in labour unfitted for their years, or in which young persons and women suffered physically from overwork, had become uncommon. The Commissioners, however, proposed large changes in the law, and in particular they proposed the consolidation of the law, which was accomplished by the Factory and Workshop Act, 1878. This great statute deals with five classes of works: (1) Textile factories, such as cotton-mills; (2) non-textile factories, including an immense variety of trades, of which iron-works, paper-mills, and print-works are examples; (3) workshops generally, in which mechanical power is not used, and where the employer has the right of access and control; (4) workshops in which none but women above the age of eighteen are employed; (5) domestic workshops, in which the work is carried on in a private house, room, or place in which the only persons employed are members of the same family dwelling there. In some cases—e.g. bakehouses, shipyards, hat-works, &c., the place is regarded as a factory or a workshop according to the use, or not, of mechanical power. In class 1, where power is used, and the large majority of workers are women and children, the highest degree of regulation is reached. In class 2, where the labour is not so hard, or the strain of attendance on the moving power not so heavy, the statutory hours of work are somewhat relaxed, but education and sanitary provisions are still compulsory. In class 3 registers of children and young persons, and certificates of age and fitness, are, except in special circumstances, dispensed with. In class 4 the hours for work and meals may be changed, and the sanitary authority is responsible for the sanitary state of the shop. In class 5 there is still greater elasticity as regards hours for work and meals; the Medical Officer of Health inspects the sanitary condition, but the employment of women is entirely unrestricted. Straw-plaiting, pillow lace-making, glove-making, and some other handicrafts of a light character may be carried on by a family in a private house or room, without fixing on the premises the legal liability of a workshop. Again, if the manual labour is exercised only at irregular intervals, and does not furnish the principal means of living to the family, the house will not become a workshop.

Under the Act of 1878 a 'factory' means a place in which machinery is moved by the aid of steam, water, or other mechanical power; a 'child' means a person under the age of fourteen years; a 'young person' means a person between fourteen and eighteen years of age; a 'woman' means a woman of eighteen years and upwards; 'parent' includes the person having the custody or control of any child; 'night' means the period between 9 P.M. and 6 A.M. The general *sanitary provision* applicable to all factories and workshops is that they shall be clean, free from effluvia, not overcrowded, and ventilated so as to render harmless, so far as practicable, the gases, vapours, dust, &c. which

are generated in the process and are injurious to health. Where anything is wrong, the factory inspector gives notice to the sanitary (local) authority. Every factory is to be lime-washed once in 14 months, unless painted in oil once in 7 years, when it must be washed once in 14 months. The inspector may order fans to be used where dust is generated by grinding, glazing, or polishing on a wheel. The machinery in a factory, and certain other sources of danger, must be fenced. Children must not be set to clean any part of the machinery while in motion. No work is to be done between the fixed and traversing parts of a self-acting machine while moved by mechanical power. The general hours for the employment of young persons and women in textile factories are 6 A.M. to 6 P.M., or 7 A.M. to 7 P.M., except on Saturdays, and on Saturdays 6 A.M. to 12.30 or 1 P.M. (according to the time allowed for meals), or 7 A.M. to 1.30 P.M. Two hours (one of them before 3 P.M.) must be allowed for meals on every day except Saturday, on which half an hour is sufficient. The employment is not to be continuous for more than 4½ hours without an interval of half an hour for meals. The variations on these rules for young persons and women in a non-textile factory, and for young persons in a workshop, are that the minimum time for meals is reduced to 1½ hour, and the period of continuous employment is extended to 5 hours. As regards children in textile factories, they must be employed on the system of morning and afternoon sets, or on that of alternate days. Their morning set ends at 1 P.M., or at dinner-time, if that is earlier; the afternoon set begins at 1 P.M., or after dinner, if that is later. The Saturday hours for children are the same as for others. Neither set is to be continued more than seven days, and no child may be employed on two successive Saturdays. Under the alternate day system, the hours for employment and meals are the same as for young persons.

In workshops in which neither children nor young persons are employed the hours for women are 6 A.M. to 9 P.M., with 4½ hours for meals and absence; and on Saturdays 6 A.M. to 4 P.M., with 2½ hours for these purposes. As regards *domestic* workshops, the actual times for work and meals are not fixed, but overtime is prohibited, and the shops remain under the sanitary supervision of the local authority. The two points fixed by statute with reference to meals in factories and workshops generally are: That the three classes of children, young persons, and women must have their meals at the same hour; that during that hour none of them is allowed to remain in a room where the manufacturing process is being carried on. In every factory and workshop the period of employment, prohibitions, meal hours, and system of children's labour must all be published in a notice put up within the premises. Employment of children under ten, and of any of the protected classes on Sunday, is prohibited. The occupier is also bound to give eight half-holidays in every year besides (in Scotland) the sacramental fasts or substituted holidays. In trades connected with the retail business the Home Secretary may authorise the giving of separate holidays to different classes of workers; and in other cases (e.g. in provincial towns where Saturday is the market-day) he may substitute another week-day for the Saturday half-holiday. A child employed on the morning and afternoon set must give one school attendance on each work day, and, if employed on the alternate day system, two attendances on each non-working day. The penalty is that the child cannot be employed in the following week before the deficiency in attendances has been made up. It is the duty of the employer to get every week from the teacher a certificate of attendance. He may also be obliged to pay to the school-manager a sum not exceeding 3d. a week, or one-twelfth part of the child's weekly wages. A child of thirteen, however, on obtaining a certificate of proficiency, will be treated as a young person. No child or young person under the age of sixteen is to be employed in a factory for more than seven days without a certificate of age and physical fitness granted after personal examination by the medical officer or certifying surgeon of the district. When an accident occurs in a factory or workshop which causes loss of life, or prevents the person injured resuming work within 48 hours, notice must be given to the inspector and the medical officer or certifying surgeon, the latter of whom must go at once to the premises and report to the inspector on the nature and cause of the death or injury.

It is impossible to mention all the special restrictions which the act imposes. For instance, no children or young persons are allowed to work at silvering mirrors by the mercurial process, making white lead, melting or annealing glass. Children must not be employed in dipping lucifer matches, or dry-grinding in the metal trade. Girls must not be employed in making or finishing bricks or salt. In glass and earthenware works and others, certain parts of the works must not be used for taking meals. The Home Secretary has power to extend such restrictions to other unwholesome occupations. Again, where the customs and exigences of a trade require it, the Home Secretary may alter the hours of labour to 8 A.M. and 8 P.M., or even 9 A.M. and 9 P.M. Of the first class, lithographic printing, envelope-making, biscuit-making, and bookbinding are examples; of the second, the straw-hat making at Luton, and warehouses in London and elsewhere. The existing state of factory regulation therefore depends largely on a series of orders in council outwith the statute.

The administration of the act is carried on by inspectors appointed and paid by government. They have large powers of entering factories, workshops, and schools, of asking for documents, of examining persons on oath. A special warrant is required to enter a dwelling-house. The certifying surgeons appointed by the inspectors are entitled to charge for their statutory duties certain fees, which are paid by the employer, but which he may deduct from wages.

It must be borne in mind that the success of the statutory supervision of labour depends greatly on the energy and wisdom of the inspectors, and that much of the good done in Great Britain is due to such men as Messrs Redgrave and Baker. The appointment of inspectors of artisan training, and in certain cases of women, is regarded as important.

Legislation of this kind has been much more fully developed in Great Britain than in the United States or on the Continent. In the United States there is no corresponding system of national legislation as to the conditions of factory labour, though a certain number of the states have passed laws fixing the hours of labour, &c. in certain industries. An International Labour Conference of delegates appointed by various governments was held at Berlin in 1890.

See the Parliamentary Reports of 1841–42, 1862–66, 1875, and, for the factory regulations in the United States, Austria, Belgium, &c., those of 1882. Authorities are Taylor, *Introduction to a History of the Factory System* (1886), and *The Modern Factory System* (1891); Jeans, *Factory Act Legislation* (1891); Von Plener, *Die Englische Fabrikgesetzgebung* (Eng. trans. 1873); Engels, *Lage der arbeitenden Klassen in England*; Marx, *Das Kapital*; Faucher, *Études sur l'Angleterre*;

Alfred's *History of the Factory Movement;* Fielden's *Curse of the Factory System;* Sadler's *Factory System.* Reference may also be made to the report of a Select Committee on the Shop Hours Regulation Act of 1886 (with which the name of Lubbock is associated), and to the valuable reports from the United States and Europe as to hours and regulations of labour, obtained by the Foreign Office in 1882. The chief inspector makes an annual report (embodying special reports) to the Home Office. In the Local Government Acts of 1888 and 1889 power is taken to transfer the responsibility in these matters from the Home Office to the new County Councils.

Faculæ (Lat. *facula*, 'a torch'), in Astronomy, are spots, brighter than the rest of the surface, which are sometimes seen on the sun's disc. See SUN.

Faculty, a name formerly applied by philosophers (Reid, Hamilton, &c.) to each of the primary or fundamental powers or functions of the mind. But the view on which this nomenclature was based is rapidly becoming obsolete. According to modern psychology, the mind is a unity, and the so-called faculties are the different specific directions or modes in which its energy works. See PSYCHOLOGY. For the faculty of a university, see UNIVERSITIES.

A Grant of Faculty by the Ordinary is an order by the bishop of a diocese to award some privilege not permitted by common law. A faculty is necessary in order to effect any important alteration in a church, such as the erection of a gallery or of an organ. Without a faculty, a person is not entitled to erect a monument within the walls of a church. —*The Court of Faculties* is a court established by Henry VIII., whereby authority is given to the Archbishop of Canterbury and his successors to grant dispensations and faculties, an authority formerly pertaining to the pope. The sittings of the court have always been held at Doctors' Commons (q.v.). Of late years the court has been chiefly occupied with granting licenses to marry without publication of banns. See ECCLESIASTICAL COURTS, LICENSE, MARRIAGE, DISPENSATION.

Fæces, the solid excrements, the matters which an animal ejects from the lower end of the intestinal canal, and in greater part consisting of those portions of food which, on passing through the alimentary canal, have been rejected as comparatively worthless in the office of nutrition. In the higher animals the fæces generally contain about three-fourths of their weight of water, the remaining one-fourth consisting in greater part of organic remains; in the case of the ox, sheep, and other herbivorous animals, of undigested woody fibre. See DIGESTION, MANURE.

Faed, JOHN, a Scottish painter, was born in 1820 at Burley Mill, near Gatehouse-of-Fleet, Kirkcudbrightshire, where his father was an engineer and millwright. His love of art was manifested at an early period, and when hardly entered on his teens he was in the habit of making tours through the villages of Galloway, painting miniatures. In 1841 he went to Edinburgh, where his talents ultimately won recognition; and he was elected an A.R.S.A. in 1847, an R.S.A. in 1851. His first picture that obtained popularity was 'The Cruel Sisters' (1851). Since then he has executed, among other works, 'Shakespeare and his Contemporaries,' 'The Cotter's Saturday Night,' and, after settling in London in 1864, 'The Wappenschaw,' 'Tam o' Shanter,' 'Haddon Hall of Old,' 'The Stirrup Cup,' 'John Anderson my Jo,' and 'The Hiring Fair.' In 1880 he returned to Gatehouse-of-Fleet, and his most recent pictures have been chiefly landscapes.

Faed, THOMAS, R.A., brother of the preceding, was born at Burley Mill, 8th June 1826, and in 1842 began his regular art studies in Edinburgh. At the Trustees' Academy he took several prizes; the first picture he exhibited was a water-colour of an incident from the *Old English Baron.* Shortly after, he discovered his true strength in 'Reading the Bible,' a simple subject from Scottish peasant life, and he was made an Associate of the Royal Scottish Academy in 1849, in which year he produced an interesting work entitled 'Scott and his Friends at Abbotsford,' which was engraved by his brother James Faed. In 1852 he removed to London, where his 'Mitherless Bairn,' exhibited in 1855, a popular and taking composition, was declared by some critics to be 'the picture of the season.' Of his subsequent works we need mention only 'Home and the Homeless,' 'The First Break in the Family,' 'Sunday in the Backwoods,' 'From Dawn to Sunset,' 'Baith Faither and Mither,' and 'The Last of the Clan.' Faed was made A.R.A. in 1861, R.A. in 1864, and elected an honorary member of the Vienna Royal Academy in 1875.

Faenza, a town of Italy, 31 miles SE. of Bologna by rail, has an imposing cathedral, a fine market-place surrounded with arcades and adorned with a fountain, and numerous palaces and ecclesiastical edifices. Its manufacture of glazed and coloured earthenware vessels, in Italy called 'majolica,' and in France 'faience,' has declined in importance, and its chief industries now are the making of silk, linen, and paper. Pop. 13,998. Faenza, the ancient *Faventia*, at one period a town of the Boii, and afterwards a *municipium* under the Romans, fell under the power of the Manfredi family; in 1509 it was captured by Pope Julius II.; and in 1860 it passed, along with the Emilian provinces, to the kingdom of Italy.

Fagging, a usage in the great public schools of England, in virtue of which the senior boys are authorised to exact a variety of services from the junior boys. A lower form boy has certain duties to perform to all the upper form boys, as in stopping the balls for them when practising cricket—and others which he owes to a special master, such as stoking his fire and carrying his messages, of a more or less private kind. The risk of capricious exercise of the senior boys' privileges in harassing or humiliating the juniors is sufficiently obvious; but, on the other hand, the system is said by its defenders to make boys handy, helpful, and docile, while taking the nonsense out of bumptious lads. And the argument chiefly relied on in its favour is that the relation thus established between seniors and juniors prevents bullying. The origin of the usage, which is prominent in tales of school-life, such as *Tom Brown's School-days*, is sought for in the necessity felt in great boarding-schools for a scheme of definite relations amongst the boys, so as to secure definite rights and immunities during the time when they are not in the teacher's presence. A similar usage, called *Pennalism*, sprang up in the German universities in the 17th century; and the freedoms taken, under the name of *hazing*, by sophomore and senior students with freshmen in the American colleges is somewhat analogous. See PUBLIC SCHOOLS.

Faggot-votes, votes manufactured, chiefly for county elections, by the nominal sale of property, under mortgage or otherwise, so as to qualify the holder to vote. The extension of the county franchise has left faggot-votes practically no longer worth the trouble of procuring. The term *faggot* described formerly a person who was hired to fill up another's place at the muster of a regiment, or to conceal a deficiency in its strength.

Fagotto. See BASSOON.

Fahlun. See FALUN.

Fahrenheit, GABRIEL DANIEL, the improver of the thermometer and barometer, was born at

Danzig, 14th May 1686. He was originally destined for a commercial career, but he early abandoned trade for natural philosophy, and, after travelling through Germany and England, settled in Holland. About 1714 he conceived the idea of using quicksilver instead of spirits of wine in the construction of thermometers, by means of which the accuracy of the instrument was very much improved (see THERMOMETER). He fixed his freezing-point at 32° to avoid negative measurements. In 1724 Fahrenheit was elected a Fellow of the Royal Society of London; and the *Philosophical Transactions* of that year contain several papers by him on points in natural philosophy. He died 16th September 1736.

Faidherbe, LOUIS LÉON CÉSAR, French general, was born at Lille on 3d June 1818. His apprenticeship as a soldier was passed in Algiers and Guadaloupe. His activity as a seasoned soldier connects him with the history of the French colony of Senegal, and with the Franco-German war of 1870–71. Proceeding to Senegal in 1852, he became two years later governor of the colony, and in that capacity not only reduced to complete submission several more or less tributary tribes, but also extended the frontiers of the colony by the subjugation of the Moorish Trarza in 1858, and of the country of Cayor in 1861. Under the dictatorship of Gambetta, Faidherbe was summoned to France in December 1870, and given command of the army of the North. After successfully withstanding Manteuffel's attack near the river Hallue, 23d December, he was severely beaten near St Quentin on 19th January 1871. In that same year, after the conclusion of peace, he was despatched by the French government to Upper Egypt to study the monuments and inscriptions. Faidherbe published various useful books on the language, geography, and archæology of northern Africa, chief amongst which are two collections of *Numidian Inscriptions* (1870–72), *Anthropology of Algiers* (1874), *Épigraphie Phénicienne* (1873), *Le Soudan Français* (1884), a work on *Sénégal* (1889), and treatises on the *Poul Language* (1875) and the *Berber Language* (1877). His *Campagne de l'Armée du Nord* appeared in 1871. Died September 28, 1889.

Faience, or FAYENCE, a general term for glazed earthenware and porcelain, derived from the town of Faenza (q.v.).

Fainéants Rois (the 'Do-nothing Kings'), the sarcastic designation of the later Merovingian sovereigns of France, under whom the famous Mayors of the Palace really governed the country. The first of the series was Thierry III., nominally monarch of Burgundy, Neustria, and Austria (i.e. Austrasia); the others were Clovis III., Childebert III., Dagobert III., Chilperic II., Thierry IV., and Childeric III. The last of these was dethroned in 730 by Pepin *le Bref*, Mayor of the Palace, who caused himself to be formally proclaimed king. Louis V., the last of the Carlovingians, and a descendant of Pepin *le Bref*, also received the epithet of *Fainéant*.

Fainting, or SYNCOPE (Gr.), is a condition in which, owing to a sudden mental or bodily impression, the circulation of blood is temporarily arrested or very much diminished in force and volume, the respiration and the functions of the nervous system being likewise suspended. The indications of fainting to a bystander are chiefly a sudden pallor, accompanied by loss of power over the limbs, with disappearance of the pulse and movements of respiration; the eyes are commonly half-open or closed, the countenance bloodless, but quite at rest, and not indicative of suffering or disturbance: the flaccid, motionless condition of all the limbs also tends to distinguish simple fainting from epilepsy and the other diseases attended with spasm; whilst the vanishing of the colour and the suppression of the pulse make a marked distinction between fainting and Catalepsy (q.v.) and other forms of Hysteria (q.v.); with which disorders, however, fainting may in some cases be associated. Minor degrees of fainting, where there is no more than a feeling of faintness and a little pallor, are also common. The mode and origin of fainting and the study of its phenomena alike lead to the conclusion that it is primarily an impression upon the nervous system, very much of the same nature as the Collapse, or shock of a severe bodily injury; this reacts, in the first instance, on the heart, and through the circulation on all the other functions of the body. Fainting may end in death, if too prolonged, or if associated with disease of the internal organs, and especially of the heart. See HEART (DISEASES OF THE). Ordinarily, a person who faints from mental emotion, a hot and close atmosphere, or other transient cause, is readily restored by being laid on the back with the head low, and allowed plenty of cool, fresh air. If the patient is or can easily be placed in a sitting posture, he is often still more quickly brought round by making him bend forward with the head between the knees. The worst possible treatment is to raise him or hold him up, the course nevertheless instinctively adopted by almost every one. Any tight articles of dress should be loosened, and a stream of cold air, or a little cold water, should be directed to the face and neck, so as to arouse the respiratory movements. It is desirable, also, to apply ammonia or aromatic vinegar to the nostrils; but a more effective way of exciting the respiration is to compress the ribs and allow them to expand again, so as to imitate the natural movement. A little alcohol or sal volatile should be administered if the patient can swallow. Care should be taken to ascertain that there is no obstruction in the throat or air-passages, as suffocation from mechanical causes has been mistaken for fainting, and the real origin of the mischief overlooked, with fatal consequences. Should all other means fail, electricity will sometimes succeed in restoring the respiration and heart's action. See ELECTRICITY (MEDICAL).

Faioum. See FAYYUM.

Fair. See FAIRS.

Fairbairn, ANDREW M., a learned theologian, was born in Edinburgh in 1839, studied at the university there, and after the requisite theological training became pastor of an Evangelical Union church at Bathgate, from which he obtained leave of absence to pursue his studies in Germany. After his return he preached in Aberdeen until his able theological writings earned him in 1878 the principalship of the Congregational College at Airedale near Bradford. In the same year he was made D.D. by his own university, and in 1881–83 he was Muir lecturer there on comparative religions. His brilliant and learned essays in the *Contemporary Review* early attracted attention, and his *Studies in the Philosophy of Religion and History* (1876), *Studies in the Life of Christ* (1880), *Christianity in the First and Nineteenth Centuries* (1883), *The City of God* (1883), and *Religion in History and in the Life of To-day* (1884) established his reputation as one of the profoundest religious thinkers of his day. In 1888 he was appointed principal of Mansfield College, a Congregationalist college at Oxford.

Fairbairn, SIR WILLIAM, was born at Kelso, in Roxburghshire, 19th February 1789. Having got some plain schooling, he was apprenticed (1804) to an engine-wright at Percy Main Colliery, North

Shields. Here he was assiduous in self-improvement, gained a knowledge of mathematics, read extensively, and made the acquaintance of George Stephenson, which was continued through life. His apprenticeship over, he moved about a good deal, till in 1817 he started business on his own account in a humble way in Manchester. It was a struggle in which, without money or connections, only great abilities and perseverance could succeed. The first great improvement introduced by Fairbairn was the substitution of iron for wood in the shafting of cotton-mills, and the substitution of light for heavy shafting where metal was already in use. This extended his reputation, and orders flowed in faster than they could be executed. Fairbairn was amongst the earliest of the iron shipbuilders, his plan of using iron boats on the Forth and Clyde Canal being the first suggestion in this direction; and in their construction he originated various improvements. His works (1835) at Millwall, London, turned out several hundred vessels, but, as they did not prove a financial success, he parted with them, after fourteen years' experience, at a loss. In 1834–35 Fairbairn and Mr E. Hodgkinson were invited by the British Association to seek out the cause of certain supposed defects in the iron produced by hot-blast furnaces. About the same time Fairbairn tested the strength of the various kinds of iron of Great Britain.

The first idea of a tubular bridge across the Menai Strait is due to Robert Stephenson, but its realisation was largely the work of Fairbairn. Stephenson's idea was a circular tube, supported by chains; but the Britannia and Conway bridges are rectangular structures, without chains, invented and designed by Fairbairn (see BRIDGE, Vol. II. p. 440). He patented his design, and erected more than a thousand bridges upon this principle. He devised improvements in connection with steam-boilers and other steam machinery, and was the inventor of a tubular crane. He aided Joule and Sir W. Thomson in 1851 in their investigations of the earth's surface, and guided the experiments of the government committee (1861–65) in the application of iron for defensive purposes. Fairbairn was a chevalier of the Legion of Honour, and was created a baronet in 1869. He published a good many works and papers on iron, bridges, boilers, mills, &c. He died at Moor Park, Surrey, 18th August 1874. See his Life by W. Pole (1877), and Smiles's *Lives of the Engineers* (1862).

Fairfax, EDWARD, the translator of Tasso's *Jerusalem Delivered*, was a son (perhaps a natural son) of Sir Thomas Fairfax of Denton, in Yorkshire. The year of his birth is not known, but is believed to have been about 1580. His life was spent quietly, in literary pursuits, at Fewston, near Otley, where he died in January 1635. His translation of Tasso's *Gerusalemme Liberata* (1600) was dedicated to Queen Elizabeth. For poetical beauty and freedom it has been the theme of universal praise. Dryden ranked Fairfax with Spenser as a master of English, and Waller said that he derived from him the harmony of his numbers. Hallam, much less enthusiastic, says that it lacks the grace of the original, though not wanting in spirit and vigour. Fairfax also wrote a *Discourse of Witchcraft* (1621), describing how two of his own daughters were bewitched. It was published by Monckton Milnes in the *Miscellanies* of the Philobiblon Society (1858–59).

Fairfax, THOMAS, LORD, generally known as Sir Thomas Fairfax, parliamentary general, was the son of Ferdinando, Lord Fairfax, and was born January 17, 1612, at Denton, Yorkshire. He studied at St John's College, Cambridge, and from 1629 served as a volunteer in Holland, under Lord Vere, whose fourth daughter, Anne, he married (1637) shortly after his return to England. On the outbreak of the Civil War in 1642 Fairfax espoused the cause of the Parliament, and was appointed general of horse under his father, who commanded the parliamentary forces in the north. He distinguished himself so much by his valour, prudence, and energy, especially at Marston Moor (1644), where he was wounded, that in 1645, when the Earl of Essex resigned the office of general of the parliamentary forces, Fairfax was appointed to the supreme command; but the real ruling genius of the army was Cromwell, who had risen to be lieutenant-general. In June 1650, on Fairfax's refusal to march against the Scots, who had proclaimed Charles II. king, Cromwell was appointed commander-in-chief in his stead. Fairfax now withdrew into private life. After the death of Cromwell he laboured for the restoration of the king, and gathered troops to assist General Monk against Lambert. He was appointed head of the commission despatched to the Hague in 1660 to arrange for the return of Charles II. He died at Nunappleton, Yorkshire, 12th November 1671. Fairfax wrote several works, prose and poetic, including two memoirs on the Civil War. See his Correspondence (4 vols. 1848–49), and a Life by C. R. Markham (1870).

Fairford, a village of Gloucestershire, 9 miles E. of Cirencester, and 26 WSW. of Oxford. Its fine Perpendicular church, built by John Tame in the 15th century, is famous for its splendid series of twenty-eight stained-glass windows, often erroneously attributed to Albert Dürer, but really of Flemish workmanship. Keble was a native. Pop. of parish, 1525. See the Rev. J. G. Joyce, *The Fairford Windows* (fol. 1872).

Fair Head, or BENMORE, a precipitous promontory of the north coast of Antrim, Ireland, opposite Rathlin Isle, which is 4 miles to the NW. It rises 636 feet above the sea, and consists of carboniferous strata, overlaid by greenstone columns, 20 to 30 feet thick, and 280 to 300 feet high.

Fairies, Elves, supernatural beings, generally of human form but diminutive size, a belief in whom has been among the superstitions of the greater portion of the European nations. The word *elf* is from the Anglo-Saxon *ælf*, which corresponds to the Danish *alf*, the Icelandic *álfr*, and the German *alp;* but the Germans adopted in the 17th century *elf* and *elfe*, from the English for the same idea. Fairy is properly enchantment, or the realm of fairy spirits, *fay* being originally the name of the sprites themselves. Fay (Low Lat. *fata*, 'fairy;' Fr. *fée*) is from Lat. *fatum*, 'fate,' and once meant the goddess of destiny. From the Old French *fae* (= *fée*) comes *faerie*, 'enchantment;' whence fairy. The Celtic fées or fairies are undoubtedly relics of those *matres* and *matronæ* which appear on Gallo-Roman inscriptions as objects of popular belief. After the transfusion of the Teutonic and southern nations the northern elves (which were originally of two kinds—the light elves, or elves proper, and the dark elves, or dwarfs) became mixed up with their Celtic kindred, the fairies, in inextricable confusion.

Tracing back the antecedent history of this widespread belief, various fanciful theories have been suggested to explain its origin and growth; most of which cannot be accepted as satisfactory. But, like many other survivals of superstition, it is probably to be connected with the mythological conceptions of the Greeks and Romans; some folklorists referring the fairy to the Parcæ or Fates of primitive times, who were supposed to rule the destiny of man. The long occupation of Gaul by the Romans familiarised its natives with their

mythological conceptions of nymphs and fauns; and indeed these closely resemble in many particulars the famous fays of the medieval romances. Again, the native Gauls themselves had a large pantheon of topical divinities, and doubtless these became fused with the other traditional figures, whether due to creative imagination or to more or less direct transmission, and thus helped to create the composite product forming the fairydom of our folklore, which through such literary mediums as the work of Straparola and the *Pentamerone* of Basil has exercised a profound influence upon western Europe. Fairies in literature have received the most different treatment: thus, Boiardo's, Ariosto's, and Spenser's fairies are mere diminutive men, with all the ordinary human emotions, while in the Oberon and Titania of Shakespeare's *Midsummer Night's Dream*, and in the fairies that touched the imaginations of Ben Jonson, Herrick, Drayton, and even the youthful Milton, we find that the aerial and supernatural quality is the predominant feature in the characterisation. Altogether they are more romantic and interesting figures, and at the same time in their other-worldly conception are more real to the human imagination.

Comparatively modern fairy legends tell us how these little beings preside at the birth of man; and we know how at the birth of Ogier le Danois six fairies attend, five of whom give good gifts. In those parts of the world where there are mountains, mists, dangerous morasses, cataracts, and stormy oceans, all superstitious, being a belief in supernatural agencies, are naturally exaggerated, and, from the dangers to which the people are liable from the agencies they deem supernatural, the belief takes deep root in their minds. Accordingly, in flat and well-cultivated countries like England, the fairy superstition is simple and homely, connecting itself with matters of domestic routine, such as the sweeping of the dwelling-house, the skimming of the milk, the preservation of the butter, and the like, numerous allusions to which are found in Shakespeare. In Scandinavia and the Highlands the fairy people are connected with storms and convulsions, betray people to their death, fly away with them into the infinite cloud-land, or lead them through endless caverns within the earth. It has been observed as a further distinction that the fairies of the German or Teutonic tribes are more harsh, fierce, uncomely, or deformed than those of the Celtic nations, which have a tendency rather to the aerial and the graceful. Still the amount of common characteristics in the superstition throughout Europe is enormous. Its peculiarities have been found so much more emphatically displayed in Scandinavia than elsewhere as to have suggested the earlier and less philosophical view that modern fairydom is merely a remnant of the old mythology of the northern nations, communicated by them to a greater or less extent in all the countries over which their vikings carried their ravages.

There is a further distinction between the fairies of poetic and heroic literature and those of popular belief—the former being princes and princesses of chivalry, only distinguished from human beings by their superhuman superiority in all the qualities which elicited respect in the age of chivalry; while those of popular belief are small in stature, sometimes decrepit, and endowed with dispositions generally more allied to malignity than magnanimity. In Ireland and the Highlands they have been spoken of as a wandering remnant of the fallen angels, and in the west of England the pixies are the souls of infants who died before they were baptised. Sometimes they are supposed to be human beings, metamorphosed or disembodied, and this form of the superstition has made fairyland a place of purgation for those whose sins have condemned them to it. The analogy is carried out in the belief that the services of the living can extricate the souls so situated; but it is rather through dexterity and courage than pure piety that the feat is achieved, and the rescues from fairyland form some of the most wild and exciting of the elfin narratives—as, for instance, the exquisite ballad of *Tamlane*. The only dark cloud that obscures the brightness of fairydom is the periodical necessity of paying a teind to hell—a necessity which casts unexpected light upon the radical affinities of the fairies, in spite of all the seeming gaiety and happiness of their world. Hence their desire for kidnapping human children, in order to pay with them the inevitable tribute. Again, they do not possess spiritual souls like men and women, and consequently have no immortality of existence—this notion forms the heart of the most exquisite of artistic fairy-tales, the *Undine* of Fouqué.

There is still another broad distinction into fairies that dwell in the upper air and fairies that dwell within the bowels of the earth, while a third class frequent the waters. The Scandinavians called the fairy inhabitants of the air white elves, those of the earth black. Whatever was genial, light, playful, and benevolent in the superstition clustered round the former; the latter did all the work that was dark, cruel, and rapacious. Naturally enough, the black or subterranean kind frequented mining districts, where they might be seen extracting the ore for themselves, and thus unwittingly leading the miner to rich veins of metal. They might be seen in an occasional peep through an aperture of a hill in their underground retreats, in chambers supported on jasper columns, where they were stowing away their ample stores of gold and silver. Some of the most exciting tales about the German *gnome*, and the Irish *leprechaun*, who was a creature of the same kind, are founded on the efforts of adventurous mortals to get possession of their riches. There exists a legend, occurring in nearly identical terms in several countries, which connects some piece of valuable plate belonging to a church with the underground fairies. The story of the horn of Oldenburg is a type of these narratives. Pictures represent it as a beautiful drinking-vessel, in the shape of a horn, exquisitely decorated with the finest fanciful silver-work, in the style contemporary with the richest Gothic architecture. The legend is that one day Otho of Oldenburg, being exhausted with hunting, and very thirsty, exclaimed, 'O God, would that I had a cool drink!' Thereupon there appeared before him, as if coming out of the rock, a lovely maiden, who offered him a drink in the fairy-horn. He made off with it, and saved himself from evil consequences by bestowing it on the church. Hence these relics are generally in churches; but one of them is still in the possession of an English family, and, as their prosperity was traditionally believed to depend on retaining it, it was called the 'Luck of Eden Hall.'

Puck and the pixies belong to the same class of beings. Of the elf-folks of Scandinavia, the male is old and ill-favoured, but the evil element in the elf-woman or elf-maid consists in her beauty, which renders her perilous to romantic and lovelorn youths, whom she beguiles either with her own charms or by assuming the aspect of their mistress. To our own literature belongs one beautiful story of this character—the ancient tale of the love between 'True Thomas' and the Queen of Fairyland, which the genius of some nameless maker has woven into imperishable verse. A common feature, both here

and elsewhere, in the stories of fairy-women who assume human form and give their love to men, is a restriction of some nature which must not be broken. All mermaids, lamiæ, and the like are subject to some such conditions. Thus, Melusine is once a week again a serpent from the waist downwards, and when her husband breaks her one condition and surprises her at her bath, she becomes a water-sprite again.

In Ireland, and also in the Border country of Scotland, the fairy superstition has been incorporated into innumerable poetic legends and mystic traditions. T. Crofton Croker, in his *Fairy Legends and Traditions of the South of Ireland* (3 vols. 1828), presents a full and amusing account of the Irish fairies or elves, which he describes as 'a few inches high, airy, and almost transparent in body; so delicate in their form that a dew-drop, when they chance to dance on it, trembles indeed, but never breaks. Both sexes are of extraordinary beauty, and mortal beings cannot be compared with them.' They do not live alone, or in pairs, but always in large societies, and are governed by a queen. The same author adds: 'They are invisible to man, particularly in the daytime, and, as they can be present and hear what is said, the peasantry never speak of them but with caution and respect, terming them the good people, or friends. They have their dwellings in clefts of rocks, caves, and ancient tumuli. Every part within is decorated in the most splendid and magnificent manner; and the pleasing music which sometimes issues from thence in the night has delighted those who have been so fortunate as to hear it.' There are Irish fairies, however, of more special character. Among these are the *banshee*, or female spirit who watches a particular family; the *leprechaun* or *cluricaun*, an elf of evil disposition, who usually appears as a wrinkled old man, and has a knowledge of hidden treasure; and the *pooka*, a spirit of diabolical disposition, who sometimes appearing as an eagle or a black horse hurries the person he gets possession of to destruction. Of similar varieties are the Scottish elves: the *brownie*, or domestic spirit nearly corresponding to the Banshee; and the *kelpie*, a kind of water-horse, not unlike the Pooka, and in form somewhat analogous to the being sung by Leyden in his charming ballad, 'The Cout of Keeldar' (*Minstrelsy of the Scottish Border*):

> 'Brown dwarf, that o'er the muirland strays,
> Thy name to Keeldar tell!'
> 'The Brown Man of the muirs, who stays
> Beneath the heather-bell.'

Fairies cannot be seen by mortal eyes with impunity—it is the main part of Falstaff's terror when he sees his assailants: 'They are fairies; he that speaks to them shall die' (*Merry Wives*, V. v.). But the greatest risk that mortals run from the denizens of fairyland is that already alluded to, of having their children stolen from the cradle, and a changeling substituted who bears a resemblance to the stolen infant, but is an ugly little creature and never thrives. On this theft of a maid, who is carried to fairyland, but in the course of time returns to her parents, James Hogg founded his fine ballad of 'Kilmeny' (*Queen's Wake*).

Besides being embalmed in imaginative literature, the fairy has a perpetual memorial in the small, exquisitely shaped arrow-heads found so abundantly in northern countries, where they were long known as elf-arrows, or bolts with which the more malignant fairies sometimes slew or injured cattle and human beings; thus, when a poor man's cow or heifer was suddenly affected with some deadly and incomprehensible illness, it was said to be 'elf-shot.' See ELF-BOLTS.

See especially Keightley's *Fairy Mythology* (1850), and the articles DEMONOLOGY, and FOLKLORE; also Ritson's *Fairy Tales* (1831); Halliwell's *Illustrations of the Fairy Mythology of a Midsummer Night's Dream* (1845); Schreiber, *Die Feen in Europa* (Freiburg, 1842); Maury, *Les Fées du Moyen Age* (Paris, 1843); Grimm's *Deutsche Mythologie* (1835; 4th ed. 1875–78; Eng. trans. 4 vols. 1879–88); and Wirt Sykes, *British Goblins* (1879); also the collections of fairy tales of Grimm, Crofton Croker, Von Hahn, J. F. Campbell, Dasent, Ralston, &c.

Fair Isle, a solitary Shetland island, 24 miles SSW. of Sumburgh Head. It is 3 miles long by 2 broad, and 3 sq. m. in area, with high rocky cliffs and promontories, rising in the Sheep Craig to a height of 480 feet. Pop. (1861) 380; (1881) 214, chiefly engaged in fishing, or knitting woollen articles. There are a public school and a Church of Scotland mission here. At Stromceiler Creek was wrecked, in 1588, the Duke of Medina Sidonia, admiral of the Spanish Armada. He escaped with a few of his crew; and from these shipwrecked Spaniards the natives of Fair Isle are said to have acquired their knowledge of the art of knitting parti-coloured woollen articles.

Fairs (Fr. *foire*, from Lat. *feriæ*, 'holidays'), great periodical markets, some of which are chiefly devoted to one kind of merchandise, while others, of a wider scope, afford opportunity for most of the sales and purchases of a district. Fairs have long been regularly held in most parts of Europe and in many parts of Asia; but, as they belong rather to a state of things which is passing away than to modern civilisation, they have not been established or have not acquired the same importance in America. In Italy, towards the close of the 5th century, we first find authentic accounts of fairs specially designed as marts for commerce, and in Greece it has been suggested that at the celebrated Greek games trade was no entirely subordinate object. Thus, Cicero tells us that as early as the age of Pythagoras large numbers of people attended the religious games for the purpose of trading; and we know how at Delphi and other places a fair was held almost every year. In modern Europe they appear to have been associated with the church festivals, which were found to afford convenient opportunities for commercial transactions, the concourse of people being such as took place upon no other occasion. This origin of fairs is commemorated in their German name *Messe*—i.e. 'mass' (compare the *-mas*, for 'mass,' in such words as Lammas, Martinmas, &c.). Some festivals, from circumstances of place and season, speedily acquired a much greater commercial importance than others, and began, therefore, to be frequented by buyers and sellers even from remote parts of the world. When the ordinary means of communication between countries and opportunities for the exchange of commodities were very limited, fairs were of great use. Princes and the magistrates of free cities found it to their advantage to encourage them, and many privileges were granted, which in some places still survive. Courts of summary jurisdiction—commonly called in English 'pie-powder' (Fr. *pied poudré*), from the dusty feet of the suitors—were established distinct from the ordinary courts of the county or city, for the determination of questions which might arise during the fair. In connection with all this the practice was necessarily adopted of publicly proclaiming the commencement and duration of the fair, and this still subsists where scarcely any other vestige remains of the old privileges of fairs.

In western Europe the goods exposed for sale at fairs are chiefly those in respect of which there is a frequent change of fashion. While in some parts of the Continent persons of all ranks still wait for the great yearly fairs to make their principal purchases of clothing and of manufactured articles of every description, such things as corn,

wine, spirits, tea, coffee, sugar, tobacco, oil, &c. are seldom seen in them. It is otherwise, however, in places on the outskirts of civilisation; and almost all the produce of great provinces is sold, and all that their inhabitants require is bought, at such fairs as those of Kiakhta and Nijni-Novgorod. In France much of the European commerce of the middle ages was transacted at the famous fairs of Champagne and Brie, where the merchants of Italy, Spain, and France congregated. The British fairs really of much use at the present day are those at which horses and live-stock are exposed for sale, and even these have greatly decayed in importance: of these some held on the borders of the Scottish Highlands and elsewhere in Scotland were wont to be frequented by buyers and sellers from all parts of the kingdom. Such are the fairs or trysts, as they are called, at Falkirk, Doune, &c. At other great yearly fairs in the south of Scotland lambs and wool are sold; and fairs chiefly for the sale of the annual produce of pastoral districts are common in almost all parts of the world.

Of the three annual fairs at Leipzig the most important are the Easter and Michaelmas fairs, each of which lasts three weeks. The chief articles sold are leather, cloth, and furs. The Leipzig Book-fair is a fair in name only, being really an occasion for the settlement of accounts among booksellers and publishers; it occurs at the time of the Easter fair. Next to the Leipzig fairs those of Frankfort-on-Maine are the most important in Germany. The great fairs of Beaucaire in France, of Frankfort-on-Maine and Frankfort-on-the-Oder in Germany, of Pesth and Debreczin in Hungary, of Sinigaglia, Alessandria, and Bergamo in Italy, and of Nijni-Novgorod (q.v.) in Russia are among the most important in Europe; the last, which attracts representatives from all parts of the Russian empire, occupying a site comprising 7 sq. miles. The fairs of Tanta in Lower Egypt, of Kiakhta and Irbit in Siberia, of Mecca in Arabia, and of Hurdwar in Northern India are also of very great importance. That of Kiakhta is a sort of barter-market, where almost all the commercial transactions between the Russian and Chinese empires take place. The fairs in Britain have latterly sunk for the most part to insignificance, and in many instances have entirely disappeared. They were gatherings adapted to a comparatively backward state of society, when the provincial stores of goods were few, and the means of communication defective. The prevalence of good roads, populous towns with dealers in miscellaneous wares, and improved methods of transport have superseded the necessity for the ordinary class of fairs, and in consequence they have in some cases degenerated into mere scenes of merriment. Such were Bartholomew Fair (q.v.), Greenwich Fair, Glasgow Fair, and Donnybrook Fair, near Dublin; all either extinct or nearly so. The boisterous merriments at these fairs were of old the devices employed as likely to attract a great concourse of people; hence each fair had its sport or drollery—football, wrestling, yawning, cudgel-playing, throwing at cocks, sack-races, flying dragons, grinning through horse-collars, mock-giants, monstrous fishes, soaped pigs, smoking-matches, eating hot hasty-pudding, whistling, wheelbarrow races. At Stourbridge Fair, one of the most important in the kingdom, an excellent proclamation was issued in 1548 by the university of Cambridge in 'crying the fair,' containing among other 'comaunds' this clause: 'No brewer sell into the fayer . . . a barrell of good ale above tuo shillings—no long ale, no red ale, no sopye ale, but good and halsome for man's body, under ye payne of forfeyture.' It has been remarked that fairs were established for the most part on the frontiers of the kingdom, or on the marches of ancient provinces; or at the foot of high mountains, at the beginning or end of the snow-season, which for months shuts up the inhabitants in their valleys; or in the neighbourhood of famous cathedrals or churches frequented by flocks of pilgrims; or in the middle of rich pastures. A fair at Christ's Kirk, in Aberdeenshire, held in May, when the nights are very short, began at sunset, and ended an hour after sunrise: it was called 'Sleepy Market.' In America the word fair is used rather for what would in England be called an industrial exhibition, bazaar, or 'fancy fair.' See Cornelius Walford's *Fairs, Past and Present* (1883).

Fair Trade. See FREE TRADE.

Fairy Rings are spots or circles in pastures, which are either more bare than the rest of the field, or more green and luxuriant. Frequently a bare ring appears, like a footpath, with green grass in the centre, and the circle which the ring forms, or of which it might form a part, is often some yards in diameter. Apart from supernatural hypotheses, it was sometimes imagined that they might be the effect of lightning. Dr Withering appears to have been the first, in 1796, to ascribe them to the growth of fungi; and they are now known to be due to the outwardly spreading growth of the perennial subterranean mycelium of various fungi, chiefly species of Agaricus, even the Common Mushroom (*A. campestris*) showing a tendency to grow in the same manner. The spot where the agaric has already grown is unfitted for its continued nourishment, and the mycelium (spawn) extends outwards to new soil, the fungus exhausting the soil to which it extends for the immediate nourishment of grass, but enriching it afterwards by the highly stimulating products of its own decay. Fairy rings of large size sometimes occupy the same situation for many years. The circle is almost always imperfect, some accidental obstacle having broken the completeness of the expanding ring of mycelium.

Faith is used by theologians in various senses. It is sometimes taken to denote the mere assent of the understanding to a set of facts or of propositions set before it; but it is more peculiarly used to express the living reception by the heart of the 'truth as it is in Christ.' Some divines have enumerated no fewer than four kinds of faith: (1) The faith of miracles, or that immediate persuasion of the almighty presence and power of their Master, which enabled the early Christians to work miracles—a persuasion, apparently, which might exist and issue in astonishing results without being associated with moral excellence. 'Though I have all faith,' says St Paul, 'so that I could remove mountains, and have not charity, I am nothing.' (2) Historical faith, or the assent of the understanding to truth, the evidence of which is irresistible, such as we have described above. (3) Partial or temporary faith, such as our Lord implies in his exposition of the parable of the Sower, and as appeared to animate those who, after having followed after Christ, turned back and walked no more with him; and (4) Saving faith, or the persuasion of Christian truth wrought in the heart by the Holy Spirit.

These distinctions are rather theological refinements than anything else; the proper and characteristic meaning of the term faith in Scripture has little to do with any of them except the last. 'Faith,' says the writer of the Epistle to the Hebrews, 'is the substance of things hoped for, the evidence of things not seen.' It is a vision, quality, or capacity of soul whereby spiritual truth is apprehended, and spiritual life engendered. The

distant is brought near by it, and substantially appropriated; the unseen is felt to be a reality. Faith is the organ by which the soul passes beyond the present and the visible to the eternal and the invisible. Still more characteristically, perhaps, faith is the living affection which binds the Christian to Christ *as a Saviour*.

Faith, in the distinctively Christian sense, can only exist by the operation of God's Holy Spirit. 'For by grace are ye saved, through faith; and that not of yourselves; it is the gift of God.' Orthodox divines greatly insist on the necessity of this operation of the Spirit of God, yet not so as to exclude the active co-operation of man. The Pelagian and Antinomian extremes respectively throw out—the former the divine, the latter the human element. Orthodoxy combines the two, attributing to God the effective agency, but to man a real and voluntary concurrence. For the theological controversies connected with faith, reference must be made to the theological treatises of the different communions.

Faithfull, EMILY, born at Headley Rectory, Surrey, in 1835, early became interested in the condition of working-women, and in 1860 founded in London a printing establishment where women were employed as compositors. The Queen marked her approval of the work by appointing Miss Faithfull printer and publisher in ordinary to Her Majesty. In 1863 she started the *Victoria Magazine*, in which the claims of women to remunerative employment were set forth; and in 1868 she published *Change upon Change*, a novel. Shortly after, she appeared as a lecturer, and in 1872–73 first visited the United States in this capacity (see *Three Visits to America*, 1884). In 1889 she was awarded a civil list pension of £50. Died June 3, 1895.

Faith-healing, a system of belief based on James, v. 14, that sickness may be treated without any medical advice or appliances, if the prayer of Christians be accompanied in the sufferer by true faith. Dorothea Trudel, at Maunendorf in Switzerland, is said to have wrought marvellous cures by faith and prayer alone between 1850 and 1860; but the recent movement in favour of faith-healing, which is especially conspicuous in Sweden and in the United States, is mainly the outcome of the success attained by Pastor Blumhardt, who began a similar system of cure at Möttlingen, in Würtemberg. He ultimately resigned his charge, and bought a property with a sulphurous mineral spring at Boll, near Göppingen, where his system was fully developed in a large and much-frequented building specially arranged for his patients. He died in 1880, aged seventy-five. See his Life by Zündel (2d ed. Zurich, 1881). There are homes for faith-healing, called *Bethshan* (Heb., 'house of rest'), at various places in Britain and the United States. Some diversity obtains amongst believers whether the cures are to be accounted miraculous or not, and whether, in addition to the laying on of hands, anointing with oil should be practised. See PECULIAR PEOPLE.

Faithorne, WILLIAM (1616–91), English engraver, whose works were catalogued by Fagan in 1888. See ENGRAVING, p. 379.

Faizabad, the capital of the central Asian state of Badakhshan (q.v.), stands on the Kokcha, a tributary of the Amu-Daria, 180 miles NE. of Kabul. It is noted for the rubies found near it. —For the Indian town of this name, see FYZABAD.

Faizpur, a town of Bombay presidency, about 200 miles E. of Surat, with a reputation for its dark-blue and red dyes and cotton prints. Pop. 9640.

Fakir, an Arabic word meaning 'indigent' (not to be confused with *fakih*, vulgarly pronounced *fikí*, 'a pedagogue'), and commonly used to designate a member of an order of mendicants or penitents, chiefly in India and the neighbouring countries. In Persia and Turkey the word is also synonymous with Dervish (q.v.), and in Egypt is particularly assigned to that class of dervishes which performs *zikrs* and chants funeral dirges. The origin of Fakírism, an institution which reaches back to the most remote antiquity, is lost in mythical darkness. The common account of the son of a mighty raja, who, expelled from his home and country by the cruelty of his father, made a vow, half in revenge and half in contrition, henceforth to roam a beggar through the world, and to win proselytes to a life of poverty and self-mortification, as most befitting man and most pleasing to the Deity, can hardly be called historical. The same yearning for rest, for peace and pious contemplation, for escape from the noise and turbulence of the world, has everywhere and always led pensive minds into retirement and solitude; and constant seclusion and ceaseless meditation in India, as elsewhere, produced in all but exceptional minds their sad results. Thus abstinence became mortification and self-torture; mental repose was turned to mystic self-absorption or frenzied exaltation. This leaning of the Hindus to a life of asceticism was fostered by their religion, which enjoins various exercises of penance and mortification upon the three higher castes in general, but upon the Brahmins in particular. The world and its usages have no more any claim upon them; even religious ceremonies are no longer necessary to the 'United with God.' They go naked, or in filthy rags, receive the meanest food only, and that without either demand or thanks. Their ethical code consists in the observance of truth, chastity, internal purity, constant repentance, and contemplation of Deity. Fakírism seems chiefly to have been framed upon this phase of Brahminism, and its adherents were not only pious men, but occasionally saints, believed to be workers of 'miracles' and healers of all ills, especially epilepsy and sterility. But the halo which from the first surrounded Fakírism, and the ready homage offered by the people, attracted to its ranks at a very early date many whose motives were anything but pure, and who under a garb of humility and mendicity collected fabulous treasures. Strabo already distinguishes these vagabonds from the more honest members of their class, and, if we may trust the travellers of our own day, the more respectable element has now altogether disappeared. Their number is variously stated. In the time of Tavernier's visits (1643–69) there were more than 1,200,000 Hindu and 800,000 Mohammedan fakírs in the East Indies, and their present number is said to exceed 3,000,000. At times, especially on their return from distant pilgrimages, they are even dangerous, as the killing of an unbeliever is supposed to be an infallible introduction to the glories of paradise. They live either separately as hermits or solitary mendicants, or unite in large gangs, carrying arms and a banner, beating drums, and sounding horns as they approach a town or village. Their appearance is often disgusting in the extreme; they go naked, besmeared with the dung of the holy animal, the cow. Some bedeck themselves with the skins of serpents, some with human bones; others array themselves in the garb of women. Their fearful shrieks, and the rollings of their eyes, add to the hideousness of their appearance. Imitating madmen, they generally end by becoming madmen. Some pass their whole lives in iron cages, laden with heavy chains; some clench their fists till their nails grow through the hand; others hold aloft both their arms till they become like withered branches; while others, again, tie their hands and feet together, and roll head over heels for long distances—for

thousands of miles in some cases, it is said. Not the least sad feature in all this is that these religious antics are not confined to men, but that youths and even children of tender age are occasionally initiated therein. See, among other works, the *Qanoon-e-Islam*, trans. by Herklots (1832). Some forms of Christian Asceticism (q.v.) have produced types, such as Simeon Stylites (q.v.), worthy to be compared with Mohammedan fakirs.

Falaise, a town in the French department of Calvados, on the Ante, a feeder of the Dives, 23 miles (by rail 31) SSE. of Caen. Crowning a rocky platform, with steep cliff or *falaise*, stands the noble ruined castle once the seat of the dukes of Normandy, and the birthplace of William the Conqueror. Its donjon keep is Norman, whilst 'Talbot's' Tower is supposed to have been built by Talbot, after the capture of Falaise by Henry V. of England. The town has manufactures of cottons, hosiery, and bobbin-net, and dye and tan works. At the large suburb of Guibray an important horse-fair, established by the Conqueror, is held in August. Pop. 8276.

Falashas. See ABYSSINIA.

Falcón, a maritime state of Venezuela, on both sides of the Gulf of Maracaibo, and separated from Colombia by the barren Sierra de Perijá (4125 feet). In the west the country is full of wooded hills; elsewhere the surface is generally level, the coasts are flat, and the fertile but unhealthy plain to the south of the gulf is covered with lakes and swamps. It contains coal, and exports goat-skins, coffee, cacao, sugar, castor-oil, tobacco, agave-rum, pistachio-nuts, dye-woods, and timber. The chief towns are Maracaybo and Coro (q.v.). Pop. (1886) 198,260.

Falcon (*Falco*), the crowning genus in the family Falconidæ, including numerous species which excel even the eagles as birds of prey. They are represented in all parts of the world except the South Sea Islands, and are almost always distinguished by their carnivorous habit, active life, and that evolved hunting talent which has led to the frequent use of not a few forms in the sport of Falconry (q.v.). The beak is short and strong, with a sharp-hooked point and an upper tooth fitting into a depression in the lower half; the claws are strong and sharp, and the outer toe is rather longer than the inner; the lower part of the leg is covered with a net-like pattern of scales; the regions round about the keen eyes are bare; the wings are long and pointed; the tail is also long and rounded. The falcons are pre-eminent for boldness, keen sight, and muscular power. One is said to have traversed the distance between Fontainebleau and Malta, not less than 1350 miles, in 24 hours; and the speed attained when in pursuit of prey has been estimated at 150 miles an hour. They are able to soar to an immense height, and always endeavour to get above the bird they wish to strike. The distinctness of the various falcons is much disputed by experts; the fivefold grouping here followed is that adopted by Professor A. Newton.

(1) The cosmopolitan Peregrine Falcon (*F. peregrinus* or *communis*) was formerly a firmly established British species, but, though still persisting in some parts, has suffered enormously from unreasonable persecution. It is a powerful bird, though only about 16 inches long, and is brave and masterly in its hunting. In colour the adult is blackish-brown to grayish-blue above, and whitish, with a reddish shade, beneath. Especially on the lighter under surface are seen the dark bars, which in this and the gyrfalcons are longitudinal before and transverse after the first moult. The female is larger and more powerful than the male, with a slightly longer body, and decidedly longer wings; she is *the* 'falcon' of the falconers, the male is a 'tiercel,' the more rufous young forms are 'red falcons' or 'red tiercels.' The peregrine preys upon flying birds, such as wood-pigeons, all sorts of grouse, partridges, and plovers, or by the seashore on puffins, auks, and other marine birds. The falconers pit them against herons, and on its own account a falcon has been known to attack an intruding eagle. The cogent argument used against exterminators of falcons is that which may be urged against any disturbance of the balance of nature: that they kill grouse, pheasants, and other game-birds is undoubted, but they naturally tend to weed out the weaker forms, and thus, unless they predominate unduly, do more good than harm. Some even regard the grouse disease as a nemesis of the destruction of the nobler falcons. Peregrines usually live in pairs, and build large nests, generally of sticks and herbage, on very varying sites—sea-cliffs, inland rocks, or even trees. The Australian Peregrine (*F. melanogenys*) and the North American form (*F. anatum*) are probably only varieties of the above species.

Greenland Falcon (*Falco candicans*).

(2) Next come a number of northern gyr- or jer-falcons, like the preceding, formerly much used in falconry. The Scandinavian Gyrfalcon (*F. gyrfalco*), which sometimes wanders farther south, and has been seen wild in Britain; the Icelander (*F. islandus*), which also comes to Britain; the nearly pure white Greenland Falcon (*F. candicans*), of which the migrating young have been seen in Britain; and the North American Gyrfalcon (*F. labradorus*) are important forms. In their native haunts they feed on ptarmigan, geese, and other such birds.

(3) Somewhat distinct are the desert falcons, by some authorities distinguished as the 'lanners' (*F. lannarius*) and 'sakers' (*F. sacer*) of south-eastern Europe, North Africa, and south-western Asia, both used in falconry.

(4) The Merlin (*F. æsalon*) is a British species, like the peregrine in process of extermination. The male is bluish above and rather ruddy beneath. It is decidedly smaller than the peregrine, and preys upon smaller birds, such as finches, larks, and thrushes; yet so bold is it that it has been known to turn threateningly upon man.

(5) The English Hobby (*F. subbuteo*), with upright carriage and long wings, is a summer visitor in Britain, an eager enemy of larks, and sometimes even condescending to eat insects. Both of the last species have been used in British falconry. The Kestrel (Tinnunculus) is a nearly allied genus, separately discussed.

Falcone, ANIELLO, Italian battle-painter, born at Naples in 1600. He studied under Ribera (Lo Spagnoletto), and subsequently founded a school of painters at Naples. During Masaniello's outbreak (1647) he organised his scholars and dependents into a secret band (Compagnia della Morte) for assassinating Spaniards at night. On

the suppression of the insurrection Falcone betook himself to France, but subsequently returned to Naples, where he died in 1665. His works, few in number, represent chiefly military scenes.

Falconer, HUGH, an eminent botanist and palæontologist, was born at Forres in Elginshire, 29th February 1808. He graduated M.A. at Aberdeen in 1826, and M.D. at Edinburgh in 1829, and joined the medical service in Bengal of the East India Company. Appointed in 1832 keeper of the botanic garden at Saháranpur, he distinguished himself by the discovery of a large number of fossils in the tertiary deposits of the Siwálik hills. It was under his care that the first experiments were made by government in the growth of tea in India; and it was he who discovered during a journey in Cashmere the asafœtida plant of commerce. Overwork told upon his health, and in 1842 he had to return to England, whither he carried five tons of fossil bones and seventy large chests of dried plants. In England Falconer devoted himself to writing memoirs and papers on Indian botany and palæontology, to arranging the Indian fossils in the British Museum and East India House, and to preparing his great illustrated folio, *Fauna Antiqua Silvalensis* (parts i.–ix. 1846–49). He returned to India in 1847 to become superintendent of the botanic garden and professor of Botany in the Medical College at Calcutta. He came home finally in 1855, and in spite of failing health continued his palæontological studies with heroic energy. He died in London, 31st July 1865. A fund of £2000 was raised to provide a memorial of this devoted martyr to science. A memorial fellowship was also founded at Edinburgh University to promote the study of palæontology and geology. The *Palæontological Memoirs and Notes of the late Hugh Falconer* were published in 1868.

Falconer, THE HON. ION KEITH, Orientalist, missionary, and athlete, was the third son of the Earl of Kintore, and was born in Edinburgh, 5th July 1856. From Harrow he went to Cambridge, and there he began evangelistic work, continued in conjunction with Mr Charrington at Mile End Road, London. Here he aided by personal effort in founding an assembly hall, to which he contributed £2000. A keen cyclist, he defeated the then fastest rider in the world (1878), and rode from Land's End to John o' Groat's. He had accepted the Lord Almoner's professorship of Arabic at Cambridge, and was settled at Shaikh Othman, near Aden, as a missionary under the auspices of the Free Church, when his bright and promising career was cut short by fever, May 10, 1887. He was author of the article 'Shorthand' in the *Encyclopædia Britannica*, and in 1885 translated the Fables of Bidpai (q.v.), with an admirable introduction. See *Memorials of Keith-Falconer*, by the Rev. Robert Sinker (Camb. 1888).

Falconer, WILLIAM, poet, was born in Edinburgh on 11th February 1732. A barber's son, he went early to sea, and before he was eighteen years of age was shipwrecked off Cape Colonna in Greece. The incidents of this voyage and its disastrous end form the subject of Falconer's principal work, the poem entitled *The Shipwreck* (1762). He then entered the royal navy, being appointed towards the end of 1769 purser on the *Aurora* frigate, which foundered at sea, with all hands, shortly after 27th December, the day on which she left Capetown. Falconer wrote several poems, but *The Shipwreck* is the one on which his fame rests; it went through three editions during its author's lifetime. His *Demagogue* is a satire on Wilkes and Churchill (1764), and he was also author of the *Universal Marine Dictionary* (1769).

Falconet, a name used in the 15th and 16th centuries for a small field-gun. The ball weighed from 1 to 2 lb., and the gun from 5 to 15 cwt.

Falcon'idæ, a large family of Birds of Prey (q.v.), occupying a position similar to that of Felidæ among Carnivores. The muscular strength and power of flight; the habit of preying upon living animals, and that in daylight; the world-wide representation by over 300 species, are to be noted. The beak is rather short, but very strong, and highest at the root; the partition between the nostrils is complete; the upper margin of the eye-socket projects; the feet bear strong, sharp, rending claws and large sole-pads. The family includes the Falcons *par excellence*—e.g. the genus Falco; the Eagles—e.g. Aquila, Haliaëtus; the Buzzards—e.g. Buteo; the Kites—e.g. Milvus, Elanus; the Hawks—e.g. Nisus, Astur; the Harriers—e.g. Circus; the Caracaras—e.g. Ibycter, Polyborus—for which see the separate articles.

Head and Foot of Brazilian Eagle.

Falconry (from Old Fr. *faulconnerie*, a term introduced by the Normans), the art of training falcons and hawks to the chase. The term hawking (from M.E. *hauk*, earlier *hauck*—i.e. *havck*, and A.S. *hafoc*), though often used synonymously, is more correctly restricted to the practice of this art in the field. In the East falconry has been traced back to a period anterior to the Christian era, and was practised there and also in Europe long before its introduction into Britain. It was known to our Saxon ancestors, and is mentioned in the *Colloquy* of Archbishop Ælfric, written in the 10th century. In the celebrated Bayeux tapestry Harold is represented with a hawk upon his glove; and the Norman nobles, who were as much addicted to hawking as to hunting, gave a great impetus to the sport in England by the importation of falcons (especially jerfalcons) from abroad, and by the large sums they expended upon this diversion. Henry II. used to send every year for young falcons from the cliffs of Pembrokeshire. Richard I. while in the Holy Land amused himself with hawking at Jaffa, in the plain of Sharon, with hawks which he had brought with him from England. King John used to send to Ireland for his hawks—amongst other places to Carrickfergus, County Antrim, and was especially fond of a flight at the crane with jerfalcons which he received from the king of Norway. He used to hawk in Dorsetshire and Somersetshire, as appears by entries in the court rolls of payments for the expenses of the journeys. When Edward III. invaded France, he had with him, according to Froissart, thirty falconers, and every day either hunted or hawked as his fancy inclined him. The Paston Letters, written in the reign of Edward IV., give an insight into the ways and doings of English falconers in the middle ages, as do also the various 'Household Books' which have come down to us. Henry VII. used to import his goshawks from France, and Henry VIII.'s love of the sport nearly

cost him his life, if we may believe the anecdote told of him in Hall's *Chronicle*. During the reign of Elizabeth hawking was much in vogue in England, and Nichols in his *Progresses* has given some interesting details of the queen's participation in this pastime. James I. was a most enthusiastic sportsman, and gave a great impulse to hunting and hawking in England by inviting those of the French nobility who were the greatest adepts in these field-sports to come over to this country, and compete in friendly rivalry with his own subjects. He was especially fond of kite-hawking with jerfalcons, and carried this branch of the sport to great perfection on the wide heaths of Royston, Newmarket, and Thetford. It may be well to correct here an erroneous statement which has been many times repeated in print to the effect that Sir Thomas Monson in the reign of James I. gave £1000 for a *cast*—i.e. for two hawks, the truth being (as stated by Sir Antony Weldon in his *Court and Character of King James*, 1650) that he spent £1000 before he succeeded in obtaining a cast which he considered perfect for kite-hawking.

These were the palmy days of falconry, when the sovereigns on both sides of the Channel (James I. and Louis XIII.) were enthusiastic falconers, giving every encouragement to the sport, when the species of hawk carried was indicative of the rank of the owner, and when the best books were written by English and French masters of the craft.

The disastrous state of the country during the period of the civil wars naturally put an end for the time being to the general indulgence in field-sports; and it may be said that at the Restoration hawking had ceased to be popular, although from that time until the present it has never ceased to be practised by a few admirers of the old sport in various parts of the country. The last member of the royal family, it is believed, who sent for or received hawks from abroad was Frederick, Prince of Wales, son of George II., who occupied the 'palace of Durdans' at Epsom, now a seat of the Earl of Rosebery's, and used to hawk over the downs, where in 1825 there was a spot still known as 'the Hawkery.' Fashion, no doubt, had a good deal to do with the decline of hawking, for so soon as the reigning sovereign ceased to take an interest in the sport the courtiers and their friends followed suit. Between the years 1751 and 1791 the third Lord Orford did much to encourage the practice of falconry in England; and during the first quarter of the 19th century Colonel Wilson (afterwards Lord Berners) in Norfolk, and Colonel Thornton, of Thornville Royal in Yorkshire, not only practised game-hawking with great success (as did also Sir John Sebright, who wrote a practical treatise on the subject in 1826), but excelled in those higher branches of the sport, kite-hawking and heron-hawking, which have long since become impracticable by reason of the extinction of the former quarry and the impossibility of securing the requisite conditions for a flight at the latter.

In 1840 the formation of the Loo Hawking Club, whose headquarters were at the summer palace of the king of Holland, kept the sport alive for many years, and several English falconers who kept hawks of their own annually repaired to Loo for the enjoyment of heron-hawking, which was there carried out to perfection by the Dutch falconers Van der Heuvel, the brothers Bots, and the veteran Adrien Mollen. The last owner of heron-hawks in England was Mr Edward Clough Newcome, of Hockwold in Norfolk, a most accomplished falconer, who died in 1871. About this time was formed the Old Hawking Club, which still flourishes, and annually pursues the sport of rook-hawking in the spring and game-hawking in the autumn, the interval being devoted to lark-hawking with merlins and flights with the goshawk at rabbits and hares. Of late years the taste for falconry has manifestly increased, and there are now a great many owners of hawks (besides the members of the club just named) who carry on the old sport with more or less success in different parts of the United Kingdom. It may therefore be said that, although from various causes hawking in England has declined since the days of the Stuarts, it has never actually died out, and is even at the present day in a fair way to be thoroughly revived.

The birds employed by falconers belong to two classes—the long-winged, dark-eyed falcons, and the short-winged, yellow-eyed hawks. To the former class belong the Jerfalcons, Peregrine, Lanner, Saker, Barbary Falcon, the Indian Shahin, the Hobby, and the Merlin; to the latter the Goshawk and Sparrow-hawk. The former take their prey by rising above it in the air, and *stooping* at it from a considerable height, and striking it to the ground; the latter pursue in a straight line, and, overtaking the quarry by superior speed, clutch it, and come down with it. The larger falcons are flown at winged game of all kinds—crows, magpies, rooks, herons, and wild-fowl; the smaller falcons, such as the merlin and hobby, are used for taking larks; while of the short-winged hawks the sparrow-hawk is flown at blackbirds and thrushes, partridges early in the season, and quails, the goshawk taking pheasants, partridges, and wild-fowl, rabbits and hares. With all birds of prey the females are invariably larger and more powerful than the males, and the sexes are consequently selected according to the quarry they have to pursue. Jerfalcons are now rarely employed, partly owing to the difficulty of procuring them, partly because the peregrine falcon is preferred, and experience has shown that except in a woody or inclosed country, where the goshawk and sparrow-hawk are preferable, the peregrine is the most useful of all the birds of prey.

Hawks are either taken young from the nest before they can fly, when they are termed *eyesses*, or are caught later, during the period of their migration, by means of a decoy-pigeon and a bow-net, when they are called *passage-hawks*. The mode of treatment is a little different, inasmuch as the latter have already learned to catch and kill prey for themselves, and only require to be tamed; the former have everything to learn. A passage-hawk on being caught is hooded, and has jesses, or soft leather straps, fastened on her legs. She is then set down on a block of turf to prevent damage to feathers, and fed once a day, at first through the opening of the hood, afterwards with the hood removed. The bird is always fed upon the gloved hand, and gradually learns to step on to it from the perch, increasing the distance daily until she is obliged to fly to reach the fist. The training then commences. The hawk is *called off*, as it is termed, *to the lure*, which means that after tying a long line to the ends of the jesses she is held hooded on the hand of an assistant, until the falconer at the distance of five-and-twenty yards swings the lure to which the bird has been accustomed to come to be fed. The hood being then removed, the hawk flies to the lure, and is exercised in this way for some time daily, until she is sufficiently tractable to be trusted without a line, care being taken not to feed her until she has flown, and always to reward her for coming to the lure with a morsel of the meat with which it is garnished. She is then *entered* at the *quarry* at which she is intended to be flown (partridge, rook, or whatever it may be)

by first giving her a live bird at the end of a long line, and allowing her to go off the fist and kill it; eventually the line is dispensed with, and she is flown at wild quarry.

Such, briefly, is the mode of training a passage-hawk. An eyess is somewhat differently treated. A straw-covered platform is put up in some shed or outhouse, and on this the nestlings (which should not be taken too young, or they will turn out *screamers*) are placed, the platform being about as high up as one can reach to feed the birds. They are fed three times a day on fresh lean beef, while growing, to keep up their strength, or *hunger-traces* will appear, like cuts across the webs of the feathers, and the latter breaking will render the birds useless. When they are strong enough and

Fig. 1.—Leg and foot of Hawk, showing the method of attaching the jesses and bell:
a, end of the leash; *b*, *b*, jesses; *c*, the bell; *d*, bewit; *e*, varvels.

able to fly, jesses are put on the legs, and a spherical brass bell (of Dutch or Indian make) on one leg, fastened just above the *jess* with a little narrow strip of leather termed a *bewit* (see fig. 1). At feeding time, now once a day, they are called to the lure, and, being allowed their liberty for some weeks (in which state they are said to be *flying at hack*), they daily gain strength and wing-power, until the time comes for taking them up and commencing their training, which after this stage does not differ much from the method above described for passage-hawks. When flying at hack, a hawk sometimes becomes wild, wanders away to a distance, and kills game for herself. When this is perceived, a bow-net, or other device for snaring, is set for her, to which she is decoyed and recaptured. The first operation in training is *hooding*, which, if successfully performed, overcomes much difficulty. It requires some patience and dexterity, and should be practised at first in a darkened room, in which the hawk will be much quieter than in broad daylight. The hood is simply a cap of leather (see fig. 2) made to fit the head in such a manner as to obscure the light, a single aperture only being left, through which the beak protrudes, and a slit behind, which is opened and closed, when the hood is put on and off, by means of *braces*, one pair of which opens, the other pair closes the slit; the eye-pieces, which to prevent injury to the eyes are carefully *blocked out*, are covered for ornament with red or green cloth. By temporarily blindfolding the hawk, the hood causes her to sit perfectly quiet, and prevents her from *bating*, or fluttering, at the risk of breaking feathers, as she would do if frightened by passers-by until gradually accustomed to them.

Fig. 2.—Hooded Peregrine on the block:
One end of the leash is attached to the jesses, the other to a ring driven into the side or top of the block; and thus the hawk is prevented from escaping.

Allusion has already been made to the jesses, or soft straps of leather (dog-skin is best), which are fastened to the legs of the hawk, by which to hold her on the glove and tie her to the perch or block. These jesses are about 6 inches long, and are never removed when the hawk is flown. In former times *varvels*, or flat rings of silver with the owner's name engraved thereon, were permanently attached to the ends of the jesses, and through these one end of the leash was passed, the other end being prevented from going through by a leather button. At the present day, however, most falconers prefer using a figure-8 swivel, which is always detached before the hawk is flown.

The *lure*, already referred to, is a device for luring the hawk back to her owner after an unsuccessful flight, and on this account the hawk is early made acquainted with it by being fed upon it daily while being trained. There are various patterns; one of the simplest and most easily made consists of a couple of pigeons' wings tied together on a flat circular leaden weight covered with leather, upon which a piece of raw meat is tied on both sides. The *tabur-stick* and *drawer*, which were formerly used as lures, have long been discarded.

The beaks and claws of wild caught hawks are generally so long and sharp as to require paring or *coping*, as it is termed; but this operation requires to be very carefully performed (the hawk being hooded and held by an assistant), and not more than the tenth of an inch removed, or the efficiency of the beak and claws will be impaired. Indeed some falconers will never cope a hawk, except when the beak is overgrown; and with goshawks especially, which have to hold such powerful prey as hares and rabbits, strong and sharp talons are indispensable.

Eastern falconers carry their hawks upon the right hand; but European falconers always carry them on the left, leaving the right hand free for detaching leash and swivel, and removing and replacing the hood.

The following are some of the technical terms used in falconry. The wings of a hawk are termed the *sails;* the tail, the *train;* the legs, *arms;* the toes, *petty singles;* the claws, *pounces;* the crop, *gorge;* the stomach, *pan*; the pellets of feathers and undigested food which are thrown up after feeding are termed *castings*. A young hawk from the nest is an *eyess;* one that can perch but not fly, a *brancher;* an eyess reared at liberty, a *hack-hawk;* one taken later on migration, a *passage-hawk;* a young hawk in the first year's plumage is called a *red-hawk*, or a *soar-* or *sore-hawk*, from the Fr. *sorel*, 'a reddish-brown colour.' A wild caught adult hawk is a *haggard*. After the first moult a hawk is said to be *intermewed;* when completely moulted, *full summed;* when purged of all superfluous fat and in good condition, *enseamed*. A broken feather is repaired by a process termed *imping;* cutting or paring the beak and claws is termed *coping*. The prey when living is called the *quarry* (from the Fr. *curée*); when dead, the *pelt*. A hawk is flown either *out of the hood*—i.e. off the fist—as in rook-hawking, or is *put up*, or *cast off*, as in game-hawking before the game is sprung.

In the latter case, when a hawk soars in circles at a height above the falconer's head, she is said to *wait on*. She *stoops* when descending with closed wings from a height at the quarry, *binds* when she seizes it in the air and comes down with it, *carries* when she flies off with it, *rakes off* when she flies straight away without soaring, and *checks* when she changes the bird in pursuit. At home she sits either indoors upon the *perch* or out of doors upon the *block*, and is carried to the field hooded upon the *cadge*, a padded wooden frame of square or oval shape, which is borne by an assistant with the aid of shoulder-straps. In this way six or eight hawks may be carried without difficulty, since, being hooded, they sit perfectly quiet.

The principal works on falconry in English are the treatise on hawking in *The Boke of St Albans* (1486) of Dame Juliana Berners (q.v.), from which very little practical instruction is to be gained; Gervase Markham's *Gentleman's Academie* (1595), a later version of the last named; Turberville's *Booke of Falconrie* (1575–1611); Latham's *Falcon's Lure and Cure* (1615–18 and 1633); Bert's *Approved Treatise of Hawks* (1619); Nicholas Cox, *The Gentleman's Recreation* (1674, and numerous later editions); John Ray's *Summary of Falconry* (1678); Campbell's *Treatise of Modern Falconry* (1773); Sir John Sebright's *Observations on Hawking* (1826); Belanay's *Treatise upon Falconry* (1841); Salvin and Brodrick, *Falconry in the British Isles* (1855 and 1873); Freeman and Salvin, *Falconry: its Claims, History, and Practice* (1859); Freeman's *Practical Falconry* (1869); Harting's *Essays on Sport* (1883), *Hints on the Management of Hawks* (1884); and *A Perfect Booke for kepinge of Spar Hawkes or Goshawks, from the original MS. of 1575* (1886).

Faldstool, a small desk in churches in England at which the litany should be sung or said. The name is also given to a folding-stool used by Roman Catholic bishops and other prelates on certain occasions.

Falemé, one of the most important tributaries of the Senegal, rises in Futa-Jallon, and after flowing in a northerly direction joins the main stream above Bakel. About 120 miles above its mouth the Falemé is interrupted by rapids and waterfalls. Up to that point it is navigable for small steamers during two months of the year.

Falerii, a city of ancient Etruria, and the capital of the Falisci, was situated west of the Tiber, and north of Mount Socrate. After its capture and destruction by the Romans (241 B.C.), the inhabitants settled on a new site a few miles off. See ETRURIA.

Falernian Wine, so called from *Falernus Ager*, the district in which it was grown—and which lay in the northern portion of Campania, between the Massican Hills and the northern bank of the Vulturnus—was one of the favourite wines of the Romans. It is described by Horace as, in his time, surpassing all other wines then in repute. In the time of Pliny, however, Falernian wine had already, owing to a want of care in its cultivation, begun to decline in quality.

Faliero, MARINO, Venetian general and doge, was born about the year 1274. At the siege of Zara, in 1346, he defeated an army of 80,000 Hungarians, and afterwards, whilst in command of the fleet, captured Capo d'Istria. Subsequently he became ambassador of the republic to Rome and Genoa. He was elected Doge of Venice in 1354. In the following year, being dissatisfied with the punishment inflicted by a patrician tribunal upon a young noble, Michele Steno, who had publicly insulted the youthful wife of the aged doge, Faliero conspired with the plebeians to assassinate the oligarchy and make himself supreme ruler of Venice. The conspiracy was, however, revealed on the eve of its execution, and Faliero was arrested and beheaded on the 17th of April 1355. His fate forms the theme of tragedies by Byron and Swinburne.

Falk, ADALBERT, Prussian statesman, one of the foremost combatants in the *Kulturkampf* (the struggle between church and state in Germany), was born at Metschkau, in Silesia, 10th August 1827. Educated for the law, he held various judicial and administrative posts in his native province, until he was appointed Minister of Public Worship and Education in 1872. In this capacity he was mainly instrumental in carrying the so-called May laws (because passed in May 1873, 1874, and 1875), aimed at the hierarchical supremacy of the Church of Rome, by limiting the influence of the clergy in the schools, by reorganising the seminaries for the training of teachers, and by defining in a stricter and more comprehensive manner the relations generally of the clergy to the state. When, however, Bismarck came to bid for the support of the clerical party, in order to carry out his later internal policy, Falk resigned in 1879. Thereafter he retired altogether from political life.

Falkirk, a town of Stirlingshire, finely situated on a rising-ground in the midst of a populous mineral and manufacturing district, and overlooking an expansive 'carse,' by rail is 3 miles SW. of its seaport Grangemouth, 22 NE. of Glasgow, and 26 WNW. of Edinburgh. Including now the suburbs of Grahamston, Bainsford, Laurieston, and Camelon, it was constituted a parliamentary burgh in 1832, and with Airdrie, Hamilton, Lanark, and Linlithgow returns one member. Its parish church—the *Eglais Bhrec, Varia Capella*, or *Faw* ('speckled') *Kirk* of chartularies and local tradition—was rebuilt in 1810. There are also the county buildings (1868), burgh buildings (1876), town-hall (the former corn exchange, 1859), an equestrian statue of Wellington (1854), a science and art school (1878), the Dollar Free Library (1888), and a cottage-hospital (1889). The famous cattle 'trysts' or fairs, where stock was annually sold to the value of £1,000,000, have been largely superseded by the weekly auctions. The iron manufacture is carried on busily at Carron (q.v.) and elsewhere. Pop. (1851) 8752; (1891) 17,307. At Falkirk on 22d July 1298 Edward I. inflicted a disastrous defeat on Wallace, and on 17th January 1746 Prince Charles Edward defeated Hawley. Antoninus' Wall (q.v.) is the chief antiquity.

Falkland, a royal burgh (since 1458) of Fife, at the north-eastern base of the steep East Lomond Hill (1471 feet), 22 miles north of Edinburgh. Nothing remains of the old castle of the Earls of Fife, in which David, Duke of Rothesay, was starved to death by the Regent Albany (1402); but there are extensive and stately remains, still partly habitable, of the later royal palace (*circa* 1450–1542), with singularly fine renaissance details. It was the death-place of James V., and has memories of almost all the other Stuart sovereigns. With the estate and a modern mansion (1844), it was purchased in 1888 by the Marquis of Bute. Pop. 1068. See Major W. Wood's *Historical Description of Falkland* (Kirkcaldy, 1888).

Falkland, LUCIUS CARY, VISCOUNT, was born most probably at Burford, Oxfordshire, in 1610, son of Sir Henry Cary, himself of literary tastes and a friend of Ben Jonson. His father, created Viscount Falkland in the Scottish peerage in 1620, was the well-meaning but unfortunate lord-deputy of Ireland from 1622 to 1629; his mother was learned in languages and in the Fathers, was an early friend of Chillingworth, and, while still a girl, became a convert to the Catholic faith, though she did not avow it for twenty years. Lucius went to Ireland with his

parents, and had his education at Trinity College, Dublin, succeeded to his maternal grandfather's property at nineteen, according to Clarendon, and soon after married, to his lasting happiness, Letice, daughter of Sir Richard Morrison. But the marriage irritated his father, who had been ambitious of a more splendid match, and moreover seems to have been displeased at the descent of his father-in-law's property to his son. With that instinctive unselfishness, linked with impulsive temper, so characteristic of his nature, Lucius at once offered, but to no purpose, to give up all claim upon the estate; he next crossed to Holland to volunteer into the service of the young republic, but soon returned to devote himself to his studies, especially of Greek. His father's death in 1633 gave him the title, and for a time he lived with his mother and listened dutifully to all her anxious arguments for his conversion. But his rational temper could not find rest in her summary solution of his questionings, and ere long, guided by the resistless intellect of Chillingworth, he reached conclusions as alien, in their large tolerance, to Puritanism as to Papistry. He soon settled down in his house at Tew, in Oxfordshire, to a severe course of study, and to that *convivium philosophicum* or *convivium theologicum* which the loving pen of Clarendon thirty years after described with so peculiar a charm. Hither came constantly the brightest intellects of the university, but sixteen miles distant, as well as the poets and wits from London. In the group of closest intimacy Clarendon enumerates Sheldon, Morley, Hammond, Earle, and Chillingworth, and to these we may add John Hales and the historian himself—great writer and constant friend. There is hardly another picture in our literary history so attractive as that of this 'university in a purer air' under the oaks and limes of Tew, and of the Tusculan disputations there of Falkland, Hales, and Chillingworth, three friends united by so warm a friendship, yet unlike in everything save supremacy of intellect, littleness of stature, and largeness of charity. To this period belong Falkland's pleasing but not striking poems, which were edited by A. B. Grosart in 1871. His *Discourses of Infallibility*, and the longer *Reply to the Answer thereto*, are a truer index to what lay closest to his heart.

For some years high thinking entirely occupied Falkland's mind, but in 1639 we find him offering his sword for service against the Scots, and actually accompanying Essex's expedition as a volunteer. After his return he sat in the Short Parliament for Newport in the Isle of Wight, and was again returned to the Long Parliament for the same place. Here he distinguished himself by his ardour and eloquence in behalf of constitutional liberty, which he felt to be endangered by the high-handed absolutism of Laud and Strafford. Although his innate love of fairness and justice impelled him at first to demand delay in the impeachment of the latter until the charges made could be fully inquired into, he both spoke and voted with the majority on the third reading of the bill of attainder. He took the same part in the question of ship-money, and vigorously attacked the real illegalities of Finch, the Lord-keeper; but, though he assailed the bishops' claims to divine right, he refused to support the abolition of Episcopacy, while willing enough at first to exclude the bishops from the House of Lords. But the popular party moved too fast for his wise and temperate patriotism, and, in his alarm at the threatening domination of a no less intolerant Presbyterianism, he found himself compelled to resist the second Bishops Exclusion Bill.

At the commencement of 1642, after much persuasion, he accepted the secretaryship of state, although he evidently mistrusted the character of the king, and had no share in the counsels of the queen and the inner party that really ruled his actions. It was characteristic of the man that he refused to make use of spies or to open letters; and, as was to be expected, we find him active in the last ineffectual efforts to bridge the ever-widening breach betwixt the Court and the Commons. When the inevitable war broke out he gave his sword loyally to the king, but his heart sank within him to see his much-loved country bleeding in civil strife. There is no more touching figure in our history than this large-hearted patriot in his last few months of life, so real yet romantic is the pathos that enshrines him. Already the shadow of death hung over him, and Clarendon tells us, in the most famous passage of the *History*, how, his cheerfulness and vivacity gone, and even his customary carefulness in his dress abandoned, 'sitting amongst his friends, often, after a deep silence and frequent sighs, he would, with a shrill and sad accent, ingeminate the words "Peace, peace," and would passionately profess that the very agony of the war, and the view of the calamities and desolation the kingdom did and must endure, took his sleep from him, and would shortly break his heart.' On the morning of the battle of Newbury, 20th September 1643, he knew that the hour for which he longed had come. He was cheerful beyond his wont, and put on clean linen as if for a banquet. Placing himself in the front rank of Sir John Byron's regiment, he rode forward to meet his death at a gap in the hedge where the enemy's bullets flew thickest. 'Thus fell that incomparable young man, in the four and thirtieth year of his age, having so much despatched the business of life that the oldest rarely attain to that immense knowledge, and the youngest enter not into the world with more innocence: and whosoever leads such a life need not care upon how short warning it be taken from him.'

See Clarendon, both in the *History* and the *Life*; also S. R. Gardiner's *History*. There is no better account of Falkland than that in chap. 3 (vol. i.) of Tulloch's *Rational Theology in England in the Seventeenth Century* (1872). See also the characteristically urbane yet irritating essay by Matthew Arnold (*Nineteenth Century*, March 1877), with the sufficient reply by Goldwin Smith (*Contemporary Review*, April 1877); and that by Lord Carnarvon in the *Fortnightly Review* for November 1882, based on his speech delivered at the unveiling of a granite memorial at Newbury, 9th September 1878.

Falkland Islands, a British colony in the South Atlantic, lying between 51° and 53° S. lat.

and 57° and 62° W. long., some 250 miles E. of Patagonia, with which they are geologically connected by a submarine plateau. The group consists of East Falkland and West Falkland, with

about 100 small islands, besides the dependency of South Georgia (q.v.). According to the most reliable measurement—that of Wisotzki—East Falkland, with the neighbouring islands, has an area of 2849 sq. m., and West Falkland, with the small islands near it, an area of 1990 sq. m. Many of the islands are occupied only by myriads of penguins, whence the title King of the Penguins sometimes bestowed on the governor of the Falklands. Total pop. (census of 1891) 1789. The shores are deeply indented with bays and inlets, containing many good harbours; the surface is for the most part undulating (Mount Adam, the highest point, 2315 feet), with numerous small streams and lakes; there are no trees, nor is coal found, but peat is plentiful. The climate is healthy, resembling that of the Orkneys, but is characterised by severe gales and abundance of moisture. The average annual temperature was 34° in 1887; the average number of rainy days in the year is 240. Some wheat and flax are raised, but tussock grass and balsam bog are the principal vegetable products. The chief industry of the inhabitants is sheep-breeding. Wool, frozen meat, live sheep, tallow, skins, and hides are exported (principally to the United Kingdom). The exports rose from £20,000 in 1870 to £126,312 in 1892; the imports from £21,000 to £70,318. The capital of the colony is Stanley (pop. 700), originally founded as a port of refuge, on East Falkland. The group, first sighted by Davis in 1592, received its present name in 1689 from Captain Strong, in honour of his friend Lord Falkland. It was occupied by France in 1710 and 1764, when it was purchased for £30,000 by Spain, who immediately thereafter was compelled to surrender her claim on receiving the ultimatum of the British government. It was for a while evacuated, but was definitely occupied by Great Britain in 1833, and utilised as a penal colony until 1852.

Fall, the name applied in theology to the change of state with respect to sin which befell Adam and Eve in Eden. The Scripture version of the fact, and the allegorical and other spiritualised explanations that have been offered by theologians, are already discussed under ADAM; here it only remains to point out the special use made of it in the orthodox Augustinian and Calvinistic scheme of theology. The Fall was due to an external temptation offered by the devil, and the inheritance of sin and a corrupted nature descended through the first sinners to all their natural descendants, to whom the guilt of the first sin was imputed in what is called *original sin*. This was possible, because Adam, as the covenant head or federal representative of the whole human race, necessarily involved all mankind—his descendants—in the consequences of his breach of the *covenant* which God made with him at his creation. Christ is 'the second man' and 'the new Adam' (Rom. v. and 1 Cor. xv.), and in the new covenant made with God the believer, through Christ's merits imputed to himself, is freed from the consequences of the Fall in so far as the after-life is concerned. See ADAM, EVIL, and SIN.

Fallacy, the incorrect performance of the process of reasoning so as to lead to error. The science of Logic reduces sound reasoning to certain rules, and when any of these rules is violated a logical fallacy is the result. The time-honoured division was into two classes, according as the error lay in the *form* of the reasoning or in the *matter:* the formal were entitled *in dictione*, or those appearing in the expression; the material were entitled *extra dictionem*, implying that the fault could not be detected from the language, but must be sought in a consideration of the meaning or subject-matter. Mill proposed to classify all fallacies under (1) Fallacies of Simple Inspection, or Fallacies *a priori*, which includes the whole of what may be termed Natural Prejudices; (2) Fallacies of Observation; (3) Fallacies of Generalisation, including Induction; (4) Fallacies of Ratiocination or Syllogism; and (5) Fallacies of Confusion, comprehending the *petitio principii*, the *ignoratio elenchi*, and ambiguous language generally. Other classifications have been more or less elaborately carried out. But, owing to the enormous variety and intricacy of inaccurate and confused modes of thought, it is difficult to draw up a scheme at once complete and rigorously scientific. See the articles LOGIC, INDUCTION, GENERALISATION; for Bacon's *eidôla*, prejudices influencing the judgment, see BACON; and for the subject of fallacies generally, see the text-books of logic, as those of Whately, Mill, Jevons, and Fowler.

Falling Bodies. See GRAVITATION, KINEMATICS, ATTWOOD'S MACHINE.

Falling Sickness. See EPILEPSY.

Falling Stars. See METEORS.

Fallmerayer, JACOB PHILIPP, a German traveller and historian, was born 10th December 1790, at Tschötsch, near Brixen, in the Tyrol. At the university of Landshut he studied law, history, and philology, and in 1826 was appointed to its chair of History and Philology. In 1831–34 he accompanied the Russian general, Count Ostermann-Tolstoi, in a journey through Egypt, Palestine, Syria, Cyprus, Rhodes, Greece, Turkey, and Italy, and twice afterwards (in 1840 and 1847) he revisited the East. The events of 1848 recalled him to Bavaria, and for a short time he sat as a deputy in the Frankfort parliament. Fallmerayer spoke a great number of European and oriental tongues. He died at Munich on 26th April 1861. His principal works are *Geschichte des Kaiserthums Trapezunt* (1827), *Geschichte der Halbinsel Morea im Mittelalter* (2 vols. 1830–36), and *Fragmente aus dem Orient* (2 vols. 1845). His views on the Slavonic origin of the modern Greeks excited the liveliest controversy at the time of their publication (1835). His complete works, with a Life, were edited by Thomas (3 vols. Leip. 1861).

Fallopius, GABRIEL, Italian anatomist, born at or near Modena in 1523. He was professor of Anatomy in 1548 at Pisa, and in 1551 at Padua, where he died, 9th October 1562. He devoted special attention to the anatomy of bones, and wrote careful descriptions of the ethmoid and sphenoid bones, and of the internal ear. The canal which transmits the facial nerve after it leaves the nerve of hearing is still known as the aqueduct of Fallopius. In myology he corrected various errors into which Vesalius had fallen. He also studied the organs of generation in both sexes, and the Fallopian tube which connects each ovary with the uterus (see OVARIOTOMY, WOMB) is named after him. He was superintendent of the Botanical Garden at Padua, and had a reputation as a botanist. A complete edition of his works in four folio volumes was published in 1600.

Falloux, FRÉDERIC ALFRED PIERRE, COMTE DE, a French author and statesman, was born at Angers, 7th May 1811. He first drew attention to himself by two works penetrated by an ardent love of the old Bourbon order of things—*L'Histoire de Louis XVI.* (1840) and *L'Histoire de Saint Pie V.* (1844). In 1846 he was chosen deputy for the department Maine-et-Loire. In religion he advocated the ideas of Montalembert, in politics those of Berryer, and united with his Legitimist sentiments a love of liberty and

education strangely incongruous with the historic character of his party. After the revolution of February 1848 he exhibited much energy as a member of the Constituent Assembly, was one of those who organised the resistance to the insurrection of the 15th May, and, as reporter on the national workshops, pronounced for their immediate dissolution. He was also one of the most ardent promoters of the expedition to Rome. On the election of Louis Napoleon to the presidency, Falloux was appointed Minister of Public Instruction, an office which he held for only ten months. After the *coup d'état* he retired from public life to a country-seat near Angers, where he occupied himself with agricultural pursuits, and where he died, 6th January 1886. He was a member of the French Academy. His writings include *Souvenirs de Charité* (1857), *Meditations et Prières* (1863), and *Le Convention du 15 Septembre* (1864).

Fallow (from the same root as Ger. *fahl* or *falb*, expressing a pale dun, tawny colour). This word sometimes signifies waste, untilled land; but usually it is applied to land that is ploughed and otherwise cultivated for a season without being cropped. The most of the wheat raised by the Romans was sown after the land was fallowed; indeed, the usual rotation was fallow and wheat alternately. It was only fertile soils that could long support such an exhausting system; hence resulted the decreasing produce which the later Roman agricultural authors so often speak of and lament.

The fallowing of land was introduced into all the countries which fell under the dominion of the Romans. Britain during their sway soon exported large quantities of wheat, and for centuries after the Romans left no other mode of cultivating the land was followed. It may here be observed that, wherever the system of fallowing without giving manure to the crops is practised, it necessarily supposes that the soil is at least moderately fertile. This system is most successful on argillaceous soils, which are retentive of organic manure, and which cannot be cleaned by any other method. The destruction of weeds, such as couch-grass (*Triticum repens*) with its long jointed roots, is the first great object of fallowing. The exposure of the soil-substance to the weathering action of the air and the rest given to the land are minor objects. The loss from washing out of valuable soluble substances, more especially nitrogen, by rain, is a serious disadvantage of fallowing; and this, along with the possibility of the land becoming more and more foul with weeds during a wet summer, makes the benefits of the practice extremely doubtful, unless under exceptional circumstances.

It was long before fallowing was introduced to any extent in Scotland; but about the beginning of the 19th century it was largely practised. Owing, however, to the draining of the soil and the extension of the green-cropping system, it is now confined to the most retentive clay-soils, where it affords the only means of thoroughly cleaning the land. Sometimes as many as three or four ploughings are given in summer before the seed is sown in autumn. In old cultivated countries land is commonly so much reduced in its organic matter that fallows require to be dressed with farm-yard manure, rape-dust, or guano, to obtain satisfactory crops. Since the general introduction of green crops the term fallow has departed in some measure from its original meaning. These crops are sown on what was formerly the fallow-break, and are now often styled fallow-crops. The land, no doubt, receives in some measure a fallowing; it is freed from weeds, and allowed to rest from the growth of grain crops. Bastard-fallowing is a term which is used in Scotland when hay-stubble is ploughed up in the end of summer, freed from weeds, and sown with wheat in autumn.

Fallow Chat. See WHEATEAR.

Fallow-deer (*Dama vulgaris*), a native of the Mediterranean districts of Europe, Asia, and Africa, whence it has been introduced into other countries, such as Britain, where it leads a vigorous semi-domesticated life in many parks. It is a very graceful animal, standing about 3 feet high at the shoulders, coming in stature between the Roe-deer (q.v.) and the Stag (q.v.). The usual summer colour is reddish-brown with white spots, while in winter the spots are fewer and the general shade grayer. The tail is black above, white below. There are, however, numerous colour varieties—e.g. white forms. The antlers, which are confined to the bucks, or males, are cylindrical at the base, give off two tines at some distance apart, and then form a shovel-like or palmate expansion. The

Fallow Deer (*Dama vulgaris*).

young male of the first year has no antlers, and the increasing annual development is marked for six years. Fawn, pricket, sorrel, soare, buck of the first lead, and buck complete are the names used to distinguish the various grades. The eyes and ears are large, and under the former there lie conspicuous sub-orbital cavities, which are wholly glandular, and not 'breathing places,' as Gilbert White and others have supposed. The breeding season is in October, and the doe bears in June. There is generally a single fawn, though occasionally two. The fallow-deer seem naturally timid and gentle, and become readily accustomed to man. The flesh is much esteemed.

As to the introduction of this southern species into north Europe, certain information is wanting. It seems to have been unknown in Germany till the 16th century. James VI. of Scotland introduced a hardy variety from Norway, when he brought home his queen, Anne of Denmark. Sir V. Brooke describes a second species (*D. mesopotamica*) from Persia. The extinct Irish Elk is believed to have been allied to the imported species. See DEER.

Fall River, a busy manufacturing city and port of entry of Bristol county, Massachusetts, at the mouth of the Taunton River, 49 miles S. of Boston by rail. The town is well built, the handsome city hall and many other buildings being constructed of a fine granite quarried in the vicinity. It has a capacious and deep harbour, and is connected with New York daily by a line of large steam-packets. Fall River is noted for its cotton-mills, of which it contains nearly fifty, with about 1,500,000 spindles. Other manufactures are nails and machinery, abundant water-power being supplied by a tributary of the Taunton, which falls 130 feet in its last half-mile. Pop. (1870) 26,766; (1880) 49,006; (1890) 74,398.

Falmouth, a parliamentary and municipal borough and seaport of Cornwall, on the southern side of the estuary of the Fal, 18 miles NNE. of the Lizard, and 66 by rail WSW. of Plymouth. It chiefly consists of a narrow street, a mile long, with suburban terraces and villas on the heights behind; and it has a branch-railway (1863), a polytechnic society (1833), and a town-hall (1866). The harbour, one of the best in England, is 5 miles long by 1 to 2 miles wide, and 12 to 18 fathoms deep. The entrance is defended on the west by Pendennis Castle (*c.* 1538–44), which crowns a rock 198 feet high, and which in 1646 surrendered to Fairfax after a five months' siege; on the east, by St Mawes Castle (1543). Pop. of the municipal borough (1851) 4953; (1891) 4273; of the parliamentary borough, which includes Penryn, and which since 1885 has returned only one member, 18,000. From 1688 to 1850 Falmouth was one of the principal packet-stations for foreign mails. There is a considerable pilchard-fishery off the neighbouring coasts. The chief exports are tin, copper, pilchards, and fuel. Here orange and lemon trees yield plenty of fruit on open garden-walls. Falmouth has arisen since 1613, Sir Walter Raleigh having drawn notice to its capabilities. Charles II. incorporated it in 1661; and at one time it was a stronghold of Quakerism. See *The River Fal and Falmouth*, by C. J. (Truro, 1876), and Caroline Fox's *Memoirs of Old Friends* (1882).

False Bay. See CAPE COLONY.

False Pretences. See FRAUD. For False Money, see COINING; for False Swearing, see PERJURY; and for False Weights, see WEIGHTS.

False Point, a cape and harbour of Bengal, 43 miles E. of Cuttack by canal. The harbour, which has a lighthouse, is safe and roomy, and is considered the best between Calcutta and Bombay; it is the entrepôt for the trade of Orissa, and a regular port of call for the British Indian Company's steamers.

Falsetto, a term in singing for the highest register of a man's voice, which joins the natural or chest voice, and which, by practice, may be so blended with the chest-voice as to make no perceivable break. See VOICE.

Falstaff. See OLDCASTLE, and FASTOLF.

Falster, a Danish island in the Baltic, south of Zealand, which measures 26 miles by 16 at its widest part, and has an area of 183 sq. m. It is flat, remarkably fruitful, and well cultivated. Its inhabitants employ themselves chiefly in agriculture and cattle-breeding. Pop. in 1890 25,006.

Falun, or FAHLUN (called also *Gamla Kopparberget*—i.e. 'the old copper-mine'), a town of Sweden, 57 miles W. of Gefle by rail. It has for more than six centuries been famous for its copper-mines, though the quantity of ore now obtained is much smaller than formerly. In 1650 the yield was 3150 tons annually; this, however, declined in 1690 to 1900 tons; at present it is only about 400 tons. The excavations extend for miles underground. Destroyed by fire in 1761, Falun was rebuilt on a regular plan; but its wooden houses have a sombre appearance, being blackened by the fumes of the numerous smelting-furnaces. Pop. 7507.

Faluns, a term given by the agriculturists of Touraine to shelly sand and marl, which they use as manure, and applied by geologists to the deposits from which they are obtained.

Fama (Gr. *Phēmē*), the goddess of rumour, a personification which appears in the works of the earliest poets. Sophocles makes her the child of Hope; Virgil, the youngest daughter of Terra, and sister of Enceladus and Cœus.

Fama Clamosa, in the ecclesiastical law of Scotland, is a widespread and prevailing report imputing immoral conduct to a minister, probationer, or elder of the church. When such report exists, a presbytery may commence process against a minister without the instance of any particular accuser, but as acting for the vindication of their own order, and in behalf of the morals of the community. If satisfied that the *fama* is not groundless, the presbytery serves the offender with a libel when no private party comes forward to execute it.

Famagosta, or FAMAGUSTA, a seaport on the east coast of Cyprus, on the supposed site of ancient Arsinoë. It was a place of importance during the Crusades; and under the Venetians from 1487 to 1571 it became a rich and flourishing seaport, with 30,000 inhabitants. On falling into the hands of the Turks after a long siege (1571), it began to decay; an earthquake in 1735 completed its ruin. The church of St Nicholas, now used as a mosque, contains many monuments of its former use, and is a fine specimen of medieval architecture; in it Richard I. of England crowned Guy de Lusignan king of Cyprus in 1191. Famagosta, which now has only about 660 inhabitants, possesses a natural harbour, 1½ mile long by ½ mile wide, but it is now almost sanded up. The chief exports are corn and its famous pomegranates.

Familiar (Lat., 'servant'), a supernatural being in attendance upon a magician, wizard, or other professor of the black art. The belief in spirits as especial patrons or guardians of individuals is very ancient, and is still widely spread among more than savage races. The guardian angel is indeed an integral part of his faith to many a Christian, as much as the *torngak* to the Eskimo, or the *genius natalis* to the ancient Roman. The genial and sportive guardian spirit of the household is also a venerable belief, and we find in Leviticus (xix. 31) a warning against familiar demons who give occult knowledge. During the middle ages the belief in 'enchanted rings' containing familiar spirits was widely diffused throughout Europe, the magicians of Salamanca and Toledo being especially famous for their skill in thus subjugating and imprisoning demons. The notion of familiar spirits is one perfectly natural to the Persians and Hindus, and Aladdin's 'slave of the lamp' is an example in point. A favourite form assumed by the familiar spirit in western Europe was that of a black dog. Such was the case with the famous Cornelius Agrippa, who was always accompanied by a devil in the shape of a black dog. When he saw that his death was at hand, according to Paulus Jovius, he took from the dog's neck a collar inscribed with magic symbols, and let him go with the words: *Abi, perdita Bestia quæ me totum perdidisti.* Butler, in his *Hudibras*, gives the dog the respectable office of tutor to the sage, and Wierus, the pupil of Agrippa, assures us that the animal was no cacodæmon but a natural pet. At least there is no doubt about the black dog in Goethe's *Faust* and his association with Mephistopheles, and there is good tradition that Simon Magus also had a familiar in the same form. See DEMONOLOGY, WITCHCRAFT.

Familistère, from the French *famille*, a name applied to an industrial village in the town of Guise. See GUISE.

Family, from Latin *familia*, which meant, primarily, the holding in slaves, and secondarily, the whole domestic property, of a paterfamilias; but which, as commonly used, denoted the body of people within a gens (a number of such bodies making up the gens) who traced their descent through males to a common ancestor. The family, in civilised countries, is the little group consisting

of a man (its recognised head), his wife, and their children, which forms the inmost circle of relationship; and is connected more or less with other similar groups by relationship—relationship being reckoned by degrees, and counted through both father and mother, and determining rights of inheritance *ab intestato* and the law of incest. It was the universally received opinion until lately that this group existed substantially in the form known to us, with the father (sometimes with more than one wife) at its head, from the beginning of society; and that it was the germ from which all societies had been developed. It was thought there could be nothing more according to nature, and that there could have been nothing more primitive. Given such a family (so the reasoning went on), as the children and their descendants married, a number of similar groups would be formed round it, separate from one another, but all subject to their patriarch, in whose family they would be as long as he lived. They would probably separate from each other at his death, and expand and multiply each by itself; but by-and-by the family groups thus arising would find it convenient to go on living together, and thereafter they would become a set of separate tribes, many of which would be neighbours, and which might form in time the population of a district. Then the remembrance of their origin remaining, it would be easy for them to act together for common purposes; and this point arrived at, the descendants of one man would be well in train for constituting a people or nation. The history of Israel was thought to favour this account of the growth of tribes and states out of the family (known as the Patriarchal Theory); for it made each of the twelve tribes consist of descendants of a son or grandson of the patriarch Jacob, while the union of the tribes constituted the nation. In Genesis, too, the population of the world is represented as composed of tribes and nations descended from Noah's three sons, Shem, Ham, and Japhet. A modified form of this theory, put forward by Sir H. S. Maine, in his work on *Ancient Law* (1861), is still perhaps (at anyrate, wherever English is spoken) the most popular account of the origin of societies.

Maine assumed that the family of ancient Rome gives the true suggestion of what the primitive family was; and this he accordingly described as having consisted of a paterfamilias, who had *patria potestas*—i.e. unlimited power over his household, with his wife, his children, persons adopted by him, and slaves. The primitive relationship was in his view merely the bond made by common subjection to the paterfamilias; and as he assumed that women when they married would become subject to a new paterfamilias—that there would be no marriages between persons of the same family—he deduced that a woman's descendants would be out of the relationship of the family of her birth at first, and that thus relationship would afterwards come (he did not show how) to be traced through males only—the relationship called at Rome agnation—and that the clans, tribes, and societies into which the family gradually developed would everywhere be agnatic. But it is certain that early societies have not been all agnatic; and, indeed, the Roman type of family, with *patria potestas* and agnation, seems not to occur in any system of old law except the Roman. Maine's primitive family, too, is too complex to belong to the beginning of society; and, the social tendency of men considered, his primitive father who acknowledged obligations to nobody is hardly to be reconciled with human nature. His theory thus appears to be liable to objections special to itself. There are others which apply to the patriarchal theory in both forms; and two of these should be mentioned.

First, there are numerous societies (not indeed of the most important) and various forms of the family of which the patriarchal theory does not even attempt to give any account. And next, in the societies upon contemplation of which it was founded, a most serious difficulty for it is presented by the tribes, which consist of several clans, each clan considered separate in blood from all the others. The patriarchal theory of course involves that the clans in a tribe are all of the same blood. Maine suggested that the clans in those cases united by the help of some fiction analogous to adoption; but the suggestion is too vague to be useful.

One form of the family which the above-described theories neglected, but which has prevailed very largely, is especially interesting because of the disclosure of it which is given us in the Book of Genesis. In *beenah* marriage (the name is taken from Ceylon) the man goes to live with his wife's family, usually paying for his footing in it by service; he is in general an unimportant person in the family; and the children are not his—they belong to the family and kindred of his wife. He is lost to his family and kindred so long as he remains a beenah husband; he may even have (as in New Zealand) to fight against his own relations. Beenah marriage, as we know it, is commonly practised concurrently with marriage by purchase, in which the husband takes away the wife and becomes entitled to her issue; but a few tribes are known which make no other marriages. Now Jacob made a beenah marriage into the family of Laban; and Genesis, xxiv. 1–8, shows that there was much more than a possibility that Isaac, as a condition of marrying into his father's kindred, might have had to do the same. It need scarcely be pointed out that Samson's marriage with a Canaanite woman was a marriage of this type. Moreover, the first reference to marriage in the Scriptures (Genesis, ii. 24) is scarcely intelligible except as a reference to beenah marriage; it cannot possibly refer to a marriage of the Roman type, and scarcely to any marriage under which the bride would go to live with her husband's kinsfolk. In Jacob's case, Laban claimed the children. Jacob, his wives concurring, had stolen away with them—and it is clear that they were not his. Isaac had married into the same family, and his children were his, because he had been allowed to purchase the mother; but Jacob had not purchased—he had merely won for himself a place in Laban's family as the husband of Laban's daughters, and to that family both he (while he chose to remain in it) and his children thus belonged. The marriage of Isaac shows that beenah marriage was not exclusively practised by the kindred of Laban—that, when they saw fit, they gave their daughters to be taken away. But, in connection with this, it is to be noticed that the bridal gifts (bride's price) for Rebekah were given not to her father, but to her mother and brother. Here the father was not the head of the family, but a secondary person in it; the mother was the head, and the daughter belonged to her and her kin.

Such might the family be among early Semites. And, of necessity, the kinship was not agnatic. There was admitted relationship between Laban and Jacob, his sister's son; and, from Judges, ix. 1–4, and many other passages, it is to be gathered that anciently a man's relatives on the mother's side considered him 'their bone and their flesh'—i.e. of their clan, or, at anyrate, of their near kindred. Among the Semites of Arabia, beenah marriage was maintained for women of condition down to a comparatively late period; and at all times it was common for men who had been received into protection by a tribe to get a wife from it and to become incorporated with it through marriage.

Marriage by purchase ultimately supplanted the beenah marriage among the Hebrews, and became the prevailing marriage among the Arabs (and no doubt the same has happened in many cases). We proceed to describe the incidents which are found with it everywhere, while it is still in a direct or crude way a means of constituting family relations.

We find at this stage that the man often gets with his wife any children she has had already, and thus he gets children born of her while he has been her beenah husband; he gets, *a fortiori*, the child of which his wife is pregnant at the time of the marriage; he gets all children born to her thereafter whether they are his own or not (about which he is often found to be indifferent); and, in cases far from rare, he may even have children of the woman born after his death accounted his, and entitled to be his heirs, by means of what is called the *Levirate*. He may actually be the father of his wife's children, or of most of them; but very commonly he is ready to give her in loan, sometimes out of hospitality, sometimes for a price (in which latter case, the child, if any, may go to the borrower); he calls in the services of a friend who gives promise of being able to beget goodly offspring; and a child by his brother may appear to him to be in precisely the same case as a child by himself—in which we find an explanation of the Levirate. The foundation of the paternal relation in such a family is, in short, purchase, not paternity; the man has bought the woman and her issue, and (whether there be much paternal feeling or little) her children are counted his, as the increase of his cattle is. Purchase is here a means for taking children out of one kindred into another. Men desire children for the strengthening of their kindred, and no doubt because they have felt stirrings of paternal feeling. But paternity has not learned to be exacting, and it is of no avail to give any right to children. The purchase marriage of the early Arabs illustrates every point that has been mentioned, and so also does the family of the early Hindus.

The family founded upon purchase in this crude way is plainly a transitional form, and its future course is certainly upward. It takes a more familiar look, as paternal feeling strengthens, and the relationship of its members puts the contractual source of that relationship into the shade. And by-and-by purchase itself disappears or remains only in a symbol. In what may be taken to be an early stage, we very frequently find that at a man's death his brother succeeds him, inheriting his wife and children with his other property. Ultimately the sons succeed. And then we often find that (as in the Hindu family) the idea of family property is firmly established; so that the father, though having sole control, is regarded as only joint-owner with his sons of the family possessions—a state of things which must have originated in some form of joint-family, in which the father had been co-owner with his brothers or other kinsmen.

Now, to go back, with what does beenah marriage appear to be connected? We have seen its relation to marriage by purchase.

With beenah marriage, children belong to the family and kindred of their mother, and we find the same thing, and a reason for it, in the rudest family system which is known to us. This is what has been called the Nair family, because of the striking example of it found among the Nairs of Malabar. Among the Nairs bodies of the nearest relations form a joint-family, and hold their land in common, the control of the joint-interests being in the oldest male; but the family proper among them consists, when at the fullest, of a woman with her mother and brothers, and of her children. The uncles are the protectors of the children, who are their heirs; brother first succeeding to brother, and then the sister's children succeeding. The woman has no husband living with her; there is no father in this family; the woman has a number of husbands who visit her in turn; and, as a result of this polyandry and of the composition of the family, no Nair knows or thinks of his own father, and it is the uncles who fulfil the father's part. The children are of the kin of the mother only, because there is uncertainty of fatherhood, and no man in the father's place. And we may safely take it that in nothing less than this, or something fully equivalent, can the ignoring of the father and tracing of kinship through the mother only have anywhere originated.

A number of rude tribes are known which seem to have only the Nair family; but the Nair polyandry is more commonly found alongside of a system of polyandry which yields a family of a more advanced sort, in which the wife goes to live with her husbands, and the husbands are brothers (which, in the Nair system, they need not be, and generally are not). The eldest brother takes the wife and is head of the family, all the children being accounted his. This has been called Tibetan polyandry, because of its prevalence in Tibet; and it has been shown upon direct evidence to have prevailed very widely, both in ancient times and in modern. The Arabian polyandry described by Strabo is of this kind; so also and more distinctly the Hindu polyandry disclosed in the Mahâbhârata; the polyandry of the Britons, described by Cæsar, is closely akin to it, but somewhat different. In families of the Tibetan type, the brother-husbands have got the woman into their mastery (be it by capture or by exchange or purchase); the children may be seen, as with monandry, to be of the blood of their kindred; and they might have been peacefully added to that kindred wherever exchange or purchase had been thought of. Only a sufficiency of women and of the means of living would then be wanting to change (let us say, among the Arabs) the Tibetan family into the monandrous purchase family already described. And the Nair would similarly be changed into the beenah family. It is male kinship that is now found with Tibetan polyandry, the brothers in order succeeding to the headship of the family, and then the eldest son of the brotherhood.

And where this succession law appears in the monandrous purchase family, brothers first succeeding, and the sons only after them, we may reasonably infer that there has been a movement from the Tibetan to the monandrous family. The same conclusion may also be drawn wherever, with succession of son to father established (a more advanced stage), it is held that a man may beget a son for his brother either in his lifetime or after his death (the latter case being the Levirate—familiar as occurring among the Hindus and the Hebrews); that provided a man's wife is mother, it suffices that his brother should be father, as it would have done in the Tibetan family. A prevalence of the Nair family, again, at some earlier period may be inferred, as we have seen, from our finding kinship counted through females only, although the family where this occurs may not be Nair.

We find this kinship with monandry, usually with the man head of the house—another form of the family, husband and children not being counted relatives—very widely, and among peoples in very different stages of advancement. Thus, it is very common in tribes like those of Australia and America, and it is established also among peoples comparatively so far advanced as the Ashantis. In the greater number of Australian tribes, though polygamy is practised largely, and a wife is little better than a slave, and is valued chiefly for her services (licentious practices which tend to make

fatherhood uncertain being, however, exceedingly prevalent), children belong to the kindred of their mother, and, as the father is not allowed to marry women of his own kindred, not to that of their father; so that the children may be of as many kindreds as the man has wives, but are never of his own kindred. Among the Ashantis, amid distinctions of rank, with wealth accumulated and with women jealously watched over, we find children similarly counted of the kin not of their father, but of their mother, the sister's son being a man's heir in preference to his son; while among the Fantis, a neighbour people of the same race, failing a sister's son, the chief slave is heir, the son being excluded from succession in his father's family altogether. The family religions seem to have in this and similar cases preserved a kinship which is not now consistent with the domestic relations.

The same kinship has of course prevailed wherever the wife has been the head of the family, of which many examples, more or less trustworthy, have been collected. In some of these daughters only have been heirs (Lycia, Egypt), sons going into other families with or without a dowry. A former prevalence of this kinship (and therefore of the Nair family) may, moreover, be inferred from such facts as permission of marriage between persons closely related through the father (but not relations under female kinship)—e.g. brother and sister german, who might marry in a certain case in Attica (for which we also have in Athenæus a clear tradition of the Nair family—of a time when no man knew who was his father), and more generally, it would seem, among the Hebrews (Abraham and Sarah, Amnon and Tamar); as the feeling for the sister's son which Tacitus noted among the Germans—which was precisely that of the rudest female kinship tribes; and, *a fortiori*, from the succession of the sister's son, if only to the sovereignty, as among the Celts of Scotland, or of the mother's brother, as in the story of Meleager. By inference the evidence for the Nair family may thus be greatly enlarged, as we have seen that the evidence for the Tibetan family may also be.

Taken altogether, the evidence suggests strongly that these two systems occurred commonly together among a people, as beenah marriage and purchase marriage do—each having left its mark upon the same people's customs. The evidence shows also, if good for anything, that the Nair kinship was *supplanted* (traces of it long remaining) by the kinship which the purchase family brought in or established.

So much polyandry among early men would of course indicate that very generally their circumstances were like those of most polyandrous peoples now, in that the struggle for existence was severe, and they had learned to keep down the number of their women by infanticide to the lowest possible point. And geologists have shown us that their circumstances were generally far harder than those of any peoples now known to us. As men have had to reason out for themselves systems of kinship, it is now intelligible that at first and for long they should not get beyond the kinships which are most obvious, those which arise through the mother, and which sufficed to connect the children with her tribe (polyandry of the Tibetan type being indeed impossible until this kinship has made a good deal of progress); and that thus the early bands of men at first acknowledged only the Nair kinship.

The theory of the growth of societies which the various forms of the family taken together seem to point to can now be indicated, but here it can only be outlined very briefly.

Among tribes of the ruder sort, whether having female or male kinship, the true family (and so travellers constantly name it) consists of all those who are considered relatives—of all who are of the same Totem (q.v.)—all of them being prohibited from marrying each other (exogamy); being bound together by the regard they have for the totem; and also all liable equally to be struck at for each other's offences, and all bound equally to revenge each other's injuries (the blood-feud). The totem is usually an animal or plant after which they are named, and from which they believe themselves to be descended. The tribe among such peoples is not a body of kindred; it is made up of people of several different totems; and the same totems are usually spread over many neighbouring tribes—all those who are of the same totem in all the tribes constituting the totem family. Now exogamy and *female* kinship account for this interfusion of the totem families throughout the tribes. It is exactly what would arise if a number of neighbouring totem families, having the female or Nair kinship, became exogamous—i.e. ceased to take to wife their own women and took the women of their neighbours. And, as the whole system depends upon the totem, we must take it that the totem families existed separately before exogamy interfused them. This gives us, for a beginning, a totem group or family having Nair kinship and not exogamous; and, next, when exogamy (in whatever way) became established, an admixture of neighbouring totems in each of the groups; which admixture, if male kinship supervened, would necessarily remain—except in so far as the scattered portions of the totem families joined together and drew apart and became each family a separate clan. With male kinship (i.e. children of the totem or kindred of their father) exogamy would bring no totem from the outside into a group; and, therefore, we are forced to believe that wherever a tribe consists of several exogamous male kinship clans or families, these must at first have had the Nair kinship. Exogamy has been the prevailing marriage law among all races; female kinship, too, is known upon direct evidence to have prevailed widely: and, accordingly, this gives a good explanation of the constitution of all the tribes which have consisted of several clans, that difficulty for the patriarchal theory for which Maine proposed the hypothesis of a fiction.

As to the family proper, we have, on this view, to believe that (though the partnership of brothers in women may have commenced in the totem group while still separate, when women would probably be got by capture), the kinship was Nair, or predominantly Nair, until the interfusion of the totems had taken place. After that, peaceful marriages could be made within the tribe between persons of different totems; they might be either of the Nair type or the Tibetan—these giving way, as circumstances improved, to beenah marriage and the more familiar form of monandry; and by-and-by, when men came to desire it, marriage agreements (made upon the consideration of exchange or purchase) would allow of children being added to the totem of their father. This brings us to the competition of the Nair or beenah family and the purchase family, which naturally ended in the triumph of the latter, followed by a progress therefrom to the family in its more familiar forms. But a kinship established in the totem family could not be easily supplanted; so that female kinship might have a long career under favourable circumstances. Licentious practices which make fatherhood uncertain, and servility to custom, seem to have maintained it among the lower tribes; while the force of religion—the totem (animal or plant or other natural object) having become a god, and its worship regulating in many ways the lives of its devotees—accounts for its having lasted among the higher African peoples.

Interfusion of 'families' (i.e. 'kindreds'), such as is produced by exogamy and female kinship, is nowhere more strikingly illustrated than among the Ashantis and their neighbour peoples.

For facts and reasonings bearing upon the subject of this article, see Sir H. S. Maine's works, especially *Ancient Law*, and *Early Law and Custom*; J. D. Mayne's *Hindu Law and Usage*; Bachofen's *Das Mutterrecht*, and in connection therewith, Giraud-Teulon's *La Mère chez certains Peuples de l'Antiquité*; *Studies in Ancient History*, and the *Patriarchal Theory*, by J. F. M'Lennan; also, 'The Worship of Animals and Plants,' *Fortnightly Review* (1869–70); *Kinship and Marriage in Early Arabia*, by W. Robertson Smith; Herbert Spencer's *Principles of Sociology*, vol. i.; Sir J. Lubbock's *Origin of Civilisation*; and Lewis H. Morgan's *Ancient Society*.

Family, in zoological classification, means an alliance of nearly related genera. Individual, species, genus, family, order, class, and phylum are the common categories of classification in ascending order, with intermediate ranks, such as sub-genus, sub-order, sub-family, section, and sub-phylum. Thus, the dolphin family—Delphinidæ—includes the genera Delphinus or Dolphin, Monodon or Narwhal, Delphinapterus or Beluga, Phocæna or Porpoise, Orca or Grampus, &c., and is itself included in the order Cetacea, in the class Mammalia, in the phylum Vertebrata. See GENUS, SPECIES, TAXONOMY, ZOOLOGY.

Family Compact, the name given to certain political leagues entered into by the Bourbon kings of Europe. Of these, two deserve mention. The first, an agreement concluded between the kings of France and Spain in 1733, was aimed on the one hand against the ascendency of Austria in Italy and on the other against the mercantile supremacy of Britain on the sea. Out of this arose a war between Britain and Spain in 1739. The second compact, signed in 1761, had for its object the union, in a close offensive and defensive alliance, of the Bourbon sovereigns of France, Spain, and the two Italian kingdoms Naples and Sicily, and Parma and Piacenza; and next year Britain declared war.

Family of Love, or FAMILISTS, or DAVIDISTS, a sect which appeared in Holland in the middle of the 16th century. It was founded by David Joris or George (1501–56), an Anabaptist of Delft, who left the Anabaptists about 1538, and founded the new communion, while apparently conforming to the Reformed Church (see ANABAPTISTS). In the reign of Edward VI., according to Fuller, Henry Nicholas, a disciple of Joris, came over to England, and commenced the perversion of silly people in a secret way. By 1572 they had apparently increased in numbers considerably, for in that year one John Rogers published a work against the *Horrible Secte of Grosse and Wicked Heretiques naming themselves the Family of Love*. In 1580 Queen Elizabeth issued a proclamation for the hunting out and punishing of this 'damnable sect.' The Family of Love, 'or Lust rather,' as old Fuller has it, tried in vain to insinuate themselves into the good graces of King James, and the society gradually disappeared in the 17th century. They disregarded dogma and church ceremonies, and insisted that religion consisted simply in love, which makes us one with God—a doctrine that led to extreme Antinomianism (q.v.).

Famines, or times during which there is a scarcity, more or less severe, more or less local, of food-supplies, are due to a variety of causes. They have been perhaps oftenest caused by drought or deficiency of rainfall, especially in tropical regions; by excess of rainfall, giving origin to floods and inundations, more particularly in northern climes; by excessive frosts and other irregular incidences of climatic conditions; by the ravages of insects (flies, locusts, ants, grasshoppers, &c.) and vermin (rats, mice, &c.); by the devastations of war; and by the wholesale destruction of forests, especially on hillsides, giving rise to drought—a cause which has operated more particularly in northern China. Apart from these causes, the occurrence of famine in a particular locality depends upon the ratio between the population and the food-supply for the time being of that district, or, more correctly, between the amount and extent of the failure in the supplies and the density of the local population. Amongst the factors which exert an injurious effect upon the food-supply must be mentioned not only backward and inadequate methods of agriculture, but sometimes also the system of agriculture in vogue; deficient means of communication and transport; misappropriation of the soil—i.e. using it for growing crops which add nothing to the food-supply when the land that is devoted to the production of the necessaries of life is inadequate for the normal wants of the population; legislative interference, either preventing the free exploitation and development of the complete resources of the soil, or throwing obstacles in the way of the natural distribution of food-supplies; the ill-regulated distribution of food-supplies apart from governmental interference; sudden immigrations of large bodies of people into districts of confined area; the social customs and agricultural habits of a people making them principally dependent upon one kind of food, as the Irish upon the potato; the religious belief of a people restricting them to certain prescribed kinds of food; lack of foresight and energy in the administrative authorities, provincial, national, or general, as the case may be, together with the limited extent and inaccessibility of the resources they have at their command; insufficient resources and powers of organisation of private merchants; undue facilities for commercial speculation in grain and other necessaries of subsistence; and the misapplication of grain, &c.—i.e. the using of it in undue quantity for brewing or distilling, and the like. Attempts have also been made to trace some law of relation between the occurrence of famines, more particularly in India, and the sun-spot cycle, the links of connection being the meteorological effects that are supposed to manifest themselves on our planet in dependence upon the cyclical phases of the waxing and waning of the sun's spots.

Famines cannot be wholly prevented. The powerful climatic causes to which they are principally due cannot be controlled by human agency, except to an extremely small degree, chiefly by the maintenance of river-banks and sea-banks, and by the regulation of the forests. The local conditions are in every case so diverse, and often so complicated, that it is fruitless to attempt to give more than a few general rules. In cases where the country is dependent upon irrigation for its fertility, it should be the first care of the inhabitants, or, failing them, of the government, to make provision for the storing of water, to regulate its distribution, and to utilise it in the most economical ways. But the most efficient methods of rendering governmental assistance are to improve the means of transport, to encourage more scientific systems of agriculture, to give warning to districts that are likely to be affected of the threatened approach of a period of scarcity, and then to leave the rest to the enterprise of private merchants. There should be no legislative restrictions on the free transmission of food-supplies from centres of abundance to districts which are suffering from famine. The systems of agriculture best calculated to prevent the occurrence of famines and counteract their devastating effects are perhaps those in which the

quantity of land in each farm is large enough to allow of a sufficient variety of crops being produced year by year, so that the cultivator need not necessarily be dependent upon the success of one single crop for his sustenance, or even his livelihood.

The appended list includes a few of the more important famines of the world, either from their historical significance or from the great destruction of life that attended them. A much more detailed list, together with a couple of excellent papers on the subject, by C. Walford, will be found in the *Journal of the Statistical Society* (1878–79).

879 A.D.	Universal famine.	1631.	India, Asia generally.
1005.	England.	1711.	Carniola; lasted several years.
1016.	Famine throughout Europe.	1769–70.	India; three million people perished.
1022.	In many parts of the world.	1781–83.	In Carnatic and Madras.
1051.	Mexico.	1782–84.	In North-west Provinces, India.
1052–60.	In Ghor, India.	1790–91.	India.
1064–72.	Seven years' famine in Egypt.	1822.	Ireland.
1069.	In north of England.	1846–47.	Ireland; potato famine.
1162.	Universal famine.	1866.	Bengal; one million and a half died.
1314.	Silesia, Poland, and Lithuania.	1877.	India.
1344–45.	India, especially in the Deccan.	1877–78.	North China; nine millions reported to have died.
1347.	Italy.	1888–89.	North China.
1491.	Ireland.		
1586–89.	Ireland.		
1600.	Russia.		

It was after a famine of 1586 that the poor-law in England had its beginning. That of 1781–83 in India led to the institution for the relief of the native poor called *Monegar Choultry*. See also Reports of *Indian Famine Commission*, and Digby, *Famine Campaign in Southern India* (Lond. 1878).

Fan, an implement for creating a current of air, generally with the view of cooling the person. The term comes from the Latin *vannus*, the broad, shallow basket into which corn and chaff from thrashing were received to be tossed in the air so that the wind might carry away the chaff. The ordinary fan may consist of any light, flat, expanded surface set in rapid reciprocating motion by the hand; but for many mechanical operations, such as sifting, winnowing, ventilating, and extracting gases, rotating fan-blades are mounted, under such names as Fans, Fanners (q.v.), or Fan-blasts, by which strong and continuous air-currents are raised. The Punkah (q.v.) employed in India for circulating air in apartments is simply an enormous fan.

The common hand-fan, used as a personal accessory, is an implement of great antiquity, which naturally was prized most in regions where the heat was greatest. It is known to have been in use among the ancient Assyrians and Egyptians, and from its frequent representation on early Greek vases it must have been a familiar implement among that people. These ancient fans were sometimes made of very large size, and carried on long shafts or poles by female slaves (*flabelliferæ*), eunuchs, or boys, whose duty was to keep the air in circulation, and to drive away flies from the table or the person. The *flabellum*, or fan to brush away flies from the sacred vessels, was used in the Western Church from the 4th till the 14th century; and gorgeous *flabella* of peacocks' feathers are still borne by the pope's attendants in solemn processions. Similar fans, used to keep flies from settling on the embroidered case of the *torak*, may be seen in Holman Hunt's picture of 'The Finding of Christ in the Temple;' and Mr Butler's *Ancient Coptic Church* contains several pages on the use of the fan in that communion. Among eastern nations generally the fan was an implement of great importance, and large fans—like sunshades, to which they are closely allied—possessed special significance as symbols of authority and emblems of royalty. In Japan, where to this day the fan is an indispensable adjunct of the daily life of all classes, large rich fans are used in ceremonial dances, in which they are accessories of peculiar significance.

Fans are of two kinds, the folding and the non-folding. To the latter class belong all state and ceremonial fans, while those carried about by ladies belong to the folding class. Beyond those distinctions, however, it is impossible to define the material, form, or structure of fans, these, especially in the case of non-folding fans, being endlessly diverse. The folding fan consists of two principal portions, the mount or leaf (Fr. *feuille*) and the stick (*bois*). The leaf, which forms a segment of a circle, consists of two equal pieces of paper, fine parchment, satin, crape, tulle, or cotton, folded into from twelve to twenty-four equal folds. The stick consists of a number of 'brins' equal to the folds in the leaf, with two stout outer guards (*panaches*) These may consist of wood, ivory, mother-of-pearl, or metal, richly carved, inlaid, or otherwise worked in the case of fine fans, the leaf of which may be elaborately painted. The upper part of the brins is continued by thin, flat strips of wood between the folds of the leaf. The brins with the outer guards are collected and held together at the head or end (*tête*) by a pin passing through them, which forms the pivot on which the fan opens or closes. The folding fan is said to have been a Japanese invention which originated in the 7th century, the idea having been supplied by the wing of the bat. From Japan the invention passed into China; but it was not till about the beginning of the 16th century that such fans began to be used in Europe. They first found their homes in Italy and Spain, but early in the 16th century they came into use in France, and their manufacture was established in Paris, where since that time they have formed the most prominent of the small industries known as *articles de Paris*. In 1673 the *maîtres éventaillistes* were formed into a corporation by Louis XIV. French fans of the 18th century became real works of art, on which frequently the ability and taste of the most skilful goldsmiths, jewellers, metal-workers, and carvers were combined with the decorative painting of artists of the foremost position. Fans painted by the 18th-century artists Watteau, Lancret, Pater, Boucher, &c. command very high prices; and such eminent artists of the 19th century as Diaz, Lami, Glaize, Isabey, Jacquemart, &c. have devoted their talents to fan-painting. See O. Uzanne, *The Fan* (Eng. trans. 1883), and *English Fans and Fan Leaves*, by Lady Charlotte Schreiber (1889).

Fanariots, the name given to the Greeks inhabiting the Fanar or Fanal quarter of Constantinople. They appear to have been originally descendants of such noble Byzantine families as escaped the fury of the Turks, and their numbers were afterwards recruited by emigrants from different parts of the old Byzantine empire. They have figured in Turkish history principally as diplomatists, administrators, and bankers. From 1669 onwards the dragomans of the Porte were usually chosen from amongst them. From them too were chosen, until the outbreak of the revolution in 1822, the hospodars of Wallachia and Moldavia, while, in addition, the disposal of most of the civil and military posts under the Turkish government was in their hands. In the Greek struggle for freedom (1821–26) the Fanariots displayed no great zeal or activity, but nevertheless were severely punished by the Turks.

Fandango, like the *Bolero*, is an old Spanish national dance, in $\frac{3}{4}$ time. It is danced most gracefully in the south country, usually to the accompaniment of a guitar, while the dancers beat time with castanets. It proceeds gradually from a slow

and uniform to the liveliest motion; and, notwithstanding the simplicity of the *pas*, expresses vividly all the gradations of the passion of love. See DANCING.

Faneuil, PETER, a merchant in Boston, U.S., was born of a Huguenot family at New Rochelle, N.Y., in 1700, and died in 1743. His name is remembered from his having built the Faneuil Hall in Boston at his own cost (1742), and presented it to the town. Originally the building contained a hall for public meetings, with lesser apartments above, and a basement used as a market. In 1761 it was destroyed by fire, and rebuilt. During the revolutionary struggle with England the hall was so often used for important political meetings that it became known as 'the cradle of American liberty.' In 1805 the building was increased in height by an additional story, and also increased in width.

Fanners, a machine employed to winnow grain, driven by hand or by machinery. In passing through the machine the grain is rapidly agitated in a sieve, and as it falls through a strong current of wind, created by a rotatory fan, the chaff is blown out at one end, whilst the cleansed particles fall out at an orifice beneath. The fanners superseded the old and slow process of winnowing, which consisted in throwing up the grain by means of sieves or shovels, while a current of wind, blowing across the thrashing-floor, carried away the chaff. A machine for the winnowing of corn seems for the first time to have been made in Britain by Andrew Rodger, a farmer on the estate of Cavers in Roxburghshire, in the year 1737. Strangely enough, there was a strong opposition to the use of this helpful instrument, the objectors seeing in it an impious evasion of the Divine will. To create an artificial wind was a distinct flying in the face of the text Amos, iv. 13: 'He that formeth the mountains and createth the wind.' See BLOWING-MACHINES.

Fanning, a coral island in the Pacific, lying in 3° 51′ N. lat. and 159° 22′ W. long. It has about 150 inhabitants, and was formally annexed by Britain in 1888, as lying in the path of a possible submarine cable between Canada and Australia. Fanning Island is also called American Island. The name of Fanning Islands is sometimes given to the group comprising Fanning, Christmas, New York or Washington, Jarvis, and Palmyra Islands.

Fano (Lat. *Fanum Fortunæ*, so called from the temple of Fortune commemorating the defeat of Hasdrubal on the Metaurus), a town and seaport of Italy, on the Adriatic, 29 miles NW. of Ancona by rail. Its cathedral of St Fortunato and numerous churches contain paintings by Domenichino, Guido, Guercino, &c.; and there is a triumphal arch of white marble, raised in honour of Augustus. The inhabitants (9484) carry on considerable trade in corn, oil, and silk goods; but the harbour is now greatly choked up with sand.

Fan Palm, a name common to all those palms which have fan-shaped (palmate) leaves, but more particularly applied to Chamærops (q.v.), and in the United States to the Palmetto. The Talipot Palm (*Corypha umbraculifera*) is also called the Great Fan Palm.

Fans, a race of aborigines, but apparently not true Negroes, in western equatorial Africa, between the Gaboon and the Ogoway rivers, first accurately described by Du Chaillu. They are a fine race of savages, but are avowedly cannibals, and their morals have suffered sadly from contact with the French. They are constantly moving westwards, and in 1867 Admiral Fleuriot de Langle estimated that no fewer than 60,000 had within a few years approached the French settlements on the Gaboon.

Fanshawe, SIR RICHARD, was born at Ware Park, Hertfordshire, in 1608, studied at Jesus College, Cambridge, and afterwards entered the Inner Temple, but found law distasteful, and went abroad to study languages. On the outbreak of the Civil War he took part with the king, and while with him at Oxford met and married in 1644 the lively and brave Anne Harrison (born 1625), with whom he lived in the most complete happiness throughout life. In 1648 he became treasurer to the navy under Prince Rupert, in 1651 was taken prisoner at the battle of Worcester, and on Cromwell's death withdrew to the Continent. After the Restoration he was appointed ambassador at the courts of Portugal and Spain, but was superseded by Lord Sandwich early in 1666, and before his return died suddenly at Madrid on the 26th June of the same year. His devoted wife carried his body to England for burial in Ware church, had much difficulty in recovering but a part of her husband's arrears of salary and money expended in the king's service, and survived till 1680. Fanshawe's works include *The Faithfull Shepheard* (1647), a translation from the Italian of Guarini; *Selected Parts of Horace* (1652); and *The Lusiad, or Portugal's Historicall Poem* (1655), a translation from Camoens. Lady Fanshawe's charming *Memoir* of her husband was first printed by Sir Harris Nicolas in 1829.

Fantasia is, like Capriccio, a title given to an instrumental composition whose form cannot be classified under any of the recognised species, but is a product of the individual fancy of the composer. In the music of the last two centuries it was applied to pieces containing imitative passages, similar to the vocal madrigal; and hence the 'working-out' section in the sonata form has obtained the name of 'free fantasia.' The modern fantasia is, however, usually a pot-pourri—a medley of favourite airs, with intermediate 'brilliant' passages—a species of effusion to which it is to be regretted an impetus has been given by pianists of the rank of Thalberg and Liszt.

Fantis, a Negro people on the Gold Coast, belonging to the same stem as their Ashanti (q.v.) neighbours, but possessing a greater muscular development. They were once the most powerful race in that part of Africa, but early in the 19th century were subjugated by the Ashantis, and since the Ashanti wars have come completely under British rule. In the war of 1873–74 they proved cowardly and worthless allies. Not very successful efforts have been made by Wesleyan and Swiss missionaries to convert the coast tribes to Christianity. See Brackenbury and Huyshé, *Fanti and Ashanti* (1873).

Fantoccini. See PUPPET.

Fan-tracery Vaulting, a kind of Late Gothic vaulting (15th and 16th centuries), so called from its resemblance to a fan. The ribs or veins spring from one point, the cap of the vaulting shaft, and radiate with the same curvature, and at equal intervals, round the surface of an inverted curved cone or polygon, till they reach the semicircular or polygonal ribs which bound the upper part of the cone and divide the roof horizontally at the ridge level into diamond and other patterns. The spaces between the ribs are filled with foils and cusps, resembling the tracery of a Gothic window; hence the name *fan-tracery*. The spaces between the outlines of the fans at the ridge level are called by Professor Whewell (*German Churches*) ridge lozenges. In Henry VII.'s Chapel, Westminster, one of the best examples of this kind of vaulting, these lozenges are occupied by pendants, which produce a very astonishing effect, looking like arches resting on nothing. They are,

however, supported with great ingenuity by internal arches, rising high above the visible vaulting.

Fan-tracery:
From the Cloisters, Gloucester Cathedral.

This arrangement is one of those *tours-de-force* which astonish the vulgar, but are only adopted when art has reached a low level and has in a great measure given place to artifice. Fan-tracery is a very beautiful kind of vaulting, and is peculiar to England, where it originated, and where alone it was practised. Among the finest examples are St George's Chapel, Windsor, and King's College Chapel, Cambridge. Fan-tracery is also frequently used in the vaulting of cloisters, as at Gloucester, Canterbury, and Chester.

Farad (from Faraday), the name of the practical unit of electrical capacity, first given by the British Association Committee on Electrical Standards in 1863, and authorised by the International Electrical Congress held in Paris in 1884. Under ELECTRICITY will be found the definitions of the ampère, the volt, and the ohm, which are respectively the practical units of current, potential, and resistance. The Coulomb is the name given to the unit of quantity, and is the quantity of electricity transferred by a current of one ampère in one second; and then the farad is defined as the capacity of a conductor which when raised to a potential of one volt has a charge of one coulomb. The farad is, however, an inconveniently large quantity, so that it is customary to measure capacities in *microfarads*, the microfarad being the millionth part of a farad. See also MAGNETISM.

Faraday, MICHAEL, one of the most distinguished chemists and natural philosophers of the 19th century, was born, a blacksmith's son, at Newington Butts, near London, 22d September 1791. At thirteen he was apprenticed to a bookbinder; yet even then he devoted his leisure hours to science, and made experiments with an electrical machine of his own construction. Chance having procured him admission, in 1812, to the chemical lectures of Sir H. Davy, the latter engaged him as his assistant at the Royal Institution. He travelled to the Continent with Davy, as his assistant and amanuensis. On their return to London Davy confided to Faraday the performance of certain experiments, which led in his hands to the condensation of gases into liquids by pressure. In 1827 he succeeded to Davy's chair of Chemistry in the Royal Institution. He was created D.C.L. in 1832.

In chemistry his treatise on *Chemical Manipulation* (1827; 2d ed. 1842) is even now a very valuable book of reference. As discoveries or investigations of a high order in this branch of science we may mention new compounds of chlorine and carbon (1821); alloys of steel (1822); compounds of hydrogen and carbon (1825); action of sulphuric acid on naphthaline (1826); decomposition of hydrocarbons by expansion (1827); and the very valuable series of experiments, made in 1829–30, on the manufacture of glass for optical purposes, which resulted in one of his greatest discoveries, to be afterwards mentioned.

As practical applications of science his suggestions as to the preparation of the lungs for diving and the ventilation of lighthouse lamps are conspicuous, as are also his celebrated letter on table-turning and his lecture on mental education.

To enumerate only the most prominent of his publications on physical science, we may commence with the condensation of the gases (already referred to); then we have limits of vaporisation, optical deceptions, acoustical figures, re-gelation, relation of gold and other metals to light, and conservation of force. Of these the condensation of gases into liquids and solids, though in some cases previously effected by others (and Faraday was ever the foremost to acknowledge another's priority), he really made his own, not only by the extent and accuracy of his experiments, but by the exquisite experimental methods by which he obtained the results. His ideas on re-gelation and its connection with the motion of glaciers have not met with universal acceptance, though (see HEAT, ICE, GLACIERS) there is no dispute as to his being correct in his *facts*. In regard to conservation of force, he seems to have been misled by the incorrect use of the word Force (q.v.), for in his article on the subject he describes experiments made with the view of proving the conservation of force proper; whereas the doctrine of conservation asserts merely the conservation of 'energy,' which is *not* in any sense force. He *may* be right also; but, if so, it will be by a new discovery having no connection whatever with 'conservation of energy.'

His Christmas lectures at the Royal Institution, though professedly addressed to the young, contain much that may well be pondered by the old. His manner, his unvarying success in illustration, and his felicitous choice of expression, though the subjects were often of the most abstruse nature, were such as to charm and attract all classes of hearers. Besides his *Lectures on the Non-metallic Elements* and *Lectures on the Chemical History of a Candle*, we have his *Lectures on the Physical Forces*, a simple work, but in reality most profound, even in its slightest remarks.

But the great work of his life is the series of *Experimental Researches on Electricity*, published in the *Philosophical Transactions* during forty years and more. Fully to understand all the discoveries contained in that extraordinary set of papers would require a knowledge of all that has been discovered during that time as to electricity, magnetism, electro-magnetism, and diamagnetism. We may merely mention the following, almost all of which are discoveries of the *first* importance. They are given in the order of publication, which is nearly that of discovery: (1) Induced electricity (1831), comprehending and explaining a vast variety of phenomena, some of which have already been applied in practice (especially as magneto-electricity) to lighthouses, electro-plating, firing of mines, telegraphy, and medical purposes—electric currents derived from the earth's magnetism; (2) the electrotonic state of matter (1831); (3) identity of electricity from different sources (1833); (4) equivalents in electro-chemical decomposition (1834); (5) electrostatic induction—specific inductive capacity (1838); (6) relation of electric and magnetic forces (1838); (7) the electricity of the

Gymnotus (1839); (8) hydro-electricity (1843); (9) magnetic rotatory polarisation (1846), effected by means of the optical glass already mentioned; (10) diamagnetism and the magnetic condition of all matter (1846); (11) polarity of diamagnetics, and the relation of diamagnetism to crystalline forms (1849); (12) relation of gravity to electricity (1851)—this, as before remarked, is Faraday's attempt to prove a conservation of force proper; (13) atmospheric magnetism (1851), an attempt to explain the diurnal changes of the earth's magnetic force by the solar effect on the oxygen of the air, a very interesting paper. Faraday's work is not only of extreme importance in itself, but it has been of the utmost consequence to science by leading Clerk-Maxwell to his wonderful investigations of the dynamics of the electro-magnetic field and the electro-magnetic theory of light.

Faraday, who had received a pension in 1835, was in 1858 given a house in Hampton Court. In 1862 he delivered his last discourse on 'gas-furnaces,' and advocated the use of magneto-electric light in lighthouses. In 1865 he resigned the position of adviser to the Trinity House, also that of director of the laboratory of the Royal Institution. Faraday, who was a devout Christian and a member of the religious body called Sandemanians or Glassites, died at Hampton Court, 25th August 1867. See Life by Tyndall (1868; 4th ed. 1884), Bence Jones (1870), and J. H. Gladstone (1872).

Faradisation. See ELECTRICITY (MEDICAL).

Faráizí (Arab. *faraiz*, 'divine ordinances'), a sect of reformed Mohammedans, numerous in Eastern Bengal since the middle of the 19th century. The sect originated in a puritan reaction against many obvious corruptions into which the Islamism of Bengal had fallen; but they differ from the orthodox Sunnites (of whom they may be regarded as a branch) in rejecting traditional custom, and in holding that the Koran is the sole and complete guide to spiritual life.

Farce (Ital. *farsa*, from Lat. *farcire*, 'to stuff'), a dramatic piece of a broad comic character. The difference between it and comedy proper is one of degree and not of kind. The aim of both is to excite mirth; but, while the latter does so by a comparatively faithful adherence to nature and truth, the former assumes to itself a much greater license, and does not scruple to make use of any extravagance or improbability that may serve its purpose. It does not therefore exhibit, in general, a refined wit or humour, but contents itself with grotesque rencontres and dialogues provocative of fun and jollity. The beginnings of Greek and Roman comedy consist of rustic farces or pantomimes (see ATELLANÆ); the first farces, in the modern sense, were composed by the fraternity of the Bazoche (q.v.) in Paris, as a contrast to the ecclesiastical plays performed by the religious orders. The most widely celebrated and most important of early farces is that of the advocate *Maistre Pierre Patelin*, which was acted in the 15th century, and quickly spread itself over Italy and Germany. It is full of genuine comic quality, and its dialogue has brightness and reality. See L. E. Chevaldin, *La Farce de Patelin et ses Imitations* (Paris, 1889), from the work by Dr K. Schaumburg. Subsequently Molière elevated and refined the farce into his wonderful series of comedies of character. In England the origin of the modern farce dates from about the commencement of the 18th century. Of all the numerous farces which have been performed before English audiences only those of Samuel Foote, who reverted, however, to the abuse of personal mimicry which characterised the earliest farces, have kept a place in literature. See DRAMA.

Farcy in horses depends upon the same causes as Glanders (q.v.)—in fact, is an outward manifestation of glanders. The absorbent vessels of the superficial parts of the body, but usually those of one or both hind limbs, are inflamed, tender, swollen, hard, and knotted. The vitiated lymph thus poured out softens, and ulcers or farcy buds appear. Unlike the ulcers of glanders, they are sometimes thought to be curable, but an animal apparently cured is not safe to be with other horses, as the *contagium*—the *Bacillus mallei*—almost invariably remains, and the animal is thus a centre of infection and a source of danger.

Farcy and glanders are included in the contagious diseases dealt with by the Contagious Diseases (Animals) Acts, 1878–86. See handbook of said Acts, pp. 126, 563, and 631.

Fardel-bound. See CONSTIPATION.

Fareham, a market-town and watering-place of Hampshire, on a creek at the north-west end of Portsmouth harbour, 12 miles SE. of Southampton and 9 NW. of Portsmouth. It has earthenware manufactures and shipbuilding. Pop. (1851) 3451; (1881) 7183; (1891) 7934.

Farel, GUILLAUME, one of the most active promoters of the Reformation in Switzerland, was born in 1489 at Gap, in Dauphiné. He studied at Paris, and was at first distinguished by his extravagant zeal for the practices of the Catholic Church; but, moved to the study of the Scriptures, he was converted to Protestantism, and, being by nature vehement even to indiscretion, he immediately commenced to proselytise. The chief scene of his labours was France and Switzerland. At Basel, in 1524, he opened his career of controversy and evangelisation by publicly sustaining thirty theses on the points in dispute between Roman Catholicism and Protestantism. He subsequently preached at Strasburg, at Montbéliard, and at Neuchâtel. In 1532 he went to Geneva, but soon had to leave the city. He returned in 1533, was again compelled to withdraw, but once more entered it in 1534; and in 1535 the town-council of Geneva formally proclaimed the Reformation. Farel, however, was a missionary, not a legislator, and the organisation of the Genevan Church passed into the hands of Calvin (q.v.). The severity of the new ecclesiastical discipline produced a reaction, and in 1538 the two Reformers were expelled from the city. Farel took up his residence at Neuchâtel. In 1557, along with Beza, he was sent to the Protestant princes of Germany, to implore their aid for the Waldenses, and on his return sought a new sphere of evangelistic labour in the Jura Mountains. When trembling upon three-score-and-ten, he married a young wife. In 1560 he proceeded to his native Dauphiné, and passed several months preaching against Catholicism; and in November 1561 he was thrown into prison for a time. He died at Neuchâtel on the 13th September 1565. His works were mainly polemical. See the German work by Kirchhofer (Zur. 1833); two French works by E. Schmidt (1834 and 1860); and a Life in French by Goguel (1873).

Farewell, CAPE, the southern extremity of Greenland, lying in 59° 44′ N. lat. and 43° 54′ W. long., consists of a rocky hill, nearly 1000 feet high, situated on an island off the coast. It is generally beset with ice, which appears to come from the north-east and to sweep round into Davis Strait. Hence the cape is but little known; and, in fact, the Danish traders and seamen generally round it at more than 100 miles distance.

Fargo, capital of Cass county, North Dakota, on the Red River of the North, 254 miles W. of Duluth by rail. From an insignificant village in 1874 it has become the financial and commercial

centre of the state, with six banks, as many public schools, a Congregational college, and numerous churches. Flour is the chief manufacture. Pop. (1890) 5800; (1892) 10,000.

Faria y Sousa, MANUEL DE, a Portuguese historian and poet, was born near Pombeiro in 1590, studied at Braga, next was secretary to his kinsman the Bishop of Oporto, afterwards lived at Madrid and Lisbon, and became in 1631 secretary to the Spanish embassy at Rome, where he enjoyed the favour of Pope Urban VIII. Three years later he returned to Spain, and died at Madrid in 1649. His writings fill more than sixty volumes, partly in Spanish, and comprise works on Portuguese history, on Portugal and its possessions in America and Africa, and commentaries on Camoens. His Portuguese poems comprise about two hundred good sonnets and twelve eclogues, and it is mainly by these, and also by three theoretical treatises on poetry, that he has influenced the development of the poetic literature of Portugal, in which he was long regarded as an oracle. His poetry exhibits talent and spirit, but is on the whole tasteless and bombastic.—He must not be confounded with Manuel Severin de Faria (1583–1655), who was one of the most learned numismatists of his age.

Faribault, capital of Rice county, Minnesota, on the Cannon River, 53 miles S. of St Paul by rail, with a Catholic academy and convent, a state institution for the deaf, dumb, and blind, and the Seabury divinity school. It has manufactures of flour, bricks, furniture, &c. Pop. (1890) 6524.

Faridkot, one of the Sikh cis-Sutlej states, south-east of Firozpur, with an area of 612 sq. m., and a pop. (1891) of 115,040. Under the political superintendence of the Punjab government, it is ruled by a rajah, resident in the town of Faridkot (pop. 6593), 60 miles SSE. of Lahore.

Faridpur, chief town of a district of the same name in the delta of the Ganges, 110 miles NE. of Calcutta. Pop. 10,263.—The district, forming a tongue of land between the great rivers Ganges and Madhumati, sinks in the south into a vast swamp, while during the rains boats of some size can ply over nearly the whole surface. Rice is, of course, the principal crop; sugar is grown and manufactured, and forms the staple of the district trade; and the river traffic and extensive fisheries employ large numbers of the inhabitants. Area, 2267 sq. m.; pop. 1,631,734.

Farina, a Latin term for meal or flour. It is also frequently extended to many substances which agree with the meal of the corn-plants or Cerealia in containing much starch; and food made of such substances is often called *farinaceous*. In South America the name is commonly applied to the meal of the cassava.

Fossil farina, mountain milk, or *Agaric mineral,* is a deposit of silicified animalcules, obtained from China, &c. In 100 parts it contains of silica 50½, alumina 26½, magnesia 9, water and organic matter 13, with traces of lime and oxide of iron.

Farina, JOHANN MARIA. See EAU DE COLOGNE.

Farini, LUIGI CARLO, an Italian statesman, was born in 1812 at Russi, in the province of Ravenna. He studied medicine at Bologna, and practised with success in his native city, but in 1841 had to leave the Papal States for Turin, owing to the part he had taken in politics. The amnesty and liberalism of the new pope, Pius IX., called him to Rome in 1846, where he became an under-secretary for Home Affairs, and held office under the ill-fated Rossi. Farini next found in Piedmont public honours as well as a home. In 1851 he became minister of Public Instruction, in 1859 provisional governor of Modena, in 1861 minister of Commerce in the last cabinet of Cavour, and he was himself premier from December 1862 till the breakdown of his health in the following March. He died near Genoa on 1st August 1866; and in 1878 his remains were translated to Russi. Among Farini's literary productions may be mentioned *Il Stato Romano,* translated into English by Mr Gladstone (4 vols. Lond. 1851–54), and *Storia d'Italia,* a continuation of Botta's celebrated work.

Farm (A.S. *feorm;* Low Lat. *firma,* from Lat. *firmus,* 'durable'), the term usually employed to denote a piece of land, either pasture or arable, held in lease by a tenant from the proprietor; but of course the term farmer is often applied to a person who owns as well as cultivates land. In America the farmer usually owns the land he cultivates. In this work the history and present position of agriculture, agricultural statistics, and the division of land are dealt with under the head AGRICULTURE; and other matters relevant to farming (such as cattle, dairy, landlord and tenant, lease) are treated under the various heads cited at the end of that article.

FARM BUILDINGS.—The buildings of a well-appointed farm in Great Britain consist of a residence for the farmer and his family, cottages for the farm-labourers, and the farm-steading. The dwelling-house varies to some extent with the size and character of the holding, the 'rules of the estate,' the fashion of the district, and the taste and social standing of the tenant. Modern farm dwelling-houses upon holdings of about 200 acres and upwards are, as a rule, both commodious and comfortable, substantial in construction if not ornate in external appearance, usually surrounded by simply but tastefully laid out grounds, with a moderately sized garden—for, despite the old adage, farmers are not now all bad gardeners. The dwelling-house should be from 50 to 200 yards distant from the steading, and, if possible, upon a slightly higher level, and so situated that from the farmer's parlour and bedroom windows the whole of the steading and stack-yard may be in view.

The servants' cottages should be near the steading, perhaps at the opposite side from the farmer's dwelling-house. The cottages should be plain, substantial, and roomy; they are often in one continuous row, often in pairs, seldom built singly. Each family may have three or four compartments, with a separate door, and a separate plot of ground for garden produce. Cottages for farm-servants are now more fully provided than prior to 1870; and it is well known that, where there is ample cottage accommodation, the supply of agricultural labour is, as a rule, both abundant and of good quality.

The *farm-steading,* as the term is understood in its narrowest and most generally accepted sense, consists of erections provided for the accommodation of the crops, stock, and farm implements and machines. The cost, character, and capacity of the farm-steading vary not only with the extent of the holding, the system of farming pursued, and the situation of the farm in regard to climate, but also to no small extent with the tastes and desires of the land-owner, and perhaps likewise, although to a smaller extent, with the fancies of the tenant. It is the presumption that all the buildings and other permanent equipments of the farm are provided by and are the property of the owner of the soil. The character of the steading is therefore, as a rule, determined by the 'rules of the estate.' These estate rules too often enforce the observance of certain plans irrespective of the exceptional

necessities and peculiarities of individual farms. On this account, and through a widespread ambition on the part of both landlords and tenants for imposing and almost luxurious farm buildings—an ambition fostered by, if not born of, the times of exceptional prosperity experienced prior to 1875—an excessive and unreasonable amount of capital has in many cases been sunk in the buildings of the farm, thus placing upon the land a burden which it is ill able to bear, and which is therefore detrimental alike to the land-owner and to the tenant. The greatest amount of steading accommodation is required upon mixed husbandry farms, where a large quantity of home-grown produce is consumed by cattle in winter. Unfortunately upon such a farm the maximum expenditure is required where the land is, as a rule, least able to bear heavy burdens—viz. in the cold northern districts, where substantial and comfortable houses have to be provided for the stock during the long and severe winters. In many instances there is four or five times as much money sunk in buildings—i.e. apart from the dwelling-houses—upon mixed husbandry farms in the north of Scotland as upon similar farms in the south of England. For farms exceeding 200 acres in extent the outlay upon buildings would range from £4 to £10 per acre.

The following estimate of the cost of buildings for different farms is based upon actual experience of extensive estates in Scotland, rent instead of acreage being taken as indicating the character and wants of the farm—viz.: £80 annual rent—dwelling-house, £190; offices or steading, £310; total, £500. £160 annual rent—dwelling-house, £325; offices, £475; total, £800. £240 annual rent—dwelling-house, £410; offices, £740; total, £1150. £500 annual rent—dwelling-house, £500; offices, £1100; total, £1600.

The farm-steading is usually situated as near as possible to the centre of the holding, on a dry, airy, yet well-sheltered elevation, with the water-supply abundant, if such is to be had on the farm, but not in close proximity to stagnant water or swampy ground. The open part of the steading should, as a rule, have a southern exposure, yet the immediate situation as to shelter may warrant variations from this rule. The most common and convenient plan for a farm-steading is in the form of three sides of a square or parallelogram, with a wing down the centre, and perhaps also stretching out a short distance at the back of the cross wing, the dimensions of the square or parallelogram being so regulated as to provide the required capacity in the various compartments. Modern experience has fully demonstrated the advantages of covered courts for cattle. In most improved steadings, therefore, the whole or greater part of the spaces between the centre and side wings is roofed and arranged as courts for cattle. The whole of the season's dung is often accommodated in these courts, and is benefited by the treading of the cattle, while the roof saves it from damage by washing with rain-water. Where good management prevails, the liquid manure is collected in a tank close to these courts, and periodically pumped over the heap of solid manure. Quantities of gypsum are sprinkled over liquid manure wherever it is exposed, to fix free ammonia, which would otherwise volatilise and pass away in the atmosphere.

A point worthy of careful consideration is the placing of the various compartments of the steading in such relation to each other that there may be no unnecessary moving of food, manure, or dairy produce, so that time in performing the various operations going on in the steading may as far as possible be economised. The straw-barn should be near the centre of the steading, and the classes of stock receiving most straw accommodated nearest to the straw-barn. The root-stores should be easily accessible from the cattle compartments, the hay-store from the stable, the dairy from the cow-house, and the stack-yard from the threshing-mill and straw-barn. The cart and implement sheds should be near to the stable.

In close steadings most careful attention should be given to *ventilation*, so as to secure a sufficient current overhead to keep the atmosphere pure and equable without allowing draughts to play directly upon the animals. Besides stone and bricks, concrete—1 part of stale Portland cement to 6 parts of broken stones or pure gravel (free from earthy matter)—is now largely employed in the construction of farm buildings, notably servants' cottages. Galvanised corrugated sheet-iron is extensively used in roofing courts for cattle. Covered stack-yards have not come into use, as was at one time expected, but large hay-barns, roofed with corrugated iron, are now very common, and are a valuable acquisition to farm-steadings.

On the American continent farm buildings are generally constructed of wood. It is common there to find all the compartments of the farm-steading grouped under one roof, which is often of great dimensions.

Farmer, RICHARD, D.D., a well-known 18th-century scholar, was born at Leicester, August 28, 1735, and in 1753 was entered a pensioner of Emmanuel College, Cambridge, where four years later he graduated a senior optime. Appointed classical tutor of his college, he took orders, and served the curacy of Swavesey, a village 9 miles from Cambridge. On Dr Johnson's visit to Cambridge the two scholars had a 'joyous meeting,' and ever after kept up the most friendly relations. Dr Farmer became a member of the famous Literary Club, and helped Johnson with Cambridge notes for his *Lives of the Poets*. He soon abandoned his projected history of Leicester, and published in 1767 his only work, the once famous *Essay on the Learning of Shakespeare*, which showed that the great dramatist derived his knowledge of the ancients from translations, having often preserved the phraseology and even the errors of the translators. In 1775 Farmer was elected to the mastership of Emmanuel College, and in 1778 became chief-librarian to the university. In 1780 he obtained a prebendal stall at Lichfield, in 1782 at Canterbury, which he exchanged in 1788 for a residentiary prebend in St Paul's. The remaining years of his life he divided betwixt residence in London and at Cambridge, beloved alike by the members of his college and by London men of letters for his geniality and his brilliant talk over a pipe of tobacco and a bottle of port. He was careless of his appearance, an inveterate collector of old books, and habitually indolent—a failing which alone prevented his making a figure in literature. He died September 8, 1797.

Farmers-general (Fr. *fermiers-généraux*) was the name given before the Revolution of 1789 to the members of a privileged association in France, who farmed or leased the public revenues of the nation. This system of tax-gathering became general in France from the year 1546, when Francis I. let out the *gabelle* or salt-tax in this way. The privileges of the position were sold to the highest bidder; but they were largely in the hands of the king's favourites. The powers, rights, and duties of the class were defined by special decrees; but, however severe may have been the fiscal laws against fraud and contraband, it is notorious that shortly before the Revolution abuses of the most flagrant description had demoralised the system and the men. During the Revolution most of these odious tax-gatherers perished on the scaffold, the innocent

among them being occasionally confounded with the guilty. Farmers of the revenue were an institution of ancient Rome (see PUBLICANI). Tolls on roads and duties of various kinds were at one time farmed also in Great Britain. See MONOPOLY.

Farm-servants. See LABOURERS.

Farnborough, a village on the east border of Hampshire, 32 miles SW. of London, contains part of the camp of Aldershot (q.v.). Near it is Farnborough Hill, the residence of the Empress Eugénie, beside which is the mausoleum whither the remains of her husband and her son were removed from Chiselhurst in 1888.

Farne, Fearne, or **Fern Isles,** or the STAPLES, form a group of seventeen islets and rocks (area, 80 acres; pop. 49 in 1881), some being visible only at low-tide, two to five miles off the north-east coast of Northumberland, opposite Bamborough. On House Island are remains of a Benedictine priory, dedicated to St Cuthbert (q.v.). The passage between the isles is very dangerous in rough weather; and on the group there are two lighthouses. Here the *Forfarshire* was wrecked in 1838 (see DARLING, GRACE); and here, in 1843, the *Pegasus* met the same fate, when sixty persons were drowned.

Farnese, the name of an illustrious Italian family, three members of whom occupy a prominent position in history. ALESSANDRO FARNESE was raised to the papal see in 1534 as Paul III. (q.v.). He founded the duchy of Parma and Piacenza.—ALESSANDRO FARNESE (1546–92), son of the second duke, and one of the most skilful generals of his age, first distinguished himself at Lepanto (1571). Afterwards, as governor of the Spanish Netherlands, he captured Antwerp (1585) for Philip II., and compelled Henry IV. of France to raise the siege of Paris (1590).—ELIZABETH FARNESE (1692–1766) became the wife of Philip V. of Spain in 1714, and was a warm supporter of the policy of Alberoni, Philip's minister.—The three pieces of antique sculpture (the Farnese Hercules, Flora, and Bull) were removed about 1790 from the Farnese Palace at Rome to the national museum at Naples.

Farnham, a town of Surrey, 38 miles SW. of London by rail, stands on the Wey, embosomed in hop-gardens. The principal feature is the old castle of the bishops of Winchester, first built by Bishop Henry de Blois, King Stephen's brother. Razed by Henry III., and afterwards rebuilt, it was garrisoned by Charles I., and restored in 1684 to its present state by Bishop Morley. A handsome Italian town-hall was built in 1866. Moor Park, the seat of Sir William Temple, with memories of Swift and 'Stella,' is in the vicinity; so, too, are the remains of Waverley Abbey (1128), whose *Annales Waverlienses* suggested to Scott the name of his first romance. The chief trade is in hops, a very fine variety being grown here. Pop. (1891) 5545. Toplady and Cobbett were natives. Aldershot Camp (q.v.) is 3 miles NE. of Farnham.

Farnworth, a township of Lancashire, 12 miles by rail ESE. of Liverpool. The manufacture of sail-canvas, watches, files, &c. is carried on. Pop. (1861) 8720; (1881) 20,708; (1891) 23,758.

Faro, the capital of the Portuguese province of Algarve, on the south coast, behind three islands which form a good roadstead. It has considerable exports of fruits, cork, sumach, and fish. Pop. 8671. Faro was burned by the English in 1596, and partly destroyed by the earthquake of 1755.

Faro, a widely-known game of hazard, played with cards by a 'banker' against an indefinite number of players. It is so called from Pharaon or Pharaoh, the old name of one of the court cards.

Faroe Islands (Dan. *Faar-Öer,* 'sheep islands'), a Danish group of islands, twenty-two in number, of which seventeen are inhabited, lying between the Shetlands and Iceland, 200 miles NW. of the former, in 61° 25′—62° 25′ N. lat., and 6° 19′—7° 40′ W. long. Their area is 513 sq. m., and their population (1880) 11,220; (1890) 12,955. The islands are the remains of a single continuous plateau, originally trenched by deep erosion valleys, which, being inundated by the sea during a subsequent era of depression of the land, became converted into fjords and sounds. Geologically they consist of volcanic rocks, horizontally disposed beds of basalt predominating. Seaward they present rugged precipitous cliffs, ranging in height from 1000 to 2300 feet, whilst inland they rise into flat-topped pyramidal mountains, which attain maximum elevations of 2502 feet in Skellingfjeld in Strömö, and of 2895 feet in Slattaretind in Österö. The currents that run through the sounds are swift and dangerous; storms and whirlwinds are frequent; and the harbours and anchorages in the fjords and bays are not very secure, but, on the other

hand, nearly always free from ice. For, though the climate is misty and moist, the winters are comparatively mild. Peat and coal are used for fuel. Trees there are none, owing to the storms; timber for building purposes is imported from Norway. Tillage is confined to the cultivation of a few vegetables, and attempts, not always successful, to grow barley. The principal sources of wealth are sheep-farming, wild-fowling, and fishing; and the products of these, including wool, feathers, salt and dried fish, train-oil, and skins, are the principal exports, sent for the most part to Denmark. The largest islands are Strömö (28 miles long by 8 broad), Österö, Vaagö, Sandö, and Süderö. The capital of the group is Thorshavn in Strömö, with 984 inhabitants; the town of Kirkebö, on the same island, was formerly the seat of a bishop. The inhabitants, of Norse descent, are simple and grave in their manners, and industrious in their habits. They speak an Old Norse dialect, though modern Danish is the language of law-courts, churches, and schools. They belong to the Lutheran Church. Since 1854 the islanders have enjoyed a certain amount of self-government under the control of three Danish administrative officers, who officiate as governor, police-inspector, and judge respectively. They send two representatives to the Danish parliament, one to the Upper House, chosen by the

popular assembly of the islands, the other to the Lower House, elected directly by the people themselves. From the time of their first colonisation in the 9th century the Faroe Islands belonged to Norway down to 1380, in which year they passed to Denmark. The natives possess a number of ancient epical ballads (*kvæði*), the most important group being the *Sjúrðar Kvæði*, or songs of Sigurd (ed. with grammar, glossary, &c. by Max Vogler, i. Paderborn, 1877). The chief names in the native literature are Svabo (1746–1824); N. Mohr (1742–90); J. H. Schröter (1771–1851), the first to devote much attention to the prose literature—some of the folk-stories he collected are to be found in *Antiquarisk Tidskrift* (1849–51); the patriotic Poul Nolsö (1766–1809), whose *Vogellied* is the most popular modern poem in the Faroe dialect; and Venzel Ulrik Hammershaimb (born 1819), editor of *Færöiske Kvæder* (i. and ii. Copenhagen, 1851–55), in the well-known *Nordiske Literatur-Samfund*. The last prepared the first grammar in 1854, and in the pages of *Dimmalætting*—the only newspaper of the islands, but printed mostly in Danish—a new translation into the modern dialect of the so-called *Færeyingasaga*.

Farquhar, GEORGE, was born at Londonderry in 1678, and received his education at Trinity College, Dublin, where, although he did not take any degree, he secured among his comrades the reputation of a wit who was a spendthrift of his witticisms. When he left the university he was engaged as an actor at one of the Dublin theatres, but, like most dramatists who have figured on the stage, he proved but an indifferent performer. Playing a part in Dryden's *Indian Emperor*, and forgetting that he wore a sword instead of a foil, he accidentally wounded a brother-performer, and was so shocked by the occurrence that he at once quitted the boards. Accompanied by the actor Wilks, he proceeded to London, and shortly after received a commission in the regiment commanded by the Earl of Orrery, which was then stationed in Ireland. Urged by Wilks, and perhaps stimulated by the gaiety and leisure of a military life, he in 1698 produced his first comedy, entitled *Love and a Bottle*, which proved a success. Two years afterwards his *Constant Couple* appeared, which met with a brilliant reception, and to which he wrote a sequel, called *Sir Harry Wildair*. In 1703 he produced *The Inconstant*, founded on the *Wild-goose Chase* of Beaumont and Fletcher, a version in which all the coarseness, and none of the poetry, of the elder dramatists is retained. Having married in the same year, he fell into serious pecuniary difficulties, sold his commission, and, struggling with adverse fortune, succumbed. He died of decline in 1707, leaving 'two helpless girls' to the care of his friend Wilks. During his last illness he wrote the best of his plays, *The Beaux' Stratagem*—in six weeks, it is said—and died while its wit and invention were making the town roar with delight. Another popular play, *The Recruiting Officer*, had been produced in 1706.

Farquhar is one of the best of our comic dramatists, although Pope called him 'a farce writer.' He is less icily brilliant than Congreve, and possesses on the whole more variety and character than any of his compeers. He had wit in abundance, but he had humanity too. He was a tender-hearted and somewhat melancholy man—'very splenetic, and yet very amorous.'

Farr, WILLIAM, statistician, was born at Kenley, in Shropshire, November 30, 1807. He studied medicine at Paris and London, and afterwards gave his attention mainly to medical statistics and the questions connected therewith. In 1839, two years after the registration of deaths, and of the causes of death was commenced in England, Farr received an appointment in the Registrar-general's Office in London, where he eventually became superintendent of the statistical department, a post which he held until 1880. He died in London, 14th April 1883. His chief books are *Tables of Lifetimes, Annuities, and Premiums* (1864); *English Reproduction Table* (1880); and *Net Premiums for Insurance against Fatal Accident* (1880). His *Vital Statistics*, a memorial volume, appeared in 1885.

Farragut, DAVID GLASGOW, the greatest of American seamen, was born of Spanish origin, near Knoxville, Tennessee, 5th July 1801. Entering the navy in 1810, he became a lieutenant in 1825, commander in 1841, and captain in 1855. On the outbreak of the civil war he held by the Union, and in 1862 was given the command of the armament of wooden steamers and mortar-boats fitted out for the capture of New Orleans. The approach to the city was defended by two strong forts, a number of Confederate steamers and an ironclad ram, besides chains stretched across the river, whilst sharpshooters and fire-rafts had been prepared to harass the attacking force. After the forts had been shelled for six days and nights without effect, Farragut decided to force the passage in the darkness, and actually carried through all but three of his vessels, in spite of the terrible raking fire poured in as they passed the opening made in the boom. The Confederate fleet was sunk or burned, and, on the 25th April, the last batteries having been silenced, the city was evacuated, and Farragut's men landed. For many months thereafter he was employed on the Mississippi, until in July 1863 the last fort surrendered, and the entire river was open to navigation. In July 1862 he had been commissioned rear-admiral, and in 1864 he returned to the Gulf, where on 5th August he fought the battle of Mobile Bay, destroying the enemy's gunboats and a powerful ironclad ram; a few days later the forts surrendered, and the port of Mobile was thenceforth closed to blockade-runners. In December he was made vice-admiral, the grade being created for him by congress, as was also the rank of admiral, to which he was raised in 1866. He died at Portsmouth, New Hampshire, 14th August 1870. There is a colossal bronze statue of Farragut in Washington, and another, of heroic size, in New York. See the Life by his son (New York, 1879).

Farrant, RICHARD, musician, was born about 1530, entered the Chapel Royal, became organist of St George's Chapel in 1564, returned to the Chapel Royal in 1569, whence he retired in 1580, and died in 1585. His name is best known in connection with the anthem, 'Lord, for Thy tender mercies' sake,' and a chant based on it, which, however, seem certainly not to be his. He actually did compose a full morning and evening service, and two anthems which have been printed, with parts of other services.

Farrar, FREDERIC WILLIAM, D.D., Archdeacon of Westminster, was born in Bombay, 7th August 1831, and graduated at London University and at Cambridge, where he was fourth classic. Ordained in 1854, he was for many years a master at Harrow, and in 1871–76 head-master of Marlborough College; in 1868 and 1874–75 he was a select preacher before the university of Cambridge, in 1869–73 honorary chaplain to the Queen, and afterwards a chaplain-in-ordinary. He became canon of Westminster and rector of St Margaret's in 1876, and archdeacon in 1883. An eloquent preacher, he has taken an active part in temperance reform. As an author, his industry and productiveness have been equalled only by the remarkable popularity of some of his writings, which include, besides *Eric* (1858) and other stories of school-life, and his earlier

works on philology and education, *The Witness of History to Christ* (Hulsean Lectures for 1870); *The Life of Christ* (2 vols. 1874), which passed through twelve editions in as many months; a *Life of St Paul* (2 vols. 1879); *The Early Days of Christianity* (2 vols. 1882); *The History of Interpretation* (Bampton Lectures for 1885); and *The Lives of the Fathers* (2 vols. 1889). He has also contributed largely to the magazines, and published several volumes of sermons; among these last is his *Eternal Hope* (1878), which denied the probability of eternal punishment. *Darkness and Dawn* (1892) is a story of Nero's days. In 1890 he became chaplain to the House of Commons. He has contributed to this work the articles JESUS CHRIST and PAUL. Archdeacon Farrar is an enthusiastic advocate of temperance.

Farrier, a shoer of horses, who formerly also treated their diseases. See HORSE-SHOEING, VETERINARY MEDICINE.

ARMY FARRIERS.—In each regiment of British cavalry there is a farrier quartermaster-sergeant (formerly farrier-major), with eight sergeant-farriers and eight shoeing-smiths, who attend to the shoeing of the horses and their treatment when sick, subject to the directions of the veterinary surgeon. The daily pay of the three ranks is 4s., 2s. 10d., and 1s. 10d. respectively. They wear as a badge on the sleeve a horseshoe, in worsted for the shoeing-smiths, and in gold for the farriers, who rank as sergeants and wear Chevrons (q.v.). All other mounted troops have farriers and shoeing-smiths in proportion to the number of their horses.

Fars, or FARSISTAN (anciently *Persis*), a province of Persia, bordering on the Persian Gulf, rises from the steep coast in a succession of broad terraces. The coast zone or 'hot country,' the productiveness of which is greatly dependent upon the rainfall, is backed by the 'land of the passes,' behind which comes the 'cold country;' the interior belongs to the Iranian plateau. The mountain chains, lying parallel to the coast, embrace numerous fertile valleys, rich in pasturage and vines and fruit-trees. Amongst the mountains are several lakes, the largest Lake Bakhtegan (q.v.). The rivers are small. The climate varies with the different districts. The principal products of the province are fruits, dates, tobacco, cotton, silk, and excellent wine. Area, about 53,500 sq. m. The population, the exact number of which is not known, is very sparse. The capital of Fars is Shiraz; the port, Bushire, on the Persian Gulf.

Farthing (Sax. *feorðing*, from *feorð*, 'fourth'), an English copper coin equivalent in value to the fourth part of a penny. In accordance with representations made to the government by Dean Swift for the improvement of the coinage, certain pattern farthings were struck in the years 1713–14, known as 'Queen Anne's farthings.' Five distinct varieties are known to exist. The scarcity and value of the pieces, which are indeed not rare amongst collectors, has been strangely exaggerated.

Farthingale, or FARDINGALE (Old Fr. *vertugalle*, from Span. *vertugada*, 'a hooped petticoat'). See CRINOLINE.

Farukhabad, a city of the North-west Provinces of India, near the right bank of the Ganges, 83 miles N.W. of Cawnpore. It is a clean and healthy place, with a considerable trade, and a population (1891) of 78,032.—The *district* of Farukhabad belongs to the alluvial plain of the Doab, the soil being for the most part high-lying, sandy, and infertile. Area, 1719 sq. m.; pop. 907,608. The most important crops are potatoes, indigo, and sugar-cane. The capital is Fatehgarh. The ruins of Kanauj, the capital of a powerful Hindu kingdom, still exist within the district.

Fasano, a town of Italy, in the province of Bari, 35 miles NW. of Brindisi by rail, in the midst of an olive district. There are numerous oil-presses in the town and neighbourhood. Pop. 13,941.

Fasces were bundles of rods usually made of birch, but sometimes of elm, with an axe (*securis*) projecting from the middle of them, which were carried before the chief magistrates of ancient Rome as symbols of their power over life and limb. They were borne by the lictors, at first before the kings, in the time of the republic before consuls and prætors, and afterwards before the emperors. Their number varied, a consul and a proconsul in his province having twelve, a prætor six, but within the city only two. Valerius Publicola introduced a law that within the city the axe should be withdrawn, except in the case of a dictator, who was preceded by twenty-four lictors, bearing as many fasces. Publicola also made the fasces be lowered at the assemblies of the people, as an acknowledgment of their supreme power.

Fascia, in Architecture, a flat space or band between mouldings. See ENTABLATURE.

Fasciation is a form of monstrosity not uncommon in plants. The growing apex loses its usual conical shape and becomes greatly extended in one diameter, so as to produce a broad band-shaped growing-point. This may continue to widen until it has reached many times the normal breadth without any proportional increase in thickness, and often becomes thrown into irregular folds, the leaf arrangement becoming correspondingly confused. Cases of fasciation occur not unfrequently in the ash-tree, the auricula, daisy, and other common plants, and constantly in the cultivated Cockscomb (q.v.). Such growths are with Welsh Gypsies an object of superstitious reverence.

Fascination (Lat. *fascino*, 'I bewitch,' doubtfully akin to Gr. *baskainō*), an interpretation of the fatal influence of some serpents over their destined prey. Kalm and others describe how the rattlesnake fixes a squirrel with its lidless eye, and so far demoralises the victim that it drops into the distended mouth. Le Vaillant describes the convulsions and finally the death of a shrike, paralysed by fear of a serpent at a distance of nearly four feet. Dr Andrew Smith reports that the non-venomous South African tree-snake (*Bucephalus viridis*) gathers quite a circle of victims. Ellis notes the interesting fact that an object pushed between the eye of the snake and a victimised frog broke the spell. In spite of many observations which suggest mesmeric or hypnotic influence, against which there is no strong improbability, most naturalists regard so-called fascination as equivalent to fear. In panic animals may undoubtedly become paralysed or stupid, or lose the usual power of co-ordinating their actions. See EVIL EYE, SERPENTS.

Fascines (from Lat. *fascis*, 'a bundle') are brushwood fagots bound together with wire, yarn, or withes. They are 18 feet long and 9 inches in diameter, used for revetting the steps and steep interior slopes of field-works and for other military purposes, such as roofing magazines, Casemates (q.v.), Blockhouses (q.v.), &c., when timber cannot be procured. A double row covered with earth several feet thick is almost bomb-proof. They also make a very strong stockade, and can be used in bridging operations and road-making. Cut into six-feet lengths, they are often carried by the men of an assaulting column to fill up the ditch of a work or lessen its depth. Five men can make a fascine in an hour.

Fasciola. See FLUKE, TREMATODES.

Fasher, a province of Dar-fûr (q.v.).

Fashion and **Fashionable,** terms applied to occupations, pursuits, education, and manners, as well as to most of the luxuries and necessaries of modern civilised life, denote an unending series of changes and modifications which are most marked and most apparent in the department of dress. Such variations of costume were unknown to most nations of the ancient world, and among the Romans only influenced the accessories of the toilet. The unchanging East is as unchanging in its dress as in everything else, and the fashions to which savage tribes uncompromisingly adhere remain unaltered for long periods. In some remote districts of European countries peasants still dress in the costume brought two or three hundred years ago by the local nobility from court, and the smock-frock of the English agricultural labourer is a relic of Saxon times. The natural conservatism of man often throws strong light upon long-forgotten social history, and nowhere more than in the survivals in modern costume. Thus, as Mr Tylor points out, there is much to be learnt from so quaintly cut a garment as the modern evening

1 2 3 4 5 6 7

1, Flemish (1341); 2, French (1410); 3, German (1530); 4, Spanish (1580); 5, French (1590); 6. 7, Beginning of 17th century.

dress-coat. 'The cutting away at the waist had once the reasonable purpose of preventing the coat skirts from getting in the way in riding, while the pair of useless buttons behind the waist are also relics from the times when such buttons really served the purpose of fastening these skirts behind; the curiously cut collar keeps the now misplaced notches made to allow of its being worn turned up or down; the smart facings represent the old ordinary lining; and the sham cuffs now made with a seam round the wrist are survivals from real cuffs, when the sleeve used to be turned back. Thus, it is seen that the present ceremonial dress-coat owes its peculiarities to being descended from the old-fashioned practical coat in which a man rode and worked.' Again, the English clergyman's bands are directly traceable through intermediate stages to the wide collars which everybody wore in Milton's time, the very name of which also survives in our word *bandbox*. And it is said that the

8 9 10 11 12

8, Louis XIV. and his Queen (1670); 9, (1740); 10, Prussian court-dress (1780); 11, À la Grecque (1800); 12, (1804).

modern cylindrical hat is the indirect descendant of the Puritan steeple-crowned hat, carried across the Atlantic by the Pilgrim Fathers, thence again to France, when Benjamin Franklin and the young Republicans were the height of the fashion, and by the French manipulated into the hat which they have given to all the world.

The Romans spread their dress with their civilisation over Europe, and it was gradually modified by the close-fitting garments of the races of the north till the two styles were united in the 5th century; but fashion in its modern sense cannot be said to begin till the 14th century. Then complaints first arise of clothes being cast aside for others of newer shape and cut. It must be remembered that till the 19th century men's clothes were as delicate in colour and as rich in material as women's; Pepys records in his diary how he had his wife's gowns cut up into waistcoats for himself. The change during the 14th century from close-fitting tunic and hose to long, loose garments trailing on the ground is even more startling than the outcrop of steeple-like headgear which distinguished the ladies of the 15th century.

The sumptuary laws of the 13th, 14th, 15th, 16th, and 17th centuries clearly show that dress was originally a symbol of rank, strictly prescribed for the various classes of society. An early French law complains of each man clothing himself as he pleased, without reference to his rank, so that it was impossible to tell from his dress whether he was a prince, nobleman, citizen, or labourer. In modern days this state of things is fulfilled to the letter, though costume still retains its old significance in the uniforms of the army and navy, of policemen and postmen, in the lawyer's wig and gown, the judge's robe, the bishop's lawn sleeves, and the university student's cap and gown, all of which, as Mr Herbert Spencer remarks, are worn by people whose office it is to uphold established arrangements in church and state. The railway companies and the Post-office impose a uniform on their employees, the maid-servant (in Britain) wears a cap and apron, and the waiter a black suit, but the only class who at all times voluntarily mark themselves off from other men are the clergy. Political and religious opinions have been at times symbolised by dress, as with the Puritans and Quakers; and instances of such distinguishing marks as the tricolor of France, the white cockade of the Bourbons and the Stuarts, the blue and green of the factions in the circus of ancient Constantinople, the orange and green of Irish political parties, and the blue and buff of English elections might be multiplied indefinitely. Dress attained its highest point of significance in France during the last half of the 18th century, when it marks unmistakably the various stages of the Revolution. Rousseau's *Émile* and *Nouvelle Héloïse* and Goethe's *Werther* brought sentimentality into fashion; women's hair was dressed in *bandeaux d'amour* or *poufs de sentiment;* and Marie Antoinette and the ladies of her court sought to return to the simplicity of nature by masquerading in the Trianon attired as shepherdesses and milkmaids. The works of Montesquieu and Voltaire had created an admiration for England, and the courtiers of Versailles dressed themselves like English foxhunting squires, while their wives and daughters got themselves up *à l'Anglaise* in coats with cuffs, collars, and facings, beaver-hats, and cravats. As the political turmoil increased, fashionable attire grew more and more eccentric and multiform, till at last republican institutions triumphed, and the women of France began to clothe themselves as like as possible those of Greece and Rome both in style and scantiness. They discarded costly materials, and shivered through the winter months clad in a few yards of muslin. Men wore a combination of antique and romantic costume invented by the painter David, which was finished off with Hungarian boots. The gorgeous and stately dress of the courts of Louis XIV. and Louis XV. had disappeared with the old régime. At the present time the fashions for women in all civilised countries are set by Paris; for men, though not so exclusively, by London.

One marked feature of the ever-changing kaleidoscope of fashion is its tendency to revolve in cycles. The widely-distended skirts of the 16th century reappear in the 18th and 19th centuries after periods of straight-falling folds; the piles of false hair, artificial flowers, feathers, and jewelry which reached their greatest height on ladies' heads about 1780 have had their modified counterpart in the modern chignon; men's nether garments are by turns skin-tight or loose and full; and the voluminous folds of muslin in which they swathed their necks at the beginning of this century recall in some degree the ruffs of Queen Elizabeth's courtiers. Cycles of alternate luxury and simplicity have also distinguished all ages, though the simplicity of fashion is often more apparent than real. There can be little doubt that fashions change more quickly each decade, a fact due in great measure to increased facilities of communication, while the triumph of democracy is shown by their universal adoption by all classes. The question cannot but arise whether in this continual variation the most advantageous and artistic costumes for men and women may not at last be found and kept, but the probabilities seem to be against such a conclusion. Lotze in his *Microcosmus* starts the theory that we prolong the consciousness of our personal existence into any foreign body brought into relationship with the surfaces of our own body, so that we feel ourselves grow taller with our high headgear, move with our fluttering laces and ribbons, and derive vigour from the feeling of resistance arising from a tight band or belt. At the same time it is generally allowed that we are more alive to a new sensation than to one which has been long in the field of consciousness, for, from the very fact that it is unusual, our attention is continually directed to it, while a well-known sensation loses its first intensity and the power of directing our thoughts to itself. In order, therefore, that our clothes may yield us the maximum of pleasant feeling which Lotze says we derive from them, they must not be too familiar in shape, colour, and cut—i.e. we must not only have new clothes, but new styles of clothes. But a volume would be required to determine whether this theory satisfactorily accounts for all the changes of fashion.

See Fairholt, *Costume in England* (new ed. 1885); Planché, *Cyclopædia of Costume* (1876-79); Challamel, *History of Fashion in France* (Eng. trans. 1882); Jakob von Falke, 'Kostüm und Mode,' in *Zur Kultur und Kunst* (Vienna, 1878); Herbert Spencer's *Ceremonial Institutions* (1879); and the articles Bloomer Costume, Crinoline, Hat, Beard, Wig, Fan, Tattooing, &c.

Fashoda, a town in the Shilluk country, on an island in the White Nile, 60 miles below the mouth of the Sobat tributary. It was founded by the Egyptians, and made capital of a province in the Egyptian Soudan.

Fast (a word common to the Teutonic tongues, which Grimm derives from a root signifying primarily to hold, keep, observe, and hence to restrain one's self; Lat. *jejunium*, Gr. *nēsteia*, Heb. *tsom*) is the word used to express a certain self-imposed restraint with respect to the nourishment of the body. The abstinence enforced may be either partial, when the restriction is confined to certain articles of food, or total, when all sustenance is dispensed with for a specified time. The origin of the custom seems to be coeval with man's first experience of the salutary influence which abstinence exercises on the health, and with his more or less instinctive consciousness of the necessity of retaining the body in due subjection to the soul. By degrees, the self-mortification which it implied raised it into a sacrifice offered to the Deity; it became a religious observance, was surrounded with rites and ceremonies, and finally bore the stamp of a divine law. Climate, the habits of a people, and their creed gave it at different periods different characteristics; but it may be pronounced to have been a recognised institution with all the more civilised nations, especially those of Asia, throughout all historic times. We find it in high estimation among the ancient Persians of Iran. It formed a prominent feature in the ceremonies of the Mysteries of Mithras, and found its way, together with these, over Armenia and Asia Minor, to Palestine, and northward to the wilds of Scythia. The ancient Hindus, in accordance with their primeval view—which they held in common with

the Parsees—of heaven and hell, salvation and damnation, of the transmigration of the soul, and of the body as the temporary prison of a fallen spirit, carried fasting to an unnatural excess. Egypt seems to have had few or no compulsory general fasts; but it is established beyond doubt that for the initiation into the mysteries of Isis and Osiris temporary abstinence was rigorously enforced. (For Buddhist usages, see BUDDHISM.) That Greece observed and gave a high place to occasional fast-days, such as the third day of the festival of the Eleusinian mysteries, and that, for instance, those who came to consult the oracle of Trophonius had to abstain from food for twenty-four hours, is well known. It need hardly be added that the Romans did not omit so important an element of the festivals and ceremonies which they adopted from their neighbours, though with them the periods of fasting were of less frequent recurrence.

As to the Semitic races, although we find the people of Nineveh undergoing occasional fasts, to which even animals were made to conform, yet the Mosaic law set apart one day only in the whole year for the purpose of fasting. The 10th day of the seventh month (Tishri), called 'the Day of Atonement' (Yom Kippur), or, as the holiest of the whole year, 'the Sabbath of Sabbaths,' was ordained for 'the chastening of the *Nephesh*,' which the traditional law explains as meaning the strictest and most rigorous abstinence from all food or drink, as also from washing, anointing, the putting on of sandals, &c., from the sunset of the ninth to the rising of three stars on the evening of the tenth day. In process of time, five days of compulsory fasting were added, in commemoration of certain days of humiliation and national misfortune—viz. the 17th of the fourth month (Tamus), as the anniversary of the taking of Jerusalem both by Nebuchadnezzar and Titus; the 3d of the seventh month (Tishri), when Ishmael had killed Gedaliah, the Jewish governor appointed by the Babylonians; the 10th of the tenth month (Tebeth), in remembrance of the siege of Nebuchadnezzar; the 13th of the twelfth month (Adar), the fast of Esther, and the day most rigorously kept next to the great Day of Atonement; and the 9th of the fifth month (Ab), the anniversary of the destruction of the first temple by Nebuchadnezzar and of the second by Titus. The community loved to express their penitence for sin, or their grief on the death of great men, by occasional fastings, which were also considered an efficient means of averting the divine wrath, of insuring victory over an enemy, or of bringing down rain from heaven. Besides, fasting was not unfrequently resorted to by those who wished to free their minds from all hindrances to meditation, as in the forty days of Moses (Exod. xxxiv. 28), or the fast of Daniel. In later times, when, after the destruction of the temple, sacrifices had ceased, fasting, as causing a decrease in the flesh and fat of the individual, was considered to be in some degree a substitute for the animal which had formerly been offered up by the priest. From a means to repentance and inward purification, it became an end and a virtue in itself, an abuse, indeed, neither unknown nor undenounced even in the days of the prophets. Many new fasts were superadded from time to time, but they soon fell into oblivion; and over and above the six already mentioned but few entire days are now observed by the orthodox, and these merely of a local character. Fasting, with the Jews, always implies entire abstinence, and lasts, except on the Day of Atonement and the 9th of Ab—when the sunset of the previous evening is the sign for its commencement—from the break of the day to the appearance of the first three stars. Sackcloth and ashes, the garb of the penitent in ancient times, are no longer worn; but the deepest mourning is visibly expressed by many ceremonies in the Jewish synagogues and homes on the 9th of Ab. Several half-days of fasting have also survived. The individual is bound to celebrate by fasting the anniversary of the death of his parents, his own wedding-day until the performance of the marriage-ceremony, and the birth of his first-born male child (up to its thirteenth year, when the duty falls upon the latter himself), and on the day preceding the Pesach (Pascha), in commemoration of the sparing of the Israelite first-born in Egypt. The Sabbath causes the postponement of any fast—that of the Day of Atonement only excepted—which may happen to be coincident with it; and children—girls up to their twelfth, boys to their thirteenth year—women with child, and the sick are exempted from the observance.

In the time of Christ, fasting, as we have seen, was held in high estimation. The Mondays and Thursdays—the market-days, on which the judges sat, and the law was read in the synagogues—were especially set aside for this purpose by the Pharisees. The Essenes fasted even more frequently. The Sadducees alone took exception to this rite, and were therefore considered ungodly. Christ himself neither approved nor disapproved of the custom, but, as in all matters of ceremony, allowed his disciples, Jews and Gentiles, to act according or contrary to their old habits. He is distinctly against such a *commandment*, and even excuses those who did not fast; his own abstinence from food for forty days was like that of Moses, entirely an individual act. Roman Catholics maintain that all the words of our Lord, which to Protestants appear to discountenance the obligation of fasting, are directed exclusively against the ostentatious and self-reliant fasts of the Pharisees. They even understand the language which he used in condemning the practice of the Pharisee fasters as containing a direct exhortation to his own disciples—not that they should abstain from fasting, but that they should fast with suitable dispositions. They hold, moreover, that in exempting his disciples from fasting he had regard only to the actual time of his own presence among them. It was incongruous, he said, that the children of the marriage should fast as long as the bridegroom was with them; but, he added, 'the days will come when the bridegroom shall be taken away from them, *and then shall they fast in those days*' (Mark, ii. 20; Matt. ix. 15). Hence they infer that from the time of our Lord's ascension the practice of fasting became obligatory on his disciples, the temporary cause of the exemption hitherto existing having ceased.

During the first centuries of Christianity voluntary fasts were frequent enough; and fasts were considered a befitting preparation for holy acts and feasts, for ordination and baptism. An annual fast generally observed by all from a very early date was that of the forty hours, from Friday afternoon to Sunday morning, during which Christ lay in the sepulchre. But during the first six centuries the difference in the various Christian communities in this matter was very great. The Montanist heretics were especially rigorous in their fasts. Bishops and councils gradually fixed the times and seasons for the whole of Christendom. The forty hours had gradually become forty days, called the *Quadragesima;* and the Council of Orleans in 541 made it binding upon every Christian not to eat any meat during this time, save only on the Sundays. The eighth council at Toledo in the 7th century declared those who ate meat during Lent sinners unworthy to partake in the resurrection. From the 8th century to the 11th,

when a gradual reaction set in, the laws of fasting and the punishments awarded to the transgressors became stricter and stricter; interdict and excommunication were among the penalties. By degrees fasts had become so numerous and different in kind that they were divided into—(1) *Jejunium generale* (a fast binding for all); (2) *Consuetudinarium* (local fast, &c.); (3) *Penitentiale* (atonement for all transgressions); (4) *Votivum* (consequent upon a vow); (5) *Voluntare* (for the better carrying out of an undertaking). These, again, were kept as either (1) *Jejunium naturale* (an entire abstinence from food or drink, especially in preparation for the reception of the Eucharist); (2) *Abstinentia* (certain food only being allowed, but several times a day); (3) *Jejunium cum abstinentia* (the same food, but which must be taken once a day only); or (4) *Jejunium sine abstinentia* (all kinds of food, but only once a day). The food prohibited on partial fast-days included, during certain periods, not only the flesh of quadrupeds, fowl, and fish, but also the 'lacticinia'—i.e. all that comes from quadruped and bird, as butter, eggs, milk, &c.

Fasts gradually developed in the Roman Church into—(1) Weekly fasts, of which Friday, as the day of the crucifixion, seems to have been early and generally observed. To this was added the Wednesday, as the day on which the death of Christ was resolved upon. At a synod in Spain in the beginning of the 4th century the Saturday was superadded; but this innovation met with great opposition, especially in the East. (2) Vigils, originally night-services observed by the first Christians on the eve of Sundays and festivals, partly in imitation of the Jewish custom of celebrating the entrance of the Sabbath and of festivals on the evening of the previous day, and partly from fear of the danger to which a service in the daytime would have exposed the early converts. Although these night-services became unnecessary in the course of time, they were still continued up to the 4th century, when, owing to the abuses to which they led, they were abolished, or rather transformed into fast-days, kept on the eve of great festivals in honour of Christ, the Virgin, Saints, and Apostles. (3) The great or forty days' fast (Quadragesimal fast), the most important and most rigorously enforced of all. The forty hours of fast, in commemoration of the forty hours during which Christ's body lay in the tomb, gradually expanded to forty days, as mentioned before, in pious allusion to the forty days of Moses, Elijah, Christ, the forty years' sojourn in the desert, or the forty camps—all considered typical; and the fasting became severer the nearer Passion-week itself approached, in which many other signs of mourning and contrition were generally exhibited. (4) The Quatember fasts on the Wednesdays, Fridays, and Saturdays in one week of each season, in imitation of the four Jewish fasts in the fourth, fifth, seventh, and tenth months.—There were still many other fasts, such as those of ordination, &c., but these had only a temporary existence, and do not fall to be treated here. Nor can we enter into the various dispensations granted by the church, or the special pastoral letters generally issued before Quadragesima, nor into the variations in the observance of fasts and fasting in our own days; we can only add that they have in a great measure lost their former severity, and that only partial abstinence is the rule in all cases. More must not be taken than one full meal, and that not before mid-day, nor consisting of flesh meat. Besides this a *collation* of about eight ounces of fruit, vegetables, bread, or small fishes may be taken. The modern meaning of this word was originally due to the slight refreshment in the ancient monastic discipline, taken just before the reading of the 'collations'—i.e. conferences (of Cassian) and such other works. In spite of its diminution of the former severity in the practice of fasting, the opinion of the church held in former days, that fasting is meritorious and conducive to the salvation of the soul, has undergone no change.

In the Greek Church fasting was and is kept with much greater severity, the non-observance of it being the least venial of sins. The days here extend over almost three-quarters of the year. The principal ones are the Wednesdays and Fridays—with a few exceptions—throughout the whole year; the great Easter fast lasting forty-eight days; that of Christmas, thirty-nine days; that in honour of the Virgin, fourteen days; and that of the Apostles, beginning on Monday after Trinity, and extending to the 29th of June. Besides those smaller fasts of preparation, which correspond to the vigils of the Roman Church, they have many more occasional fasts, which we, however, must omit here.

The Church of England considers fasting a praiseworthy but by no means obligatory custom. Hook, in his *Church Dictionary*, explains the distinction between the Protestant and the Roman Catholic view of fasting as consisting in this, that the Roman Catholic regards the use of fasting as an imperative means of grace, the Protestant only as a useful exercise preparatory for the means of grace. In proof how much the Church of England has left the question of fasting to the conscience and discretion of her members, it may be observed that she has neither defined the mode or degree of fasting, nor anywhere given a positive command to fast. The days named by the English Church as seasons of fasting or abstinence are the forty days of Lent (q.v.), including Ash-Wednesday and Good Friday; the Ember (q.v.) days; the three Rogation (q.v.) days; all the Fridays in the year (unless Christmas Day fall on one); and the eves or vigils of certain festivals.

The sacramental *fast-days* so long observed in Scotland are now falling into disuse, and are already completely discontinued in such cities as Glasgow (1886) and Edinburgh (1887). The Scotch fast-day was instituted as a day for 'fasting, humiliation, and prayer,' and always fell upon some day of the week preceding the yearly or half-yearly *Communion Sunday*, or Sunday set apart in the Presbyterian churches for the dispensation of the Lord's Supper. It was observed exactly as a Sunday, with sermons in the churches and the complete cessation of business.

In the United Kingdom, on occasion of wars and public calamities, the sovereign has from time to time appointed by proclamation a day for a solemn national fast, humiliation, and prayer—as on 21st March 1855 (the Crimean war), and 7th October 1857 (the Indian Mutiny).

A few words remain to be said of the Mohammedan fasts. Islam, as an offspring of Judaism and Christianity, adopted this custom with many others from both churches. During the whole month of Ramadan, in which the Prophet brought the Koran from heaven, eating, drinking, smoking, smelling perfumes, &c. are strictly forbidden from daybreak till sunset; for the intervening nights, however, all these restrictions are removed. There are, besides, many voluntary fasts, expiatory like the 10th of Moharram, corresponding to the Jewish Day of Atonement, or for the averting of the divine wrath in sudden calamities, or as an indemnification for the omission of certain pious acts, as the pilgrimage, &c. See JEWS, MOHAMMEDANISM, MONACHISM, ASCETICISM.

Besides the *Bible*, *Schulchan Aruch*, *Koran*, and the Fathers generally, see Bingham, *Origenes Ecclesiastica*, vol.

ix. (1708–22); Fabricius, *Bibliogr. Antiquaria;* Muratori, *De Quatuor Temporum Jejuniis*, &c.; Siegel, *Alchristl. Alterthümer;* Walch, *De Jejunio Quadragesimali* (1727); Robert Nelson, *Festivals and Fasts of the Church;* and Liesmayr, *Die Entwickelung der Christlichen Fastendisziplin* (1877).

FASTING.—By this term is meant the deprivation of food—the materials by which loss of matter and energy from the body is made good.

Food-stuffs may be divided into (1) oxygen, (2) water, (3) solid food-stuffs. For a discussion of the relationship of oxygen to the other food-stuffs, the reader is referred to the articles upon RESPIRATION, METABOLISM. There is now no doubt that it takes part in the constructive changes in the tissues, and for this reason it must be classified among the food-stuffs. Deprivation of oxygen rapidly results in death (see ASPHYXIA).

When water is withheld death occurs in the course of a few days. For the protoplasm of the tissues to undergo the chemical changes upon which its vitality depends, a certain proportion of water is essential, and when this is not present death ensues through the cessation of these changes.

It is more especially to the deprivation of *solid food* that the term *Fasting* is applied. The physiology of this condition has been most carefully studied in dogs, cats, and other of the lower animals, while one or two observations have also been accomplished in cases of voluntary fasts in man.

To understand the condition, it must be remembered that the energy required in the body is under normal conditions supplied by the various organic food-stuffs, which, entering the body in the condition of large and complex chemical molecules, are broken down and excreted as simpler bodies, and by their disintegration yield energy (see METABOLISM, NUTRITION). During fasting it is by the disintegration of the tissues of the body that the necessary energy is yielded. This energy is required not only for the production of mechanical work done by the body, but also for the production of heat, so that the temperature of the body may be maintained. Whenever, therefore, muscular exertion is severe, or when the individual is exposed to cold and has to produce large amounts of heat, then more energy must be forthcoming, and hence tissue waste is enormously increased. Whereas, if complete rest is maintained, and the animal is kept surrounded by air at a temperature approaching that of the body, the waste of tissue-substance is reduced to a minimum. From this it will be apparent that no conclusions of value with regard to the possible duration of life in the fasting state can be drawn from the records of those exposed to cold and hardships after shipwreck. It will be at once apparent that the amount of energy employed in maintaining the temperature of the body must be very much greater in warm-blooded than in cold-blooded animals. Indeed, in the latter class, where the temperature is at most only a few degrees above that of the surrounding atmosphere, waste of tissue for the production of heat is practically in abeyance. The same may also be said of hibernating animals, which may be regarded during their winter sleep as cold-blooded. For this reason, and because during certain periods their movements are by no means active, cold-blooded animals can endure very prolonged periods of inanition. In the case of some, months, and even apparently years, may pass without a cessation of the vital processes.

When we come to consider the physiology of fasting more closely, we find that the amount of waste of the various tissues of the body is by no means equal. The following figures, indicating the percentage loss of various tissues in an animal dying of starvation, are taken from Voit's article in Hermann's *Handbuch der Physiologie:*

Fatty tissue lost	97 per cent.
Muscle	31 "
Blood	27 "
Brain and spinal cord	3 "
Heart	8 "

We thus see that the more essential tissues feed upon the less essential, and that the fats of the body are the great source of nourishment during inanition. As long as a fair amount of fat remains in the body, the muscle can undergo its chemical changes, disintegrating and yielding energy, but always again undergoing a process of reconstruction. Whenever the fat is used up, we find that a rapid disintegration of muscle-substance without reconstruction occurs, and death rapidly ensues. The onset of this condition is indicated by a rise in the excretion of nitrogen in the Urine (q.v.). In dogs this stage is reached in about thirty days.

Jacques undertook a voluntary fast of thirty days at Edinburgh in 1888, and at London one of forty-two days in 1890, and of fifty in 1891. Succi fasted forty days in 1890.

In regard to the symptoms observed during starvation little need be said, since in most cases they are due rather to the conditions which have led to or which accompany the fast. The sensation of hunger is a prominent symptom during the earlier days, but appears to diminish. Emaciation is, of course, invariable—the skin feeling harsh and dry from the loss of subcutaneous fat. The temperature falls below the normal, and lassitude and finally torpor supervenes before death, which appears to occur simply from asthenia.

In treating such a case, food must be administered with care, in small quantities at a time, and in a digestible form.

Fast and Loose, the name of a cheating game, also called *Pricking at the Belt*, which appears to have been much practised by the Gypsies in the time of Shakespeare. The following is Brand's description: 'A leathern belt is made up into a number of intricate folds, and placed edgewise upon a table. One of the folds is made to resemble the middle of a girdle, so that whoever shall thrust a skewer into it would think he held it fast to the table; whereas, when he has so done, the person with whom he plays may take hold of both ends, and draw it away.' The game is still practised at fairs, races, and similar meetings under the name of *Prick the Garter;* the original name, in the phrase 'to play *fast and loose*,' has gone into the language to designate the conduct of those whose easy ethics do not forbid them to say one thing and do another. See Book XIII. chap. xxix. of Reginald Scot, *The Discouerie of Witchcraft* (1584).

Fasten's E'en. See SHROVETIDE.

Fasti (Lat. *Dies fasti*), those days among the ancient Romans on which it was lawful to transact legal or public business, in opposition to *nefasti*, on which it was not permitted. But the sacred books, in which the lawful days of the year were marked, were themselves denominated *fasti*, and the term was employed, in an extended sense, to signify various kinds of registers, especially the *Fasti Sacri* or Kalendares, and the *Fasti Annales* or Historici.

The *Fasti Kalendares* or calendars of the year were kept exclusively by the priests for about four centuries and a half after the building of the city. The appearance of the new moon was proclaimed by a pontifex, who at the same time announced to the people the time which would intervene between the Kalends and the Nones. On the Nones the country-people assembled for the purpose of learning from the Rex Sacrorum the various festivals of

the month, and the days on which they would fall. In the same way those who intended to go to law learned on what days it would be right (*fas*) to do so. The mystery with which this lore was surrounded, for purposes of power and profit, by the favoured class was dispelled by Cn. Flavius, the scribe of App. Claudius Cæcus, who surreptitiously copied from the pontifical book the requisite information, and published it to the people in the forum. Consequently time-tables (*fasti*) became common, very much resembling modern almanacs. They contained the days and months of the year, the Nones, Ides, lawful and unlawful days, &c., astronomical observations on the rising and setting of the fixed stars, the commencement of the seasons, brief notices concerning the introduction and signification of certain rites, the dedication of temples, the dates of victories, disasters, and the like. In later times the exploits and honours of the imperial family were duly entered in the calendar. The celebrated *Fasti* of Ovid is a sort of poetical year-book or companion to the almanac, as arranged by Julius Cæsar, who remodelled the Roman year.

Several very curious specimens of fasti on stone and marble have been discovered, of which the most remarkable are the *Kalendarium Maffeianum* (so called from its first possessor), upon almost all the days of the year; the *Kalendarium Prænestinum* of Verrius Flaccus, discovered in 1770 at Præneste, containing the months January to April and December; the *Kalendarium Vaticinum* (March, April, August), *Venusinum* (May, June), *Esquilinum* (May and June), and *Farnesianum* (February and March). These are printed in vol. i. of Mommsen's *Corpus Inscriptionum Latinarum* (Berlin, 1863), in which the Roman calendar for almost the complete year is elucidated.

The *Fasti Annales* or *Historici* were chronicles containing the names of the consuls and other magistrates of the year, and an enumeration of the most remarkable events in the history of Rome, noted down opposite the days on which they occurred. From its application to these chronicles the word fasti came to be used by the poets as synonymous with historical records. Of these, fragments have come down to us, of which the most important are the so-called *Fasti Capitolini*, discovered in the neighbourhood of the ancient forum in the 16th and 19th centuries. See CALENDAR; also Boor, *Die Fasti Censorii* (1873), and Wehrmann, *Die Fasti Prætorii* (1875).

Fastnet Lighthouse, on a rock 4 miles SW. of Cape Clear (q.v.), with a revolving light 148 feet above high-water, and visible for 18 miles.

Fastolf, SIR JOHN, was born about 1378 at Caistor, near Yarmouth, and 'exercised,' says Caxton, 'the wars in the royaume of France and other countries for forty years enduring.' He distinguished himself at Agincourt (1415), and still more in the 'Battle of the Herrings' (1429), so called because, while convoying supplies to the English besiegers of Orleans, he formed a sort of *laager* of herring-barrels, and with his archers beat off a whole French army. Later in the same year he was less successful against Joan of Arc, and at Patay, according to Monstrelet, whom Shakespeare follows, displayed such cowardice that the Duke of Bedford stripped him of his Garter. This, however, is very questionable; he rather seems to have retained all his honours till in 1440 he came home to Norfolk, and in 1441 he was granted a pension of £20 'for notable and praiseworthy service and good counsel.' His Norfolk life is mirrored faithfully in the *Paston Letters*, where we see him adding to his broad possessions, heaping up riches, building a huge new castle at Caistor—a hard old man, yet not without love of learning and the church. He died 5th November 1459. His identification with 'Sir John Falstaff' is at least incomplete, for Oldcastle (q.v.) was certainly Shakespeare's prototype.

Fat. See FATS, OBESITY.

Fata Morgana, the Italian name for a striking kind of mirage observed in the Strait of Messina. A spectator on the shore sees images of men, houses, ships, &c., sometimes in the water, sometimes in the air, the same object having frequently two images, one inverted. It is so named because supposed to be caused by the fairy (*fata*) Morgana of Arthurian romance. See MIRAGE.

Fate. The Fates, Fatalism, express a conception which has more or less prevailed in all religions. The words are derived from the Latin *Fatum*, which has primarily a passive signification, denoting something uttered—a decree or ordinance. The Greeks expressed the same thought by *Eimarmenē*. *Moira* (from *meros*, 'part' or 'lot,' 'share'), again, was the active personification of the idea—the goddess Fate or Destiny. It constituted in the Greek mythology something like an ultimate monotheistic element—the vague Unity binding together and dominating over the crowd of Olympian deities. With Homer, who in every instance save one speaks of Fate (Moira) in the singular, Fate was not a deity, but a mere personification, the destinies of men being made by him to depend upon the will of the gods; whilst, according to the later Greeks and the Romans, the gods themselves were subject to the control of the *Moirai* or *Parcæ*. Hesiod, however, who is almost contemporary with Homer, speaks of three Fates, whom he calls daughters of Night—Clotho, the spinner of the thread of life; Lachesis, who determines the lot of life; and Atropos, the inevitable. They were usually represented as young women of serious aspect; Clotho with a spindle, Lachesis pointing with a staff to the horoscope of man on a globe, and Atropos with a pair of scales, or sun-dial, or an instrument to cut the thread of life. In the oldest representations of them, however, they appear as matrons, with staffs or sceptres. They had places consecrated to them throughout all Greece, at Corinth, Sparta, Thebes, Olympia, and elsewhere.

With the course of Greek thought the conception of Fate became more spiritualised. In Æschylus it is an inexorable Destiny; in Sophocles and Plato it is more of a free and ordering Will. In the later forms of Greco-Roman speculation, again, it undergoes various modifications. With the Epicureans it seems identical with Chance (*Tuchē*); with the Stoics it is the very opposite of this. In the one case the Absolute is a mere blind fatality; in the other case it is an imminent necessity of reason, governing with iron sway the apparently accidental phenomena of life.

In the two great religions of modern times, Christianity and Mohammedanism, the same conception is found in various forms. In the latter the Highest seems to be conceived as inexorable law, swallowing up every lower law of activity; yet the abject self-subjection to fate generally understood to be implied in the Moslem *Kismet* is by no means inculcated in the Koran (see MOHAMMED). In Christianity and the modern speculation which it has coloured it shows itself less broadly in the well-known doctrines of Predestination and of philosophical Necessity. In the Predestination theory of Augustine, Calvin, and many others, the old fatalistic doctrine is repudiated; the recognition of a free determining element in the divine Will separates their idea of it altogether from that of a mere blind Destiny; but the influence of the mode of thought out of which

the old idea sprung appears in the manner in which the divine decrees are sometimes spoken of as inexorably overbearing human freedom. In the doctrine of philosophical necessity promulgated by Leibnitz and Edwards, and in a somewhat different form by modern scientific modes of thought, the same idea emerges as inevitable sequence—of an invariable connection linking together all phenomena, material and mental. An immutable law is declared to pervade and harmonise all existence. This is a much higher conception, but is obviously not wholly unrelated to the old pagan doctrine of Fate. See PREDESTINATION, NECESSITY.

Fatehganj ('Victory Market'), the name of two villages and battlefields in Bareilly district, in the North-west Provinces. (1) EAST FATEHGANJ, 23 miles SE. of Bareilly, was founded by the Nawáb of Oudh to commemorate the British victory over the Rohillas (1774), which gave him possession of a large part of Rohilkhand.—(2) WEST FATEHGANJ, about 35 miles NW. of the former, was the scene of another victory over the Rohillas in 1794. There is a monument over the grave of the Company's troops, and a carved and minareted tomb holds the remains of two Rohilla chieftains.

Fatehgarh, the cantonment and administrative headquarters of Farukhabad district, lies 3 miles E. of the native city of Farukhabad, with which it forms a joint municipality. Government has here an important gun-carriage factory; and there are flourishing settlements of native Christians, established by the American Presbyterian Mission, which was formed in 1838. A British military station since 1802, the place was attacked by Holkar in 1804, and is infamous in the annals of the mutiny of 1857, in the course of which upwards of 200 Europeans—men, women, and children—mostly fugitives brought back after escaping down the Ganges, were sabred or shot by the rebels, either here or at Cawnpore. Pop. 12,435.

Fatehpur, (1) capital of a district in the North-west Provinces, on the East Indian Railway, 70 miles NW. of Allahabad. It contains two interesting mosques, and has a trade in hides, soap, and grain. Pop. 21,328. The *district* of Fatehpur lies wholly within the Doab (q.v.), and occupies its entire breadth from Jumna to Ganges. Area, 1639 sq. m., more than half of which is highly cultivated; pop. (1891) 699,157, nearly nine-tenths Hindus.—(2) A fortified town of Rajputana, 145 miles NW. of Jaipur. Pop. 14,731.

Fatehpur Sikri, a former capital of the Mogul empire, was founded by Akbar in 1570, but soon after abandoned for Agra, 23 miles to the east. The remains of the magnificent architectural works with which he and his son enriched it are inclosed by a high stone wall, about 5 miles in circuit, and include several palaces, a noble mosque, and numerous other splendid ruins. Within the bounds of Akbar's wall are the modern town of Fatehpur and the village of Sikri, with insignificant manufactures of carpets and millstones. Pop. (1891) 6878.

Father. See PARENT AND CHILD, FAMILY, and the works referred to at Family.

Father-lasher, a name applied to two Bullheads (*Cottus scorpius* and *bubalis*) which occur commonly on British coasts. They have a wide European and American distribution, and belong to the Gurnard (q.v.) family (Cottidæ), in the spiny-rayed (Acanthopteri) order of bony fishes. They are both somewhat forbidding little fishes, four or five inches in length, with dark, quaintly mottled skins, and with spines on the head. The head and pectoral fins are large in proportion to the body. The male builds a nest and guards the young. In Scotland the second species is sometimes called the Lucky Proach, while the first species is also known as the Sea Scorpion. Both forms, but

Father-lasher (*Cottus bubalis*).

especially the first, are often left on the shore or among the rocks by the retiring tide.

Fathers of the Church (*Patres Ecclesiastici*), a term which, strictly used, denotes only certain early writers of unimpeachable orthodoxy and eminent sanctity, who have been accepted by the church as duly qualified exponents of her doctrines. The title of 'father' was given in early times to all bishops, confessors, and heads of monasteries (see ABBOT); but the expression 'fathers of the church' has become restricted to this more definite sense, while those writers whose heterodoxy is manifest are called simply *Scriptores Ecclesiastici* ('Church-writers'). The title of 'fathers,' however, is often bestowed on some, such as Origen and Tertullian, the errors in whose writings are overlooked for the sake of the value of their orthodox contents. Historians are generally agreed in excluding from the patristic period the Apostolic Fathers (q.v.), and in dating its commencement from the 2d century; but there is no unanimity regarding the time at which it may be said to have closed. In the Greek Church the period is often brought down to the Council of Florence (1441). Roman Catholic writers include within its limits all writers who were witnesses to the Catholic doctrine of the church during the first twelve centuries of the Christian era, or even down to the Council of Trent; moreover, in 1871–78 Saints Alfonso de Liguori and Francis de Sales, the former of whom died so late as 1787, were raised to the dignity of *Doctores Ecclesiæ*. But there appears no good reason why Anselm and Bernard and those that immediately follow them should be removed from the list of the schoolmen, and the patristic period may conveniently be taken to have closed for the Eastern Church with John of Damascus (756), and for the Western with Gregory the Great (604). Even Roman Catholic theologians acknowledge the higher value and importance of the fathers of the first six centuries. Arranged in the order of their deaths, chief among the ante-Nicene fathers are Justin Martyr, Irenæus, Clement of Alexandria, Tertullian, Origen, Cyprian, and Gregory Thaumaturgus; while the post-Nicene fathers include Eusebius of Cæsarea, Hilary of Poitiers, Athanasius, Basil, Cyril of Jerusalem, Gregory Nazianzen, Gregory of Nyssa, Ambrose, Epiphanius, Chrysostom, Jerome, Augustine, Cyril of Alexandria, Leo the Great, Gregory the Great, and John of Damascus. For all these, see separate articles, as well as for many of the other early writers whom the Latin Church includes in the list. In both divisions of the church four authors are recognised as fathers *per eminentiam:* in the East, Athanasius, Basil, Chrysostom, Gregory Nazianzen; in the West, Ambrose, Jerome, Augustine, Gregory. The study

of the life and writings of the fathers is sometimes regarded as constituting a distinct discipline, known as patristics or patrology; but this practically constitutes a study of the church's history during the first six centuries. See CHURCH HISTORY. With respect to the authority of the fathers, the Roman Catholic position is that the teaching of individual fathers is to be accepted or rejected on its merits, and their evidence as witnesses to the tradition of the church, either singly or when several concur, is to receive so much credence as may appear due after the quality and circumstances of the testimony have been considered; but their morally unanimous consent is held to carry decisive authority in matters of faith. Protestant writers, on the other hand, while acknowledging the merits of the patristic writings, and recognising in many important points a *consensus patrum*, dwell upon the admitted fallibility of the authors, and insist upon the sufficiency of Holy Scripture, as containing 'all things necessary to salvation.' See EXEGESIS; also INFALLIBILITY.

Editions of individual fathers are noted under their separate articles. Collective editions are De la Bigne's *Maxima bibliotheca veterum Patrum* (Paris, 1575; improved ed. 27 vols. Leyden, 1677—the Greek writings translated into Latin); Gallandi's *Bibliotheca veterum Patrum* (14 vols. Venice, 1765–81); and Migne's exhaustive *Patrologiæ cursus completus* (387 vols. Paris, 1844–66). This last is continued in Horoy's *Medii ævi bibliotheca patristica, sive Patrologia ab anno 1216 usque ad concil. Tridentinum* (1st series, *Doctores eccl. lat.*, Paris, 1879 *et seq.*). Also the Vienna Academy has been issuing since 1866 a *Corpus scriptorum ecclesiasticorum latinorum*, based on a critical comparison of MSS.; a fifth of the series, which will be completed in about 100 volumes, had appeared down to 1889. English translations are numerous. Clark's *Ante-Nicene Library* (Edin. 1864–71) is complete in 24 vols., and the *Library of the Fathers* (Lond. 1838–85), edited by Pusey, Keble, Newman, and others, extends to 48 vols. There is a *Select Library of the Nicene and post-Nicene Fathers* (New York; 9 vols. down to 1889), edited by Dr Philip Schaff; and the useful series of *Fathers for English Readers* (S.P.C.K., 11 vols. 1878–84) likewise deserves mention. See also Farrar's *Lives of the Fathers* (2 vols. Edin. 1889).

Fathom, a measure of six feet, principally used in reference to marine soundings, and in mines. Originally a fathom (A.S. *fæðm*) was taken as the width to which the two outstretched arms extended.

Fatimides, or FATIMITES, an Arab dynasty, descended from Ali and Fatima, daughter of Mohammed, ruled over Egypt and North Africa (909–1171), and later over Syria and Palestine. In religion the Fatimides were Shiites of the Ismailian sect. The Fatimide calif Hakem was the founder of the Druses (q.v.). Compare also CALIF, EGYPT.

Fats are natural oils, solid at the ordinary temperature, which occur in plants and animals. They are all compounds of glycerin with various fatty acids. The animal fats are to be regarded as ethers formed by replacing the removal atoms of hydrogen in the triatomic alcohol glycerin, $\left.\begin{matrix}C_3H_5\\H_3\end{matrix}\right\}O_3$, by the acid radicles of the acetic and oleic series. The most important of these fats are Palmitin, Stearin, and Olein.

$$\text{Palmitin } \left.\begin{matrix}C_3H_5\\(C_{16}H_{31}O)_3\end{matrix}\right\}O_3$$

$$\text{Stearin } \left.\begin{matrix}C_3H_5\\(C_{18}H_{35}O)_3\end{matrix}\right\}O_3$$

$$\text{Olein } \left.\begin{matrix}C_3H_5\\(C_{18}H_{33}O)_3\end{matrix}\right\}O_3$$

In addition to these we have in milk, butter, &c. small quantities of the neutral fats of Butyric, Caproic, Caprylic, Capric, and Myristic acids. They are oily bodies; some solid, others fluid, at the ordinary temperature. They are insoluble in water and in cold alcohol, soluble in hot alcohol, in ether, chloroform, &c. Under the action of caustic alkalies or superheated steam they are decomposed into their fatty acid and glycerin. The fat of different animals differs in its characters according to the relative proportion of these various fats which it contains. Thus, the fat of the dog, which contains a large proportion of olein, melts at a comparatively low temperature, while the fat of the sheep, on the other hand, which is particularly rich in stearin, has a much higher melting-point.

Whatever be the nature of the fat, it occurs in the animal body inside the living units or cells in the form of small globules. Fats appear to be an almost invariable constituent of all living protoplasm; but in certain tissues they accumulate in very large amounts. This is especially the case in the cells of loose fibrous tissue, where the deposition of fat is frequently so great as to form regular masses or lobules. Under the skin, in the abdomen, in the orbits, round the heart, and in various other places these masses are well marked.

The quantity of fat in the human body varies considerably at different periods of life. In the earlier stages of fœtal existence we find scarcely any fat; in new-born children there is usually a considerable quantity of this substance deposited under the skin, and the organism continues rich in fat till the age of puberty, when a marked diminution of the substance occurs. It again increases about middle life, and then occasionally occurs in great excess; for example, three or four inches of fat are not unfrequently found under the skin of the abdomen in corpulent persons.

The fats of the body are derived not only from the fats of the food, but also from both carbohydrates and proteids. It has now been clearly shown that an animal takes up and stores in its body any fat which may be administered in the food, and that it may thus for the time being have the chemical nature of its fat entirely altered. After a time, however, the living protoplasm of the body seems to be able to convert the foreign fat so stored into the proper fat of the animal.

By feeding dogs on a flesh diet, and carefully analysing the excreta, Pettenkofer and Voil have shown that the flesh of the food is a source of fat in the body. That carbohydrates—such as sugar and starch—are also sources of fat is a matter of popular belief. Various researches have clearly demonstrated that this belief is correct. By feeding young growing pigs on a diet of known composition, and afterwards killing them and analysing their bodies, it was shown that the fat found was in such amounts that it could have been derived only from the carbohydrates of the food.

The physiological value of the fats is due partly to their physical and partly to their chemical characters. The uses of the fat deposited beneath the skin are, first, to protect the body from external shocks by a uniform diffusion of pressure through the whole adipose tissue; and, secondly, to keep up the heat of the body, by materially checking, through its very slight conducting power, the loss of free heat by radiation. This use of the fat is most clearly seen in some of the lower animals (the seal, whale, &c.), which are exposed to very low temperatures. Another physical use of fat is to promote the mobility of various organs. Hence, in cases of extreme emaciation, it always remains in the parts where motion is most essential, as the heart and the orbit of the eye.

The chief chemical use of the fats is as a store of potential energy for the body (see FAST).

On account of the large amount of carbon and the small amount of oxygen contained in the molecule, it is peculiarly valuable in this respect. Measuring the potential energy in gramme degrees, we find that 1 gramme of fat yields 9069 gramme degrees of heat; 1 gramme of proteids yields 4368; 1 gramme of carbohydrates yields 3912. Unfortunately the process of digestion and assimilation of fat is difficult, and for this reason, as well as on account of its relatively high price, only a moderate amount can be daily consumed (see OBESITY).

Fatty Acids. See OILS.

Fatuity. See IMBECILITY, INSANITY.

Fatwa, a town of Bengal, at the confluence of the Punpun and the Ganges, and on the East Indian Railway, 8 miles from Patna. It is thus a place of some commercial importance; and as the Ganges is here deemed peculiarly sacred, Fatwa is at certain seasons of the year the resort of large numbers of pilgrims. Pop. 10,919.

Faucher, LÉON, a French publicist and statesman, was born at Limoges, 8th September 1803. He studied at first philology and archæology, but about the period of the July revolution (1830) betook himself to journalism and political economy. From 1830 to 1842 he was successively editor of the *Temps*, the *Constitutionnel*, and the *Courrier Français*. In 1843 he began to write for the *Revue des Deux Mondes* a series of articles on the industrial condition of England, collected in two volumes in 1845 under the title of *Études sur l'Angleterre*. After the revolution of 1848 he sat in the Constituent and Legislative Assemblies for the department of Maine. When Louis Napoleon was chosen president, Faucher became first minister of Public Works, and subsequently minister of the Interior; but, when the president proposed to appeal to universal suffrage, Faucher gave in his resignation, and withdrew from political life. He died at Marseilles, 14th December 1854. Several of his most valuable contributions to politics are printed in *Économistes et Publicistes Contemporains*, and in the *Bibliothèque des Sciences Morales et Politiques*.

Faucit, HELEN. See MARTIN (THEODORE).

Fault, the term in Mining and Geology for any interruption in the continuity of the strata, coupled with the displacement of the beds on either side of the line of fracture. See DISLOCATION.

Fauna, a term employed to designate animals collectively, or those of a particular country, or of a particular geological period. Thus, we speak of the fauna of Great Britain, the recent fauna, the fossil fauna, the fauna of the Eocene period or formation, &c. The term bears the same relation to the animal kingdom that *Flora* does to the vegetable. Its derivation is from the mythological fauns, regarded as the patrons of wild animals. In the fauna of any country are included only those animals which are indigenous to it, and not those which have been introduced.

Fauns. Faunus, grandson of Saturn, was an ancient Italian king, who instructed his subjects in agriculture and the management of flocks, and was afterwards worshipped as the god of fields and of shepherds. The festival of the *Faunalia*, held on the 5th December, referred to the protection he exercised over agriculture and cattle. *Fauna* was his female complement. He was also worshipped as a prophetic divinity. As deity of the woods and of flocks and herds, he corresponds to the Greek Pan, and hence with his name became associated the attributes of the latter. The idea also arose of a plurality of Fauns, like the Greek Satyrs, who were represented with short horns, pointed ears, tails, and goats' feet, and to whom all terrifying sounds and appearances were ascribed. Readers of Hawthorne's *Marble Faun* (or *Transformation*) will remember the artistic use there made of the conception.

Fauntleroy, HENRY, forger, was born in 1785, and at fifteen entered the London banking-house of Marsh, Sibbald & Co. His father had been one of the original founders, and on his death in 1807 the son became a partner, and ere long almost its sole manager. In 1824 it was discovered that the signatures of two trustees for a sum of £1000 had been forged four years before for the purpose of selling the stock, while Fauntleroy had been paying the dividends regularly ever since. Other and much larger transactions of the same nature were discovered, and Fauntleroy was put on trial (30th October) with seven separate indictments against him, the one on which the attorney-general most relied being a forged deed in his sister-in-law's name for a transfer of £5480. A paper in Fauntleroy's handwriting was produced in which he confessed to having forged powers of attorney in order to save the credit of the house. The prisoner was condemned to death. The case excited great interest, and many influential persons exerted themselves to procure a commutation of the penalty, but without success. Fauntleroy was hanged, 30th November 1824, in the presence of a vast multitude of spectators. See Griffith's *Chronicles of Newgate* (1884).

Fauriel, CLAUDE CHARLES, an eminent French *littérateur*, was born at St Etienne, 21st October 1772, and educated at the Collége des Oratoriens at Tournon. In 1799 he was appointed secretary under Fouché, but soon resigned his office to devote himself entirely to letters. He made himself familiar with Sanskrit, Arabic, and the treasures of classical antiquity and of the middle ages, and put in circulation, says M. Renan, a greater number of ideas than did any contemporary writer. After the July revolution he was appointed a professor in the Paris Faculté des Lettres, and was elected to the Academy in 1836. He died at Paris, 15th July 1844. His earliest works were translations of Baggesen's *Parthenais* (1810), Manzoni's tragedies (1823), and modern Greek folk-songs (1824). In 1836 he published his chief work, *Histoire de la Gaule Méridionale sous la Domination des Conquérants Germains* (4 vols.); the year after, an edition of the Provençal rhymed chronicle on the crusade against the Albigenses, with a remarkable historical introduction. Fauriel also contributed several important essays to the literary journals of France, the best known, *Sur l'Origine de l'Épopée du Moyen Âge* (1833). Two years after his death appeared his professorial lectures, *Histoire de la Poésie Provençale* (3 vols. 1846), in which he endeavoured with great erudition and originality of criticism to show that to the Provençals are to be attributed the composition and primitive development of the greater portion of the romances of chivalry, including those which describe the contests of the Christians and Moors in Spain, and those which form the Charlemagne cycle, and that thus the old Spanish and German poetry found its origin on the soil of France. See Sainte-Beuve in vol. iv. of *Portraits Contemporains*.

Faust, DR, a famous dealer in the black art, whose legendary story, a product of the Reformation period, has filled a great place in literature. The historical person who bore the name of Faust lived in the first half of the 16th century, and can be traced in the testimonies of contemporaries from 1507 down to about 1540. He was born at Knittlingen in Würtemberg, or, according to others, at Roda, near Weimar. His parents were poor, but

the bequest of a rich uncle enabled him to study medicine and magic at Cracow. From a letter of the Abbot Trithemius of Spanheim, written August 20, 1507, we find an account of him first at Gelnhausen the year before, then at Würtzburg, next at Kreuznach, under the name of Georgius Sabellicus *Faustus junior*. He is described as a vagabond, boastful and pretentious, giving himself out as skilled in necromancy, astrology, magic, chiromancy, agromancy, pyromancy, and hydromancy, able to restore by his own genius the works of Aristotle and Plato if they were lost, and reproduce as often as required all the miracles of Christ. At Kreuznach he was employed to teach by Franz von Sickingen, but was soon obliged to flee for his abominable debaucheries. In 1509 one Johann Faust was pursuing his studies at Heidelberg, where he took the degree of bachelor of theology, and may be the same as the vagabond scholar whom Tritheim denounced. Mutianus Rufus, in a letter to Henri Urbain in 1513, speaks with contempt of one Georgius Faustus at Erfurt, whose follies—as those of a stranger—are of no consequence. Here he seems to have made long and frequent sojourns, if the chronicle first published by Motschmann may be accepted as contemporary evidence; and, moreover, the main elements in his story appear to be already formed. In 1516 we find him at Maulbronn, next in 1525 (traditionally) at Leipzig; in 1528, as Dr George Faust of Heidelberg, he was expelled from Ingolstadt. The physician Philip Begardi, in his *Index Sanitatis* (1539), speaks of him as having been for some years known as a rogue and a vagabond who gave himself out as *philosophus philosophorum*, and was highly renowned among his dupes for his great skill, not alone in medicine, but also in chiromancy, necromancy, physiognomy, crystallomancy, and the like other arts. Begardi had not himself seen him, but had many accounts of him. A somewhat ambiguous sentence at the end of the passage about Faust has been interpreted as conveying the fact that he was just dead, and certainly after 1539 we have no positive proofs of his existence, while we know that he was dead by 1544. The Protestant theologian Johann Gast, in the second volume of his *Convivialium Sermonum Liber* (1544), speaks of having supped with Faust at Basel, where he was attended by a dog and a horse that were evidently demons, and further describes his deplorable end, how the devil strangled him, and how his dead body lay constantly on its face on the bier, although as often as five times turned upwards.

Conrad Gesner of Zurich, in a letter written in 1561, mentions him as a wandering scholar of marvellous powers, long since dead. Next Manlius, a pupil of Melanchthon, tells us in his *Locorum Communium Collectanea* (1562) that his master knew Faust, who was a native of Kundling in his own country, and described him as 'turpissima bestia, et cloaca multorum diabolorum.' He described further how he had studied magic at Cracow, worked many vain wonders throughout Germany, and was at last carried off by the devil some years before. Joannes Wierus, a pupil of Cornelius Agrippa, in his *De Præstigiis Dæmonum* (1583), speaks of Faust as having been born at Kundling and educated at Cracow, and as having travelled over all Germany, and been imprisoned for his misdeeds in a town in Holland. He tells two stories of him which harmonise with the tradition. According to Widman, Luther in his conversations spoke freely of Faust and his familiar in illustration of the craft and wickedness of the devil, and of the necessity of avoiding all perilous dealings with him. Faust he condemned as the typical infidel and impious man, as well as the mere profligate and the vagabond. Here we see the beginnings of the religious colour which was later to become one of the main characteristics of the story. Count Froben Christoph von Zimmern in his *Chronik* twice alludes to Faust, confirming the account that he died in an inn during the night at the hands of his familiar when his hour had come. One of the last notices of Faust before the publication of the *Volksbuch*, which was to fix the form of the legend for all time, is that of Augustin Lercheimer of Steinfelden, a Protestant theologian, and, like Manlius, a pupil of Melanchthon. In his *Christliche Bedenken und Erinnerung von Zauberei* (1585) we find frequent notices of Faust, and in the minuteness of his details we see the legend full-grown. Again, in two among the seventeen tracts composing the *Theatrum de Veneficis* (1586) there is distinct mention of Faust. Martin Delrio, in his *Disquisitionum magicarum Libri sex* (1624), and Philip Camerarius, in his *Operæ Horarum Subcisivarum* (1658), testify further to his story.

The first literary version of the Faust story was the Volksbuch, published by Johann Spies at Frankfurt in 1587, under the title *Historia von Dr Johann Fausten, dem Weitbeschreiten Zauberer und Schwartzkünstler, &c.*, of which but five copies are in existence—one in the British Museum. At the close of the dedication Spies explains that he has printed the book for a warning to all Christians, and tells how he had received his version of the legend from a friend at Spires, evidently a Protestant theologian from the Scripture texts with which it is scattered. The 'preface to the Christian reader' is an admirable sermon upon the damnable consequences of magic and commerce with the devil. The book is divided into sixty-eight chapters, unequally arranged in three parts and a conclusion. The first part recounts, in seventeen chapters, the birth of Faust at Rod, near Weimar, his early studies and bold speculations, his meeting with the devil in a wood near Wittenberg, and his three several disputations in his own dwelling with the fiend, who gives his name as Mephistophiles, when the compact is concluded by which Faust signs away his soul in blood drawn from a vein in his left hand, in return for the services of Mephistophiles for twenty-four years. The fiend now supplies him with the means wherewith Faust and his *famulus* Wagner are able to live in the greatest luxury. Ere long Faust wishes to marry, but is not allowed, as marriage is an institution of God, and therefore hateful to the devil. Then follow the answers of Mephistophiles to Faust's questions about hell and its ten governments, the form and figure of the fallen angels, the power of the devil, the division of hell called Gehenna, its creation, and the tortures peculiar to it.

The second part contains fifteen chapters relating to the rest of Faust's questions about astronomy and astrology, the causes of winter and summer, the creation of the firmament; after which follow the false answers of the fiend about the creation of the world and the birth of man, and the account of Faust's earliest adventures, including a visit to hell and an account of its hierarchy, a journey to the stars, riding upon Mephistopheles in the form of a horse with the wings of a dromedary, and next to many distant countries and famous cities, as Paris, Naples, Venice, and Rome. Here he torments and bewilders the pope with his strange enchantments, remaining three days invisible in the papal palace, seeing in the pope and his attendants countless sins like his own—shamelessness, audacity, pride, presumption, gluttony, drunkenness, luxury, adultery, and impieties of all kinds. At Constantinople he lives royally in the sultan's palace in the form of Mohammed, returning to Wittenberg after a year and a half's absence.

The third part, in twenty-eight chapters, narrates the conclusion of Faust's adventures, and especially the mighty deeds done by his necromancy at the courts of divers potentates. At Innsbruck he calls up the shades of Alexander the Great and his wife for the delectation of the Emperor Charles V., and afterwards plays many tricks upon his knights—planting a stag's horns on the head of one, devouring a peasant's load of hay together with the horse and wagon, and producing fresh apples and grapes in January; and at carnival time he revels with a company of students, drawing forth wine from a table, and raising Helen of Troy from the shades to gratify their eyes with the sight of her beauty. The story tells further of his debaucheries, and of the seven diabolical succubuses whom he made his concubines; and lastly of his liaison in the last year of his term with the famous Helen of Troy, who bore him a son whom he named Faustus junior. As the end approached he was filled with profound melancholy, seeing hell yawning before his eyes and its unutterable torments, from which there was for him no possible escape, while the wicked spirit now began to torment him with cruelly ironical raillery. On the night on which his twenty-four years expired he was in company with a group of students in a tavern of the village of Rimlich, near Wittenberg, and to them he made a long address expressing his deep penitence, after which he remained alone in his chamber. At midnight a fearful storm arose; horrible hisses as of a thousand serpents were heard, and for a little the agonising cries of Faust with a hollow and suffocated sound; but soon all was still. In the morning the floor of the room was found stained with blood, his brains were spattered upon the walls, and his body was found outside, lying near a dunghill, the head and every member hanging half torn off. Helen and her child had disappeared, and the famulus Wagner succeeded as heir to his master's property. The history ends with an edifying conclusion.

This Volksbuch, which we have seen is not a product of the imagination, at once became popular, as many as four impressions being printed before the close of the following year. A second and corrected edition was published by Spies himself in 1588. In the same year a Low German rendering was published, and a close though somewhat shortened English translation before 1589, the earliest copies not being dated. See the reprint in vol. iii. of W. J. Thoms's *Early English Prose Romances* (2d ed. 1858). Danish, Dutch, Flemish, and French versions were also made—the last not till 1598. A Berlin edition of 1590 added six new chapters, of which one relates to the Leipzig tradition of Faust's adventures in Auerbach's cellar. A version of the book in rhyme, executed by Tübingen students, appeared there in 1588 (printed in vol. xi. of Scheible's *Kloster*, 1849). At Hamburg in 1599 was issued the second form of the popular book, the enlarged version of Widman (printed in vol. ii. of Scheible's *Kloster*, 1846). Many additional stories and details are here inserted, and each chapter concludes with an edifying discourse, called a *reminder* (*Erinnerung*), which reveals a violently Protestant bias, extorting everywhere a moral against Rome. A later version of Widman is that by the Nuremberg physician, Johann Nicol. Pfitzer (1674; new ed. by A. v. Keller, Stuttgart, 1880), which is chiefly interesting as containing the prototype of Goethe's *Gretchen* in the citizen's daughter whom Faust wishes to marry, but which the devil will not permit him to do. Yet another version was issued at Frankfurt about the beginning of the 18th century, by 'One with Christian Intentions,' in an abridged and modernised form, which was the basis of many widely diffused chapbook impressions (see 'Des Christlich Meynenden Geschichte Faust's,' in vol. ii. of Scheible's *Kloster*, from an edition dated 1728). The life of Christopher Wagner (Scheible's *Kloster*, vol. iii. 1846) was issued in 1593, and originated in the same year an imitation, rather than a translation, in English. It closely follows the form of Faust; Wagner is attended by an ape-shaped attendant devil named Auerban, has similar adventures to his master's, and in the end shares the same fate.

Independent poetic versions of the Faust story also began early to appear. Of these, the earliest, and still the greatest but one, was Marlowe's *Tragical History of the life and death of Doctor Faustus*. English itinerant players traversed Germany in the beginning of the 17th century, and may have carried with them Marlowe's magnificent tragedy, but the popularity of the theme was so great that it may well have inspired the native imagination also, and given rise to the numberless marionettes in which the story was continuously represented down to the present century. These were seldom printed, and usually largely extemporised, keeping at the same time more or less closely to the theme. See the excellent Ulm piece and others in vol. v. of Scheible's *Kloster* (1847); also the marionette versions edited by W. Hamm (1850; Eng. trans. by T. C. H. Hedderwick, 1887), O. Schade (1856), K. Engel (1874), Bielschowsky (1882), and Kralik and Winter (1885).

Lessing had projected two versions of the story, one close to the original legend, the other with the supernatural element eliminated; but of these only some fine fragments now exist. Klinger worked the subject into a romance, *Fausts Leben, Thaten, und Höllenfahrt* (1791; translated into English by George Borrow in 1826); and Klingemann published in 1815 his absurd tragedy, 'the hero of which,' says Carlyle, 'is not the old Faust driven desperate by the uncertainty of human knowledge, but plain John Faust, the printer, driven desperate by an ambitious temper and a total deficiency of cash.' Heine's ballet, *Der Doctor Faust, ein Tanzpoem*, appeared in 1851, and N. Lenau's really poetical epico-dramatic *Faust* in 1836. The *Faust* made known to the English public by Henry Irving was a free adaptation of Goethe's Part I. from the pen of Mr W. G. Wills (1885). Again, librettos for operas on the subject have been written by Bernard for Spohr (1814), and by Barbier and Carré for Gounod (1859).

Of artistic representations of Faust all the world knows the fine engraving by Rembrandt. Still older are those by Christoph von Sichem. The most famous illustrations to Goethe's *Faust* have been those of Cornelius, Retzsch, Seibertz, Kaulbach, and Kreling. The first of the two ancient mural paintings in Auerbach's cellar at Leipzig represents Faust sitting at the head of the table during a revel; the second, as being by magical art carried out into the street sitting astride a wine-cask. Since Goethe's time many fresh paintings have been added to the two venerable studies, which are dated 1525.

But it is time to come to the greatest genius who has ever experienced the spell of this ancient legend. 'The marionette fable of *Faust*,' Goethe says, 'murmured with many voices in my soul. I too had wandered into every department of knowledge, and had returned early enough satisfied with the vanity of science. And life, too, I had tried under various aspects, and always came back sorrowing and unsatisfied.' Goethe had thought out his *Faust* as early as 1774, but did not publish the first part of his greatest work till 1808, the second till 1831. In his hands it has become a splendid masterpiece, the most really original, moreover, of all his works, although, indeed, in the details of the plot he has invented nothing. It will remain a magnificent

dramatic realisation of the elemental struggle between the higher and the lower natures in man. Impossible as it is to compare the English with the German *Faust*, it is still true that Marlowe's conception of the character has the stronger grasp of the actual. His Faust is always a man, real and living; Goethe's is often idealised and subtilised to the point of being a shadow, or rather a symbol.

See Sommer, in Part 42 of Ersch u. Grüber's *Encyklopädie* (1845); Düntzer, *Die Sage vom Doctor Faustus* (1846); Ristelhuber, *Faust dans l'Histoire et dans la Légende* (1863), to be read with caution; and Dr Ernest Faligan's admirable work, *Histoire de la Légende de Faust* (1888), with its excellent 'index bibliographique' (pp. 433–452). A complete special bibliography of Faust literature is Karl Engel's *Zusammenstellung der Faustschriften* (Oldenburg, 1885), containing 2714 numbers.

Faust, JOHANN, printer. See FUST.

Faustina, mother and daughter, wives of two of the noblest among the Roman emperors. The elder, Annia Galeria, usually spoken of as *Faustina Senior*, was the wife of Antoninus Pius, and died 141 A.D.; the younger, known as *Faustina Junior*, was married to his successor, Marcus Aurelius Antoninus, and died at a village near Mount Taurus in 175 A.D. Both, but particularly the younger, were notorious for the profligacy of their lives, yet after their deaths their memories were marked with signal honours by their forgiving husbands. Institutions for the relief of poor girls were founded by both emperors, and were called '*puellæ alimentariæ Faustinæ*.'

Fauvette, a name sometimes used for the birds called Warblers. See WARBLER.

Favara, a town of Sicily, 4 miles SE. of Girgenti, with sulphur-mines and marble-quarries. Pop. 15,983.

Favart, CHARLES SIMON, a French dramatist, was born at Paris, 13th November 1710, and first became known by his *La Chercheuse d'Esprit*, performed in 1741. In 1745 he became director of the *Opéra Comique*, where he and his wife (a singer and actress, who had a share in the composition of several of her husband's plays) made the first attempt to harmonise the costume of the actors and actresses with their impersonations. This excited the jealousy of the other theatres, and the *Opéra Comique* was closed in the first year of its existence. After spending some time in Flanders, with a troupe of comedians, in the army under Marshal Saxe, Favart returned to Paris and continued to write operas. He died 12th May 1792. His most celebrated pieces are *Le Coq du Village*, *Bastien et Bastienne*, *Ninette à la Cour*, *Les Trois Sultanes*, and *L'Anglais à Bordeaux*. An edition of his works in ten volumes was published at Paris in 1810; *Les Mémoires et la Correspondance de Favart*, giving delightful glimpses of the literary and theatrical world of the 18th century, was published at Paris in 1809 by his grandson.—*Madame Favart* is the subject and the title of a popular comic opera (1878) by Offenbach.

Faversham, an ancient municipal borough and river-port of Kent, 52 miles by rail ESE. of London, and 10 WNW. of Canterbury, chiefly consists of four streets forming an irregular cross. It has a valuable oyster-fishery, and sends much agricultural produce to London. The creek on which it is situated admits vessels of 200 tons. In the vicinity are important powder-mills. Pop. (1851) 4595; (1891) 10,478. Under the name of Favresfield it was a seat of the Saxon kings, where Athelstan in 930 held a Witenagemot. It has scanty remains of a Clugniac abbey founded (1147) by King Stephen, whose tomb is pointed out in the parish church. This is a fine cruciform building, Early English in style, with a spire 148 feet high. Near it is the house of 'Arden of Feversham,' whose murder by his wife in 1551 forms the theme of an anonymous tragedy (1592; edited by A. H. Bullen, 1888). A grammar-school, founded in 1527, was rebuilt outside the town in 1879. In 1688 James II. was seized at Faversham, attempting to flee to France. See local histories by Jacob (1774) and Giraud (1876).

Favre, JULES CLAUDE GABRIEL, a French advocate and statesman, was born at Lyons, 21st March 1809. He studied for the bar at Paris, and took an active part in the July revolution of 1830. As the defender of the *Mutuellistes* at Lyons in 1831, and in 1835 of those who had been impeached in April, he displayed a spirit of the most ardent and uncompromising republicanism; and in the February revolution of 1848 he wrote the notorious circular for which Ledru-Rollin's administration was so severely reproached, investing the commissioners of the republic with dictatorial authority in the provinces. On being elected deputy to the Constituent Assembly for the department of the Loire, Favre became a member of the Committee of Foreign Affairs, and advocated the prosecution of Louis Blanc. After the election of the 10th December he showed himself a persistent antagonist of Louis Napoleon, and after the flight of Ledru-Rollin became the virtual leader of the Mountain. The *coup d'état* closed his political career at this time, and compelled him to return to his profession. In 1858 he defended Orsini, on his trial for a conspiracy to murder; this procured his election as member of the Legislature for Paris, and he became one of the leaders of the republican party against Napoleon III. In September 1870, after the downfall of the empire, he was appointed minister of Foreign Affairs, and carried on negotiations, though fruitlessly, with Bismarck. But in January 1871, when settling the terms of the capitulation of the capital, he committed the very serious blunders of omitting Bourbaki's army from the armistice and allowing the National Guards of Paris, contrary to Bismarck's advice, to retain their arms, thus facilitating the outbreak of the Commune. He resigned office in July 1871, and resumed practice at the bar. Favre died at Versailles on 20th January 1880. He was greatest in political repartee, and though long accustomed to public strife, his language was noted for its Attic elegance. See Maritain, *Jules Favre, Mélanges Politiques* (1882).

Favus (Lat., 'a honeycomb'), a disease of the skin, chiefly of the hairy scalp, characterised by yellowish dry incrustations of more or less roundish form, and often cup-shaped, composed of the Sporules and Mycelia (q.v.) of a vegetable growth belonging to the order of Fungi (q.v.), with usually an unpleasant mousy odour. The discs of favus are produced with great rapidity, and spread rapidly, if not attended to at the first, over the whole scalp, destroying the bulbs of the hair, which becomes very short and thin, and then falls out altogether. Favus is a disgusting and unsightly, but hardly a dangerous disorder; it is, beyond doubt, contagious, but only spreads where cleanliness is greatly neglected, and is therefore almost unknown among the better classes. It is far more common among children than among adults, often affecting those in delicate health, and seems to be more frequent in Scotland than in England, and more frequent also on the Continent than in either England or Scotland. It seems to be gradually diminishing in frequency. On the general surface of the body it is easily cured; but on the hairy scalp its eradication is a matter of great difficulty. The treatment consists in careful removal of the crusts and scrupulous cleanliness, pulling out the hairs from affected parts by the roots, and the persevering

employment of ointments containing a parasiticide. Resorcin, a substance allied to benzoic acid, is much praised by recent writers. General tonic treatment is usually necessary. Favus, if allowed to run its course unchecked, is almost always followed by permanent baldness of the parts affected; unlike Ringworm (q.v.), which is a minor disease of the same order.

The Favus fungus, *Achorion Schœnleinii*, is nearly allied to the fungus which is so destructive to vines, and has by some botanists been placed in the same genus, Oidium.

Fawcett, HENRY, was born in 1833 at Salisbury. His father, William Fawcett (born at Kirkby Lonsdale, Westmorland, in 1793), settled at Salisbury in early life, entered into business as a draper, married (1827) Mary, daughter of Mr Cooper, solicitor of that city, and was mayor in 1832. Henry was the third of their four children. His parents took a keen and active interest in politics and were decided Liberals. In 1841 Mr W. Fawcett took a farm at Longford, near Salisbury, under the then Earl of Radnor, one of the few anti-protectionist land-owners of that time. The political and social influences under which Henry Fawcett's youth was spent deeply affected his character and aspirations. As a mere lad at school he formed the intention of entering parliament, mainly in the hope that from that vantage-ground he would be able to do something to promote the education of the people and to improve the lot of the agricultural labourer. His natural impulses were far less for a life of study than for one of outdoor exercise and field-sports, which were his principal source of pleasure throughout life. He, however, succeeded in curbing his love for them sufficiently to devote the energies of his powerful mind to win success first of all in a student's life. For it was through a successful career at school and college, and afterwards at the bar, that he hoped to reach the House of Commons. Henry Fawcett was sent in succession to Queenwood College, Hants, King's College School, and King's College, London, and in 1852 to Cambridge, where in 1856 he graduated as seventh wrangler, and was elected to a fellowship at Trinity Hall. He commenced reading for the bar, and contemporary private letters show that he kept firmly to his boyish intention to enter parliament, and to work for a better time for agricultural labourers, natives of our Indian empire, and in general for all who were 'desolate and oppressed.' He was greatly influenced at this time by the writings of John Stuart Mill, and afterwards by his personal friendship. In September 1858 an event occurred which would have crushed all heart and hope out of any less dauntless spirit. When shooting partridges on Harnham Hill, near Salisbury, shots from his father's gun entered both Fawcett's eyes, and the beautiful scene on which he had looked a moment before was blotted out for ever. With characteristic courage he at once realised and faced the extent of his misfortune, and resolved that it should not prevent him from entering parliament. He never once complained, and immediately set himself to work to adapt himself to the altered conditions of his life. He gave up the bar; he had never looked upon it as anything but a stepping-stone to the House of Commons. He now determined upon a more direct pursuit of his ultimate object. 'Blind, poor, unknown, he would force his way into the House of Commons.' His first candidature was at Southwark in November 1860. He retired before the day of the poll; but he had kept up a spirited contest for a month, and done much to remove the impression that blindness was an insuperable obstacle to a parliamentary career. His next fight was at Cambridge in January 1863, where he went to the poll, but was defeated by the Conservative candidate. About this time he brought out the result of several years' work, his *Manual of Political Economy*, a text-book based mainly on the lines laid down by Ricardo and J. S. Mill: the book has passed through a very large number of editions. The opportune appearance of this work no doubt contributed to his election to the chair of Political Economy in the university of Cambridge in the autumn of 1863, a post which he held without interruption till his death. The best known of his other writings are *The Economic Position of the British Labourer* and *Protection and Free Trade*. In 1864 he fought a contested parliamentary election at Brighton, and was defeated; but he had gained a hold on the constituency which led to his return in the general election of the following year; in June 1865 his boyish ambition was fulfilled, and he entered parliament as member for Brighton, and was again returned for the same place in 1868. In April 1867 he married Millicent, daughter of Mr Newson Garrett of Aldeburgh, Suffolk. They had one child, Philippa, born in 1868.

Henry Fawcett's candidature in his various electoral contests had not been favourably regarded by the wire-pullers of his own party; and from the beginning of his active political life he showed an independence of party ties and a disregard of party discipline which were often misconstrued as half-hearted Liberalism. His first step in the direction of political independence was joining the so-called 'Tea-room' party, which virtually insured the passing of Mr Disraeli's Household Suffrage Bill of 1867. He had pledged himself to support the extension of the suffrage, and he did not wish to refuse household suffrage because it was offered by the Conservative party. He devoted himself to urging forward measures for the abolition of religious tests at the universities, to the extension of the factory acts to agricultural children, and to the promotion of universal compulsory education. He also took up two questions with which his name will always be identified, the preservation of commons and open spaces, and the government of India and the condition of its native populations. In all these questions his chief foes were among the leaders of his own party, and the friction between him and them became so acute that the parliamentary secretaries to the Treasury ceased to count him as a member of the party. Fawcett regarded with special distrust Mr Gladstone's attitude with regard to religious tests in education. When Mr Gladstone brought forward his Irish University Bill in 1873, Fawcett offered it a most uncompromising opposition. One of its features which he most strongly condemned was contained in the so-called 'gagging' clauses, which prohibited the teaching of modern history, philosophy, and theology in the new university. The debate on the second reading resulted in the defeat of the bill by three votes, and Mr Gladstone's government received a blow from which it never rallied. After this a bill introduced by Fawcett for the abolition of tests in Trinity College, Dublin, became law. In the general election of February 1874 Fawcett lost his seat for Brighton; but his parliamentary position was now assured, and friends and foes alike deplored his absence from the House of Commons. His geniality and straightforwardness prevented him from having any personal enemies, and those who differed from him the most widely were among the most eager to welcome him back to the House of Commons. Through an informality in the Hackney election of February 1874, the seats were declared vacant, and Fawcett became member about six weeks

after his defeat at Brighton. The Liberal party having suffered a great reverse in the general election of 1874, the causes which had separated him from the official heads of his party were removed, and he joined cordially with them in opposition to the policy adopted by Lord Beaconsfield's government in reference to the Eastern Question. He continued his work for India, and was popularly known as 'the member for Hindustan.' He also pursued his efforts for the preservation of open spaces; and the retention of Epping Forest, the New Forest, and other regions of silvan beauty is a debt which the nation owes, in part at least, to the labours of one whose eyes could never behold them. While supporting the Factory Acts in their application to children, he was an opponent of legislative restrictions upon the industry of women, and a warm supporter of the claims of women to the protection of representation. He also supported various forms of proportional representation. He always took a lively interest in the welfare of Ireland, and hoped that much good would come of efforts to allay religious animosities in that country; he also looked for benefit resulting from the creation of a peasant proprietary and from the development of the industrial resources of Ireland. He never supported the Home Rule party, as he believed a separate parliament for Ireland would be injurious both to that country and to England. When Mr Gladstone was returned at the head of a large parliamentary majority in 1880, Fawcett had again been elected for Hackney by 18,366 votes against 8708 given for his opponent. Mr Gladstone offered him the Postmaster-generalship in his government, but without a seat in the cabinet. It was generally felt that his political position entitled him to cabinet rank, but fears were expressed that his blindness would render it impossible for him to guard cabinet secrets with the requisite jealousy. He accepted the decision with cheerfulness, but by no means regarded it as final.

His situation was not an easy one, for his official position prevented him from criticising the government, while he had no voice or control of any kind in the preparation of its measures. He would have found the position unbearable but for the extraordinary vigour with which he threw himself into an entirely new field of work, the administration of a great government department. Before he had been a fortnight at the Post-office he had set before himself the task of carrying out five reforms: (1) the introduction of the parcel post; (2) the introduction of postal orders; (3) a scheme for encouraging small savings; (4) the promotion of life-insurance; (5) sixpenny telegrams; and these, with the one exception of the life-insurance scheme, he was able to set on foot in such a manner as to insure their successful working. He was the antithesis of red-tape and officialism; he regarded himself and his department as nothing but the servants of the public; and every act of his official life was influenced by the conviction that his duty was to serve the convenience and interests of the public by all means in his power. He refused to regard the General Post-office simply as a department of revenue, and held that the outlying districts where the delivery of letters, &c. was a source of expense should have postal facilities granted to them out of the surplus revenue yielded by populous regions. His care for the well-being of every member of the immense staff of the Post-office (90,000 persons) was manifested in a variety of ways; he instituted an annual week's holiday for country postmen, improved the pay and conditions of employment of several branches of the service, encouraged and extended the employment of women, appointed female medical officers for the female staff in London, Liverpool, and Manchester, and extended the system of good-conduct stripes carrying an extra shilling a week with them from the town to the country letter-carriers. If the humblest employé had to be censured or dismissed, Henry Fawcett would spend hours in most careful weighing of all the evidence, and he would be completely unable to rest or think of anything personal to himself unless he were thoroughly convinced that justice had been done. This sensitiveness on his part to his duty to the public and to the well-being of his staff won him the most devoted affection in all ranks. A serious illness in 1882–83 revealed for the first time the place he had gained, not only as an upright politician but as a man, in the gratitude and affection of his countrymen and countrywomen. He seemed completely to recover; his immense frame (his height was 6 ft. 3 in.) appeared as stalwart as ever, and he took pleasure in riding, fishing, swimming, skating, &c. as of old. But the first illness had probably weakened him more than any one perceived. In the autumn of 1884 he caught a severe cold which turned to congestion of the lungs, and he died after a few days' illness, November 6, 1884. His most memorable characteristics were his chivalrous nature and his power of entering into pain and loss, as well as into pleasures which he could never share. It was this that made him the friend of women seeking to earn an honest living; of agricultural labourers going to bed at sundown because they could neither read nor write; of natives of India living on 3d. a day, and paying taxes on one of the first necessaries of life; and it was this that made him strive to preserve the open heaths and lovely forests, although his own eyes could never enjoy them. He sometimes said of himself that he had no imagination; but there were those who thought that it was a very true and rare kind of imagination which enabled him so vividly to realise what made the happiness or unhappiness of lives very far removed from his own.

He was buried at Trumpington, near Cambridge. A national memorial has been erected to him in Westminster Abbey. See Leslie Stephen's *Life of Henry Fawcett* (1885); and his article in the *Dictionary of National Biography* (vol. xviii. 1889).

Fawkes, GUY, conspirator, was born in York of Protestant parentage in 1570. Becoming a zealous Catholic before he was of age, he served in the Spanish army in the Netherlands from 1593 until 1604, when he crossed to England at Catesby's invitation. For his share in the Gunpowder Plot (q.v.) he was hanged 31st January 1606.

Fay, ANDRÁS, a Hungarian poet and author, was born on 30th May 1786 at Kohany. He was educated for the legal profession, but abandoned it for literature, writing fables, plays, romances, and tales. The fables show richness of invention, simplicity of design, and truth of character. Of the novels the most interesting are *The House of the Beltekis* (1832) and *Doctor Javor* (1855), both humorous. From 1825 to 1840 Fay was one of the chief leaders of the Liberal opposition. He was the founder of the first savings-bank at Pesth, and one of the founders of the Hungarian national theatre. His earlier works were published in eight volumes at Pesth, 1843–44, and his novels in three volumes in 1883. He died 26th July 1864.

Fayal, one of the Azores (q.v.). The island (area, 69 sq. m.; pop. 26,264) is fertile, has a mountain 3000 feet in height, and on its south-east coast a bay with good anchorage, on which stands the town of Horta.

Faye, HERVÉ AUGUSTE ETIENNE, French astronomer, born in 1814 at St-Benoît-du-Sault,

studied under Arago, and became in 1873 professor of Astronomy at the École Polytechnique, and in 1878 director of the Paris Observatory. In 1843 he discovered the comet now known as Faye's comet.

Fayetteville, capital of Cumberland county, North Carolina, at the head of navigation on the Cape Fear River, 82 miles by rail (55 direct) S. of Raleigh. It contains several cotton-mills, and exports large quantities of tar and turpentine. Pop. (1880) 3485; (1890) 4222.

Fayûm (from Egypt. *Phiom*, 'marsh-land'), a province of Egypt (pop. 160,000), consisting of a nearly circular basin or oasis, about 30 miles in diameter, or 840 sq. m. in area, sunk beneath the level of the Libyan desert, about half a degree S. of Cairo, and connected with the Nile valley by a narrow pass, through which an ancient canal (the Bahr-Yûsuf, or 'Joseph's stream,' so named after Saladin, who restored an original construction of the Theban Pharaohs) pours the fertilising water which renders the Fayyûm one of the most productive parts of Egypt. The irrigation was anciently regulated by a large reservoir, called Lake Mœris (q.v.), described by the Greeks as a work of extraordinary hydraulic ingenuity (the site of which was identified by Linant near the modern capital Medînet-el-Fayyûm, though other sites have been proposed by Mr Cope Whitehouse and others), and the overflow now forms the large sheet of brackish water, 35 miles long, known as the Birket-el-Karn, which marks the eastern boundary of the oasis. On the banks of Lake Mœris was the famous 'labyrinth,' probably built by Amenhemhat III., and reckoned one of the wonders of the world. The remains of this vast palace are seen in the ruins of numerous chambers near the brick pyramid of Hawâra. The capital of the Fayyûm was Crocodilopolis, afterwards named Arsinoë, after the queen of Ptolemy Philadelphus, near the site of which is the modern chief town (pop. 10,000). Fidimin is a picturesque village in the Fayyûm. Recent explorations by Mr Petrie and others have revealed more interesting remains of antiquity in the province than had formerly been suspected. The Fayyûm abounds in fruit, oranges, peaches, pomegranates, olives, figs, grapes, &c., and is famous for roses and other flowers. The inhabitants are chiefly agriculturists and fishermen. The fields yield splendid crops of cereals, besides rice, cotton, sugar, flax, and hemp. For an account of excavations in the Labyrinth, the ruins at Hawâra, &c., see W. M. Flinders Petrie's *Hawâra, Biahma, and Arsinoë* (1889).

Fazy, Jean James, Swiss journalist and publicist, was born at Geneva, 12th May 1796. His early life was spent in Paris, where he acted as a political journalist in the ranks of the Liberal opposition. Returning to Geneva in 1833, he founded the *Revue de Genève*, and became the leading spirit in the radical movement which resulted in the new constitution of 1846. From this latter year until 1861 he was the real ruler of Geneva, and it is due to his influence that the city has of late years been enriched with numerous fine public buildings. Fazy died on 5th November 1878. He wrote a *History of Geneva* (2 vols. 1838–40), and a *Treatise on Constitutional Legislation* (1874).

Feal and Divot (words both meaning turf), in the law of Scotland, are usually conjoined with the word Fuel, as 'Fuel, Feal and Divot,' to denote the rural servitudes which give right to the proprietor of the dominant tenement to dig and win peat and turf from the servient tenement for fuel, or for building fences, or thatching houses, or similar purposes. They involve also a right of access to the peat-ground, and a right of using the ground to dry the cut turf.

Fear. See Force and Fear.

Fear, Cape, the most southerly point of North Carolina, forms the southern extremity of Smith's Island, at the mouth of the Cape Fear River. It has a lighthouse, with a light 110 feet above the sea.—Cape Fear River, formed by the Deep and Haw rivers, runs south-east, and enters the Atlantic after a course of 250 miles, more than half of which is navigable for steamboats; it is the largest river whose course is entirely within the state.

Feasts. See Festivals.

Feather-grass (*Stipa*), a genus of grasses remarkable for the long awns which give a peculiar and very graceful appearance to the species, mostly natives of warm temperate climates, and including Esparto (q.v.). *S. pennata*, *S. capillata*, and *S. elegantissima* are favourite ornaments of gardens. When gathered before the seeds are ripe, its feathery awns remain attached, so that the tufts retain their beauty throughout winter. The feathery awns not only assist in the diffusion of the seed, which is carried by the wind to great distances, but in a very interesting manner help to fix it in the soil. Being very hygroscopic, the awn lengthens or shortens with each change of moisture, and each lengthening thus tends to push the sharp pointed grain a little into the earth, its return being prevented by barbed hairs. The awns are hence sometimes used to make rough hygrometers.

Feather River, California, a feeder of the Sacramento, rises in two forks in the Sierra Nevada, and has a southerly course of about 250 miles. It is navigable for steamboats to Marysville, and large quantities of gold have been found on its banks.

Feathers, modified outgrowths of integument, characteristic of birds, and belonging to the same series of skin-structures as the scales of fishes and reptiles and the hairs of mammals. Even Aristotle suggested the parallelism of fish-scales and bird-feathers, and modern knowledge of the development has proved the fundamental similarity or homology of all the three types of integumentary outgrowth. Feathers must have been very early acquisitions of birds, since the most ancient form we know of—Archæopteryx from Jurassic strata—already possessed them.

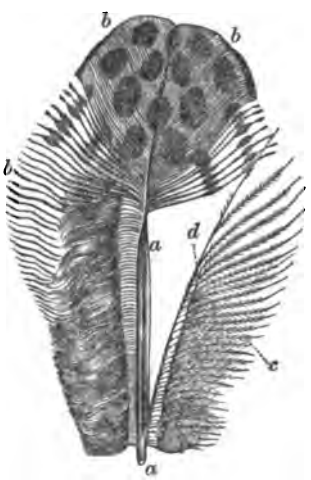


Fig. 1.—Feather from the back of *Argus giganteus*:
a, shaft (rachis); *b*, barbs forming the vexillum, removed from one side of both shaft and undershaft; *c*, barbules on the barbs; *d*, after-shaft (after Nitzsch).

Structure. — An ordinary feather exhibits two principal parts—axis and barbs. The axis is divided into a bare, hollow, inferior portion—the quill, and a barb-bearing, solid, upper part—the shaft. At its base the quill is partly imbedded in a small sac of the skin, and shows at the very end a small aperture for the entrance of the nutritive vascular pulp. The barbs or small plates, which together form the vane, are linked together by pointed lateral barbules, which may be again interlocked by minute hooklets. Each barb with

its barbules is thus itself like a little feather. In the ostrich family the barbs, though possessing barbules, are free, and the familiar loose plume results. In a great many birds the quill bears a second shaft, rising at the base of the vane. This is usually small, but in the cassowaries and a few other birds main shaft and 'aftershaft' are almost equal, and the feather is thus distinctly double.

Relation to the Skin.—Only in a few birds—e.g. the ostrich tribe and the penguins—do the feathers occur all over the surface; usually they are restricted to 'feather-tracts' between which the skin is bare or at most downy. Each feather is imbedded in a sac, readily obvious on a plucked bird, and with this sac are associated muscle fibres, more or less abundant, serving to erect the feather. Unlike hairs, feathers have no sebaceous glands associated with them; they are, however, anointed by the secretion of the 'preen-gland' on the tail.

Kinds of Feathers.—The most conspicuous feathers clothing a bird are such as have been above described—'contour feathers,' or *pennæ*. Among these, however, there are down-feathers or plumes, in which the barbs remain soft and free from one another. These are the first feathers, for a time abundant on young birds, but gradually for the most part ousted and replaced by the ordinary forms. Besides these are still simpler and smaller feathers with a long shaft and a rudimentary brush of barbs—the 'filoplumes.' In addition to these common forms there are numerous peculiar modifications of restricted occurrence. Thus, in herons and some other birds small down-feathers occur, 'the summits of which break off into a fine dust or powder as fast as they are formed,' and give rise on certain parts of the skin to 'powder-down patches.' In many aquatic birds an almost fur-like down is very common, the minute component feathers having only a slight development of shaft. In great contrast are a few strong quills on the cassowary's wing, where the long shaft is quite destitute of barbs.

Development.—The cells of the under-skin or dermis multiply and push out the epidermis into a papilla. As the papilla elongates into a cone, its

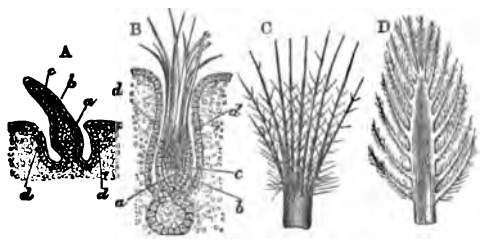


Fig. 2.—The Development of a Feather (from Wiedersheim and Parker, mainly after Studer):

A, an early stage of the feather papilla and follicle: B, the papilla breaking up into a tuft of barbs; C, the quill and primary rays or barbs, with indications of barbules; D, the thickening of one of the rays to form the stem of the vane. *a*, pulp of dermis; *b*, outer or horny layer of epidermis; *c*, inner or Malpighian layer of epidermis; *d*, feather-follicle.

base sinks and becomes surrounded by a moat-like depression, the feather-follicle or sac. The core of the cone, consisting of dermis, is a nutritive pulp; the sheath of the cone, consisting of epidermis, forms the feather. But here as elsewhere the epidermis has two layers—an outer or horny, an inner or Malpighian stratum (see SKIN). The inner layer forms the real feather; the outer layer is only a protective sheath which is eventually shed. 'The cells of the Malpighian layer multiply rapidly, giving rise to a series of radial folds along a central axis, which extend inwards towards the pulp, and are externally bounded by the horny layer. These folds then become cornified and separated from the surrounding cells, and by a gradual drying of the central pulp-substance give rise to a tuft of horny rays, which are, however, at first bound together by the enclosing outer layer.' After hatching, the sheath is shed and the barbs set free; the undivided lower part remains as the quill; the barbs develop barbules; the result is an embryonic down-feather.

The more permanent feathers have an essentially similar history. From the base of the first follicle a second is formed; the growing papilla within the latter ousts the embryonic feather and replaces it; one of the rays formed as above described 'becomes rapidly thickened, and forms the main axis or stem, to which the barbs are attached on each side.' The result is an ordinary penna or contour-feather.

Growth and Shedding.—When in process of formation, feathers are of course genuinely alive; the vascular nutrient core of dermis keeps up the supply. They grow with great rapidity, and in some birds attain a length of more than two feet. When fully formed, however, the pulp dries and shrivels, and the feathers become virtually dead from tip to base. They usually last only one year, being replaced by a fresh growth, which generally occurs at the end of the reproductive period. This process of moulting is in a general way equivalent to the 'skin-casting' of reptiles and the shedding of hair in mammals, but its physiology is not yet understood. Involving no little expenditure of vital energy, generally occurring after the already severe strain of reproduction, brooding, and parental care, moulting is frequently associated with mortality, but when successfully accomplished is obviously of great advantage in repairing the injuries of the past and in equipping the birds afresh for migratory flight or the ordinary business of life (see BIRD).

Colour.—Feathers excel hairs and scales in the richness and variety of their colouring. This is usually most prominent in the male birds, but is emphasised in many cases only when sexual maturity is attained. Very often the bright colouring is acquired along with other decorations in a spring moult before the breeding period. The colour is due to the presence of pigment, but is greatly enhanced by physical peculiarities, such as markings on the barbs and the occurrence of air-spaces (see PIGMENTS).

In regard to the general physiology of feathers but little can be said. Their utility as a clothing for the skin and as organs of flight is evident enough, but the conditions determining the historic and individual development of these most highly-evolved skin-structures are quite obscure. It is noteworthy, however, that this climax of integumentary outgrowth occurs in animals living a very active life, with the highest body-temperature, and with peculiarly thin skin almost devoid of the usual glands.

Industrial Uses.—Feathers are still largely used as Quills (q.v.) for writing, for holding the sable hairs of artists' brushes, and for toothpicks. Much more important is their use for stuffing beds, quilts, and cushions, when dried and cleaned; the feathers and down of the Eider-duck (q.v.) being most highly esteemed, and after them those of geese, swans, and poultry. The feathers of most kinds of birds are used for personal ornament, often after being washed, bleached, dyed, curled, or made up. Ostrich (q.v.) feathers are the most notable for ornamental purposes, and it is for its feathers alone that it is reared. Other feathers for various kinds of ornament are those of the American ostrich or

rhea, adjutant, bird of paradise, humming-bird, albatross, grebe, and penguin (see the articles on these various birds). The value of ornamental feathers and bird skins imported into the United Kingdom increased from £800,000 in 1875 to over £2,000,000 by 1885. Feathers are often wrought into ingenious artificial flowers.

See BIRD, FLIGHT, HAIR, PIGMENTS, SKIN. Nitzsch, *Pterylography*, trans. by Sclater, Ray Soc. (1867); R. Wiedersheim and W. N. Parker, *Comparative Anatomy of Vertebrates* (Lond. 1886); Huxley, 'Tegumentary Organs,' Todd's *Cyclop.* vol. v. (1859); T. Studer (Development), *Zeitschr. wiss. Zool.* vol. xxx.

Febrifuge (Lat. *febris*, 'a fever,' and *fugo*, 'I drive away'), a medicine calculated to remove or cut short Fever (q.v.).

Febronianism, a system of doctrine antagonistic to the claims of the Roman pontiff and asserting the independence of national churches, propounded in 1763 by Johann Nikolaus von Hontheim (q.v.), under the pseudonym 'Justinus Febronius.'

February, the second month of the year, contains in ordinary years 28 days, but in leap-year it has an additional or intercalary day. Until the time of the Decemvirs it was the last month of the Roman year. Its name was due to the fact that during this month (15th) was held the *Lupercalia* (q.v.) or *Februa*, the great feast of expiation and purification. The word *februum* ('a means of purification') appears to have been of Sabine origin.

Fécamp, a manufacturing town and seaport in the French department of Seine-Inférieure, is situated in a narrow valley, flanked on either side by steep cliffs, at the mouth of a little stream, 28 miles NNE. of Havre by rail. It consists mainly of one long street, and has a fine abbey church (*c.* 1220) in the Early Pointed style, rich in painted glass, monuments, and carved woodwork. The harbour is frequented by colliers from Newcastle and Sunderland, by Baltic timber-ships, and by fishing-vessels. Fécamp has cotton-mills, sugar-refineries, tanneries, shipbuilding-yards, and some linen-cloth and hardware manufactures. Pop. (1872) 12,651; (1886) 12,487; (1891) 12,688.

Fechner, GUSTAV THEODOR, one of the principal German writers on the subject of psycho-physics, or the relations and laws that obtain between the mental and the physical sides of man's nature, was born at Gross-Särchen in Lower Lusatia, 19th April 1801. After studying physics at Leipzig, he became professor of the sciences comprehended under that name in the same university in 1834, his labours being principally devoted to galvanism, electro-chemistry, and the theory of colour. Five years later, however, in consequence of a disease of the eyes, he abandoned these branches for that of philosophy and psycho-physics. His most important book on this subject is *Elemente der Psychophysik* (2 vols. 1860), whilst on galvanism he wrote *Massbestimmungen über die galvanische Kette* (1831), and brought out an enlarged translation of Biot's *Handbook of Experimental Physics* (5 vols. 1828–29). Besides these he wrote some books on belief and on the soul, and under the pen-name of Dr Mises published a number of smaller miscellaneous works, including a volume of *Humorous Essays* (1824) and another of *Poems* (1842). In *Mind* for 1876 will be found a paper on Fechner's psycho-physical law by James Ward. Fechner died 18th November 1887.

Fechter, CHARLES ALBERT, an actor of eminence, was born in London, 23d October 1823, his father being a Frenchman of German extraction, his mother an Englishwoman. When only three or four years old he went with his parents to France, and was there educated as a sculptor. His predilections were, however, in favour of the stage; and, making his *début* in 1840, he soon became a popular actor. In 1860 he appeared in London with great success in an English version of *Ruy Blas*, and next year astonished Londoners by his powerful impersonations of Hamlet and of Othello, departing widely from stage traditions. Subsequently Fechter became the lessee of the Lyceum Theatre, playing the chief part in most of the pieces produced. In 1869 and 1872 Fechter paid visits to the United States, where he thenceforward remained. He was not successful as a manager in Boston. He died at his farm near Quakertown, Pennsylvania, 5th August 1879.

Fecundation. See FERTILISATION.

Federalists, a political party formed in the United States in 1788, whose members claimed to be the defenders of the constitution and of the federal government, in opposition to the Republicans or Democrats (q.v.), whom they dubbed Anti-federalists. Besides Washington and John Adams, Hamilton, Jay, and Marshall were among its leaders. Its fate was sealed by the holding of the Hartford Convention (q.v.), and by 1820 the Federalists, as a national party, had disappeared.

Federation. When several states, otherwise independent, bind themselves together by a treaty, so as to present to the external world the aspect of a single state, without wholly renouncing their individual powers of internal self-government, they are said to form a Federation. The contracting parties are sovereign states acting through their representatives; and the extent to which the central overrules the local legislatures is fixed by the terms of the contract. In so far as the local sovereignty is renounced, and the central power becomes sovereign within the limits of the federated states, the federation approaches to the character of a Union; and the only renunciation of sovereignty which a federation as such necessarily implies consists in abandoning the power which each separate state otherwise would possess of forming independent relations with foreign states. 'There are,' says Mr Mill, 'two different modes of organising a federal union. The federal authorities may represent the governments solely, and their acts may be obligatory only on the governments as such, or they may have the power of enacting laws and issuing orders which are binding directly on individual citizens.' The former was the plan of the German so-called confederation, and of the Swiss constitution previous to 1847. 'The other principle is that of the existing constitution of the United States, and has been adopted by the Swiss confederacy. The federal congress of the American Union is a substantive part of the government of every individual state. Within the limits of its attributions, it makes laws which are obeyed by every citizen individually, executes them through its own officers, and enforces them by its own tribunals. This is the only principle which has been found or which is even likely to produce an effective federal government. A union between the governments only is a mere alliance, and subject to all the contingencies which render alliances precarious.' Federalism is opposed to Centralisation (q.v.). See GOVERNMENT, and UNITED STATES; and for schemes of federating the British colonies in an imperial confederation, see COLONY.

Fee; Fee-simple and **Fee-tail.** The term fee is derived from *feudum*, a feudal holding; but in English law it has now no reference to tenure; fee means an estate of inheritance in land. The person who has the fee is entitled not only to the annual profits, but also to the corpus of the land; he may sell or otherwise dispose of it, and he may commit acts of waste, which impair its permanent value. If he dies owner in fee, the land will go to his heirs

or to the person entitled under his will (in legal phrase, the devisee). If a man holds 'to him and his heirs,' he is owner in fee-simple; he has the largest estate known to the law. But a fee-simple may be made *determinable*, as if land be given 'to A and his heirs, lords of the manor of Dale;' in this case, if A or any of his heirs ceases to be lord of that manor, the estate, and all interests derived from the owner of the estate, will come to an end. A fee-simple may also be made *conditional*, to vest only on the happening of an event. In early times, if land was given 'to A and the heirs of his body,' or 'to A, if he shall have an heir of his body,' the judges held that the fee was conditional; as soon as the condition was fulfilled (as soon, that is, as a child was born to A), the donee became owner in fee-simple, with full power to alienate the estate. In 1285 the lords and great men of the kingdom procured an act, commonly known as the statute *De Donis Conditionalibus*, whereby it was provided that in such cases the land should descend to the heirs of the body, according to the form of the gift. The statute therefore restricted the right of alienation, and limited the succession to a particular class of heirs. An estate given with words limiting it to heirs of the body was therefore called a fee-tail (*taillé*, 'cut down or limited'). The strict rules of the statute remained in force until means were devised for breaking entails. See ENTAIL. It is to be observed that, when heirs are mentioned in limiting an estate, the heirs themselves take nothing directly; thus, an estate given to A and his heirs means simply an estate of inheritance given to A. If land be granted to A and his heirs in trust for B and his heirs, the legal fee is in A the trustee, and the equitable fee in B the beneficial owner. An estate in fee may be given by will without technical words of limitation; but in a deed it is necessary to mention heirs or heirs of the body, or to use the words 'in fee-simple,' or the words 'in tail.'

In Scotland the term fee signifies the property in land granted to be held by feudal services. *Fee* is also used as a correlative to *liferent*, to signify the corpus or full ownership of land or money. In some cases the fee is vested in a person whose beneficial interest does not extend beyond his life; his 'fiduciary fee' corresponds to the 'legal fee' of English law.

Feeling. See EMOTION.

Fees. Neither a barrister nor an advocate can take legal proceedings against his client for the recovery of his fees, even under a special contract. The case of Kennedy *v.* Broun (13 *Common Bench Reports*, N.S., p. 677) clearly established this doctrine: 'The relation of counsel and client,' it was laid down, 'renders the parties mutually incapable of making any legal contract of hiring and service concerning advocacy in litigation.' There is nothing, however, to prevent an advocate recovering fees earned by him, by the exercise of his professional knowledge where the relation of counsel and client did not exist between the contracting parties—e.g. by acting as arbitrator or returning officer. There is some, but not strong, authority for the proposition that an express promise to pay fees might be enforced by a barrister against a solicitor who had actually received them from the client. On the other hand, a solicitor is entitled under his general retainer to employ and pay counsel; and fees so paid can be recovered by the solicitor from his client, or from an unsuccessful adversary. No action lies to recover back fees given to a barrister to argue a cause which he did not attend. Special pleaders, equity draftsmen, and conveyancers who have taken out certificates to practise under the bar, and are not therefore counsel, may recover their reasonable charges for business done by them. Barristers' and advocates' fees are paid before being earned. This rule, by removing from members of the bar all pecuniary interest in the issue of suits, has done much to maintain its independence and integrity.

In the United States the two branches of the legal profession are not separated as in England. A barrister is entitled to recover his fees, and is liable to be sued for professional incompetency or negligence. Nor is there anything illegal or improper in an American counsel agreeing to let the payment of a fee by a poor client depend on the issue of his action.

In France an action by a barrister for his fees is maintainable, but in most of the French bars such a proceeding is rigorously discountenanced, and in Paris it would lead to disbarment. The fees of French advocates are now usually paid in advance, and any bargain between an advocate and his client which made the amount depend upon the issue of an action would be regarded as most dishonourable.

The theory that an advocate's services ought to be given gratuitously arose at Rome. To defend his client was one of the duties incumbent upon a patron, and it was all the more readily and faithfully discharged when forensic eloquence was perceived to be an avenue to political power. The Cincian law (204 B.C.), in which the receipt of pecuniary reward by an advocate was simply prohibited, gave expression to the prevalent public feeling upon the subject at this time. The Cincian law was first systematically evaded, and was then practically repealed by a decree of the Emperor Claudius, which limited the maximum fee which an advocate might receive to 10 sestertia (about £78). The old Roman idea that the gifts of eloquence and persuasion should not be sold has made itself felt in the restrictions imposed by law or custom upon an advocate's power to bargain for fees or to secure their payment.

By the common law of England, a physician could not recover his fees by an action at law; but this rule was repealed in 1849.

The members of the inferior branches of both professions, such as solicitors, apothecaries, and dentists, have never been prevented by any rule of law from taking legal proceedings for the recovery of their charges.

Fehrbellin, a town of Prussia, with 1920 inhabitants, 40 miles NW. of Berlin by rail. Here on 28th June 1675 the Swedes under Wrangel were disastrously defeated by the Great Elector, Frederick William, with a loss of 2100 men. A tower (1875–79) marks the battlefield.

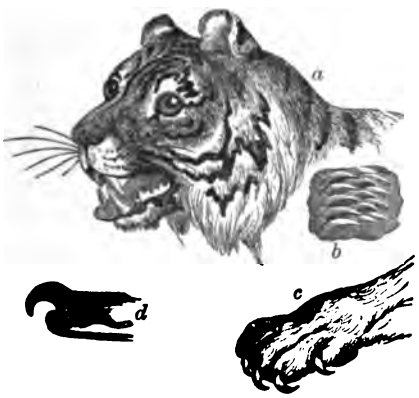
Feith, RHIJNVIS, a Dutch poet, was born 7th February 1753, at Zwolle, in Overyssel. He studied law at Leyden and settled in 1772 at his native place, of which he became mayor in 1780, and where he died on 8th February 1824. Feith tried almost all kinds of poetry. In 1792 appeared *Het Graf* ('The Tomb'), a didactic though sentimental poem; in 1802, *De Ouderdom* ('Old Age'); in 1796–1810, four vols. of lyrical pieces marked by a high enthusiasm and warmth of feeling. Of his tragedies the best known are *Thirza* (1784), *Johanna Gray* (1791), and *Ines de Castro* (1793). Of Feith's prose works the most important are his *Brieven* ('Letters on Different Subjects,' 6 vols. Amst. 1784–94), which by their polished style and refined criticism did much to improve the literary taste of Holland. His complete works (1824) fill 11 vols.

Felaniche, or FELANITX, a well-built town of the island of Majorca, is situated in a mountain-girdled valley, which produces wine. The making of water-jars and brandy-distilling are carried on, and wine is exported. Pop. 11,018.

Felegyhaza, a town of Hungary, 80 miles SE. of Pesth by rail, has an extensive trade in grain, fruit, wine, tobacco, and cattle. Destroyed by the Turks in the 17th century, it was not rebuilt until 1743. Pop. 23,912.

Felidæ, a family of carnivores in the digitigrade or æluroid section, corresponding to the genus Felis of Linnæus, and to what we commonly call the cat tribe. They include the most carnivorous of Carnivora, excelling the less specialised forms, just as falcons and eagles are in a similar direction more perfect than many other less predacious birds. Their chief characteristics of habit and structure may be taken together, being obviously complementary.

Conspicuous for their muscular development, they express this most characteristically in the sudden leaps and bounds to which they trust after stalking their prey with all the cunning of true hunters. They crawl stealthily on noiseless, velvety paws, or patiently lurk for passing victims; at the fit moment occurs a sudden, almost explosive, output of reserved energy, a great bound, a yell inspiring terror, a blow or two with the powerful forelimbs, and the sharp canines and sharper retractile claws begin their murderous work on the struggling prey. With the exception of the lion, the Felidæ are more or less arboreal, and make good climbers.



Characteristic Features of the Felidæ:

a, tiger's head; *b*, portion of tongue; *c*, right fore-paw, showing claws; *d*, claw, showing tendons. For dentition, see article CARNIVORA.

The body is rather long, and very lithe and graceful; the limbs are rather short, except in cheetahs and lynxes; the tail varies from a long appendage to a mere stump. They are the most digitigrade of carnivores—i.e. they walk on the tips of their (five) fingers and (four) toes. Under a glove of velvet they have claws of iron—strong, much curved, very sharp, and retractile; withdrawn by special muscles and ligaments into sheaths when not in use, and their points even turned upwards, so that they are not blunted by unnecessary friction, and do not interfere with the movements of the animal by hooking objects which are in the way. The collar-bones or clavicles, though unattached to shoulder or sternum, are better developed than in other carnivores.

The Felidæ never bury or store their dead prey, but often drag it off to some place of shelter, and in so doing exhibit enormous strength. The leaps a lion can take with a mouthful half as big as itself are herculean marvels. Besides the strength of grip, the powers of rending and mastication are equally well developed. Thus, we find a skull which tends to be short, broad, and rounded, with large posterior ridges for the fixing of muscles, and with a wide cheek (zygomatic) arch in which lie the relatively enormous muscles working the jaws. The latter form powerful short levers, and the articulation is such that only an up and down, and no rotatory, motion is possible.

The teeth are well adapted for their work, the chief features in the dentition being the large size, strength, and sharpness of the canines, and the two specially adapted cutting teeth ('carnassials' or 'sectorials')—viz. the last premolar above and the single molar below, which are both compressed into sharp blades. The front teeth are relatively small, and so, but more markedly, is the molar on the upper jaw. The numerical relations of the teeth may be summed up in the formula $\frac{3131}{3121} = 30$. The well-known character of the tongue, most conveniently exemplified in the cat, is also to be associated, as far as utility is concerned, with the carnivorous diet. It is thickly covered with sharp, recurved, horny papillæ, strong enough to rasp off the skin and draw blood from the hand, and obviously useful in clearing the flesh off the bones of victims. As is usual in carnivorous animals, the cæcum of the intestine is small and simple. The food varies widely, from the large ruminants attacked by lions and tigers to the mice for which cats hunt. Some of the large forms are said to develop a special partiality for human flesh; some of the smaller do not disdain to eat big insects. In attack the Felidæ often exhibit a wise discretion in seeking to avoid a fair fight with large animals.

Many members of the family have exceedingly beautiful fur, soft and glossy in texture, generally striped and spotted according to the varied pigmenting of the hairs. The markings in some may be regarded as protective; thus, the stripes of the tiger 'assimilate,' according to Wallace, 'with the vertical stems of the bamboo,' and the spots of the leopard are suited to the interrupted light of the jungle. It seems also true, as Eimer has emphasised, that the markings illustrate definite rhythms of development, and exhibit an orderly progression both in the individual and in a series of related forms. They are in fact, here as elsewhere, external indices to constitutional changes. The colour-differences between the sexes are seldom marked, though they are distinct in the Ocelot (*Felis pardalis*) and a few other forms. The male lion, stronger and larger than the female, is distinguished by his mane, which appears to have protective as well as decorative value. The male Canadian Lynx (*F. canadensis*) also excels his mate in the development of a ruff round the neck. The Felidæ are very cleanly, taking pains to keep their fur in order, and are free from unpleasant smells. They have, however, a notorious dislike to water.

As one would expect from their habits, the senses of Felidæ are highly developed. Keen scent; quick sight, especially for near objects, and well suited for night-work; acute hearing, and great power of localising sounds; and a delicate tactile sensibility in the strong hairs of the moustache or whiskers, are characteristic. The eyes are large, and possess marked powers of accommodation to different quantities of light; the pupillary opening is rapidly altered, contracting in bright light to a narrow slit, though in some forms into the usual circular shape. The animals generally hunt at night, and then their eyes seem to 'burn brightly.' The ears are of moderate size, usually pointed, and mobile.

The intelligence of the family is certainly highly developed, and many of the members can be readily tamed when young, though a deeply ingrained wildness keeps the domesticated cat or tamed individuals of other species from exhibiting the

marvellous educational results familiar in dogs. They are not social animals, never hunting in troops, and even the males and females usually live apart except at the breeding season. In spite of the individualism and ferocity of the Felidæ, maternal care and affection are exhibited in a high degree. Not only will a lioness robbed of her cubs risk her life to rescue them, but the habitual care is tender and lavish.

The wild Felidæ seem to be less prolific than the Canidæ, two or three at a birth being an average number. There are usually eight teats, lying on the breast and the abdomen.

While the above are the chief characteristics of Felidæ, it is necessary also to notice that the family is separated from the adjacent civets (Viverridæ) and hyænas (Hyænidæ) by technical details such as the reduction of molars to one above and one below in each jaw, the presence of only two inferior premolars, the division of the bony auditory prominence or tympanic bulla into two chambers, the number (thirteen) of dorsal vertebræ, and so on.

The Felidæ are almost world-wide in distribution, absent only from the Australian region, Madagascar, and the Antilles. They are especially abundant in warmer climates. In the Old World, Lion (*Felis leo*), Tiger (*F. tigris*), Leopard or Panther (*F. pardus*), Ounce (*F. uncia*), Wild Cat (*F. catus*) are well-known species; while in the New World may be noted the Puma (*F. concolor*), the Jaguar (*F. onca*), and the Ocelot (*F. pardalis*). The Lynx (*F. lyncus*) is probably common to both hemispheres. The Cheetah or Hunting Leopard is sometimes placed in a separate genus, Cynælurus.

Numerous Felidæ occur in Tertiary strata, many quite like species now alive, others with more numerous and less carnivorous teeth, others again (e.g. Smilodon, Machærodus, and especially Eusmilus) with much greater development of upper canines than in modern forms. Through extinct American genera like Nimravus, Professor Cope traces back the modern Felidæ to a race of primitive unspecialised cats. So far as natural selection means the destructive elimination of one animal by another, the Felidæ must rank high as agents in the process, and it is at least certain that their abundant presence must exert an often wholesome restraining influence on many more prolific animals. See CARNIVORA, CAT, CHEETAH, JAGUAR, LEOPARD, LION, LYNX, OCELOT, OUNCE, PUMA, TIGER, &c.

Felix, ANTONIUS, or CLAUDIUS, a Roman procurator of Judæa in the time of the apostle Paul, was a freedman of the Emperor Claudius I. and was brother of his favourite Pallas. The circumstances under which he received his appointment are related differently by Tacitus and Josephus. The latter tells us that he cleared the country of robbers, and vigorously suppressed the chaotic seditions of the Jews; but his cruelty, lust, and greed were unbounded. His wife was Drusilla, a beautiful but renegade Jewess, whom he had induced to abandon her first husband. According to Tacitus, she was a granddaughter of Antony and Cleopatra. We read in Acts (xxiv. 25) that Felix trembled as Paul reasoned of 'righteousness, temperance, and judgment to come.' He was recalled to Rome, 62 A.D., on account of the accusations preferred against him by the influential Jews of Cæsarea, and narrowly escaped the sentence of death.

Felix I.-IV., POPES. FELIX I. succeeded Dionysius in the see of Rome in 269. Little is known of his history, for though he has been put amongst the martyrs there is no early evidence as to the manner of his death. Felix II. was the first antipope (see ANTIPOPE), being consecrated when Liberius was banished (356) for refusing to condemn Athanasius. When Liberius was restored in the following year, Felix was constrained to retire from the city. Most ancient authorities treat him as an unauthorised interloper; but he was ultimately regarded as a saint and martyr (on what evidence does not appear).—FELIX III. ascended the pontifical throne in 483 as the successor of Simplicius. He was a native of Rome, and of the family from which afterwards sprung Pope Gregory the Great. Immediately after his accession Felix repudiated the Henoticon or Decree of Union between the Eastern Church and the Monophysites proclaimed by the Emperor Zeno, and proceeded to excommunicate Acacius, patriarch of Constantinople, because he refused to do the same, thus originating the first disruption between the churches of the East and West, a breach which on this occasion lasted thirty-four years. Felix died 24th February 492, and was succeeded by Gelasius.—FELIX IV., a native of Benevento, succeeded John I. in 526. He was appointed by Theodoric, and failed to meet with the approval of the clergy and the people. He died in 530. His successor was Boniface II.—FELIX V. (antipope). See AMADEUS (VIII. of Savoy).

Felix, ST, with his sister and fellow-sufferer Regula, the patron saints of the city of Zurich and its cathedrals. Early in the 3d century he preached Christ there, and was beheaded on the site of the great cathedral. His day is the 11th September.

Felixians, a Spanish sect of the later part of the 8th century, so called from Felix, Bishop of Urgel. See ADOPTIANISM.

Felixstowe, a coast-village of Suffolk, with a railway station (1 mile off) 9½ miles SE. of Ipswich. It is named from a priory (1105), dedicated to St Felix, a Burgundian, who from 631 to 647 was first bishop of Dunwich. With a fine beach for bathing, a pier, good golf-links, and many Roman remains near by, the place is rapidly becoming a popular seaside resort. Pop. 864; with it is now joined Walton, 1 mile to the west (pop. 1272).

Fell (Norw. *fjeld*, Swed. *fjäll*), the name given in Scandinavia to the bare plateaus which occur in its mountainous regions; they are destitute of vegetation, and generally lie above the snow-line. The word enters as a component into the names of innumerable mountains, owing to the fact that in their formation they have taken on the shape of a fell. Fell is also used in the north of England and south of Scotland to designate a barren hill, and indicates Scandinavian settlements.

Fell, JOHN, Dean of Christ Church and Bishop of Oxford, was born most probably in 1625, his father, Dr Samuel Fell, being also Dean of Christ Church, of which the boy became a student at the age of eleven. He volunteered for the king, and with Wallis and two others contrived to maintain Church of England services during the Commonwealth; at the Restoration he was rewarded by being made Canon and four months later Dean of Christ Church, royal chaplain, and D.D. He governed the college strictly, restored its buildings, reformed its discipline, and himself attended divine service four times a day. He was liberal of his money to public purposes and the necessities of poor scholars, and did much to promote learning and the advancement of knowledge. In 1676 he became Bishop of Oxford, without, however, giving up his deanery. He rebuilt the episcopal palace at Cuddesdon, and died in 1686. His works no longer concern the world, but his name lives in the well-known proverb: 'I do not like thee, Doctor Fell, the reason why I cannot tell,' usually said to be a paraphrase made by Tom Brown,

when a student at Christ Church, from Martial's 'Non amo te, Sabidi,' but more likely to be rather his paraphrase of the following version of Martial in Thomas Forde's *Virtus Redviva* (1661): 'I love thee not, Nel! but why, I can't tell.'

Fellâh (pl. FELLÂHÎN), an Arabic word meaning 'tiller' of the soil, specially applied to the agricultural or labouring population of Egypt by the Turks, in a contemptuous sense, as 'yokels,' or 'boors.' They form the great bulk of the population, and are descendants of the ancient Egyptians, intermingled with Syrians, Arabs, and other races which have been converted to Islam. In their physical conformation and features they differ among themselves, those of the northern provinces of the Mediterranean being of whiter hue, while at Assouân they are almost black. They are described as of middle stature, with large skull, facial angle almost 90 degrees, oval face, arched eyebrows, deep dark eyes, large, well-formed mouth, with rather thick lips, thin beard, short nose, large chest, small belly, arched back, and small hands and feet. Their dress generally consists of a blue or brown cotton smock and linen drawers. On their shaven head they wear the *tarbûsh*, or only a thin cotton cap, but the better-off wind a poor turban round it. The women are singularly graceful and slender, with beautiful skin (despite their tatooing) and often lovely features, and especially magnificent eyes; their dress is a single cotton smock, which they pull up over their mouth before men, and few wear the regular face-veil. They are often married at eleven years, become mothers at twelve, and grandmothers at twenty-four. The children are pot-bellied, dirty, and fly-bitten, but grow up straight, strong, and healthy. Their villages are mere groups of mud-hovels. The food of the Fellâhîn consists almost entirely of vegetables, chiefly millet bread and beans, which they eat in a crude state. Even rice is too dear for them, and animal food seldom attainable. Their drink is limited to the water of the Nile and coffee, and the only luxury which they enjoy is the green tobacco of the country; yet on this diet they are robust and healthy, and capable of extraordinary labour and endurance. In their social position they are inferior to the Bedouin, who, although they will marry the daughters of the Fellâhîn, will not give to them their own in marriage. They exhibit the moral qualities of the ancient Egyptians—are intelligent, docile, pliable, cheerful, and sober on the one hand, and quarrelsome, satirical, licentious, and of unbending obstinacy on the other; and they inherit the traditional hatred of their ancestors to the payment of taxes, which were formerly too often extorted by the bastinado. Their condition under British direction has improved, but is still far from satisfactory. Each village is governed by a Sheykh-el-Beled, who is responsible to the Nâzirs and Mamûrs, or district officials, for the conduct of the inhabitants and their due payment of taxes; and the government of these several officers is frequently characterised by injustice, peculation, and extortion. The political rights recently accorded to the Fellâhîn are apparently but little understood or exercised. See Lane, *Manners and Customs of Modern Egyptians*; Clot Bey, *Aperçu générale*; Lane-Poole, *Egypt*.

Fellows, SIR CHARLES, English archæologist, was born at Nottingham in 1799. Devoting himself to the work of exploration in the western peninsula of Asia Minor, and along the course of the ancient Xanthus, he discovered (1838) the ruins of the city of Xanthus, formerly the capital of Lycia, and those of the ancient Tlos. Having made drawings of some of the fine remains of architecture and sculpture which he found in these cities, and copies of some of the inscriptions, Fellows returned to England, and published *A Journal written during an Excursion in Asia Minor* (1839). In the course of another visit to Lycia in 1839 he discovered the ruins of no less than thirteen cities, each of which contained works of art, and which he described in *An Account of Discoveries in Lycia* (1841). Under the auspices of the British Museum, Fellows went out to Lycia twice, in 1841–44, for the purpose of selecting works of art, and marbles and casts, from the cities he had discovered. Knighted in 1845, he died at Nottingham, 8th November 1860. Besides his *Journals*, he wrote *The Xanthian Marbles* (1843), *An Account of the Ionic Trophy Monument excavated at Xanthus* (1848), and *Coins of Ancient Lycia before the Reign of Alexander; with an Essay on the Lycian Monuments in the British Museum* (1855).

Fellowship, in a college, is a foundation which usually entitles the holder to be a member of the college, to share in its revenues and government, and, in Oxford and Cambridge, to have rooms in college, with other privileges. Celibacy was usually insisted on in old days, and life fellowships were usual. Commonly now fellowships are for a term of years, or while the fellow continues to perform specified work. In some universities, such as those of Scotland, the fellowship is a university prize for one or more years, bestowed after examination on graduates. See UNIVERSITIES, OXFORD, CAMBRIDGE.

Felo de se. See SUICIDE.

Felon and Felony. The Old Fr. *felon* was derived from a Low Lat. *felo*, *fello*, 'a traitor,' a word probably of Celtic origin (cf. Gaelic *feallan*, 'a traitor'), but ultimately cognate with Lat. *fallere* and Eng. *fail*. Its original signification was supposed to be a vassal who failed in his fidelity or allegiance to his superior, thus committing an offence by which he forfeited his fee or feud. From this it came to signify traitorous or rebellious, and was gradually generalised till it reached its modern meaning. In English text-books felony is usually defined as a crime which works a forfeiture of land or goods. Treason itself, says Coke, was comprised under the name of felony, and all capital offences; also such offences as suicide, manslaughter, and larceny, 'as they submit the committers of them to forfeitures.' At the present day it is not possible to draw any logical and consistent distinction between those crimes which are called felonies and those which are called misdemeanours. Sir J. F. Stephen, in his *History of the Criminal Law*, has pointed out that the distinction is obsolete; and, if parliament should ever find time to recast the criminal law in general principles, the term will probably disappear. The general principles of American law are the same as those of English law. In Scotch law the term felony has not now any special significance. See COMPOUNDING OF FELONY, and FORFEITURE.

Felsite, a fine-grained, compact, or cryptocrystalline rock composed essentially of 'felsite matter,' which appears to be an intimate admixture of orthoclase and quartz. This rock is now recognised as only a variety of quartz-porphyry.

Felspar (Ger. *Feldspath*, 'field-spar'), a general term in mineralogy for the most important rock-forming group of minerals. The felspars are usually divided into two series—in one of which the minerals crystallise in monoclinic forms, and in the other in triclinic forms. They are all anhydrous silicates of alumina, containing either potash, soda, or lime alone, or two of those bases together. Thus they are often spoken of as potash-, soda-, lime-, soda-lime-felspars, &c. They have a hardness

between 6 and 7—that is to say, they can just be scratched with a good penknife. Their specific gravity is about 2·6. The most important felspars are shown in the following table:

		Silica percentage.
Monoclinic....	Orthoclase (potash-felspar).....	64·68
Triclinic....	Microcline (potash-felspar).....	64·68
	Albite (soda-felspar).....	68·62
	Oligoclase (soda-lime-felspar)...	61·9—68
	Andesine (soda-lime-felspar).....	55·4—61·9
	Labradorite (lime-soda-felspar)..	61·9
	Anorthite (lime-felspar).....	43

Orthoclase (Gr. *orthos*, 'straight,' *klasis*, 'a fracture') is so called because the two cleavage-planes of the mineral are at right angles to each other. As a rock-former, it occurs most frequently in the form of imperfect crystals or irregular crystalline aggregates. In porphyritic rocks, and especially in drusy cavities in such rocks as granite, it often appears in tolerably well-developed crystals. It is an essential constituent of granite, syenite, orthoclase-porphyry, and quartz-porphyry. The compact ground-mass of the two last-mentioned rocks is largely composed of micro-crypto-crystalline orthoclase. Orthoclase occurs also as an accessory ingredient in most plagioclase rocks, and is present in many of the crystalline schists, especially the gneissose rocks. A clear glassy variety of orthoclase called *sanidine* is a common constituent of many igneous rocks of Tertiary and Recent date, such as liparite, phonolite, trachyte, &c. Orthoclase, as a rule, is readily acted upon by the weather—the potash and some of the silica being removed in solution, while a fine-grained clay or Kaolin is left behind. Ordinary orthoclase is either gray, white, or flesh-coloured, and these tints of the felspar generally determine the colour of the rock in which it occurs. Thus we have *gray* granites and *red* or *pink* granites.

Microcline has the same composition as orthoclase, and its cleavage-angles differ so very slightly from a right angle that it might well be looked upon as simply another form of orthoclase. It is frequently associated with the latter in plutonic and schistose rocks.

The other triclinic felspars are grouped together as *Plagioclase* (Gr. *plagios*, 'oblique,' and *klasis*, 'a fracture;' in reference to the cleavage-planes, which are not at right angles to each other), and are among the most important rock-formers. According to Tschermak, they form a series of which anorthite and albite are the extremes, while the others are isomorphous mixtures of these two types in various proportions. The plagioclase felspars often assume a tabular aspect when growth has taken place in the direction of the lateral axis. At other times the crystals, owing to extension in the direction of the principal axis, acquire a long prismatic form. As rock-formers they occur either as well-developed crystals, or as irregular crystalline granules, or sometimes as a crypto-crystalline matrix or ground-mass, through which other rock-forming minerals are disseminated. On fresh unweathered faces of an igneous rock the crystals frequently appear as clear glassy strips or rods, in which may often be detected by the eye or by a lens a fine parallel striation, formed by the union of many twins, sometimes thirty or more appearing in one and the same crystal. This structure is never seen in orthoclase. This repeated twin-lamellation has been developed artificially in untwinned plagioclase by subjecting the mineral to a high temperature, and the same molecular change has been superinduced by pressure. Plagioclase is an essential constituent of many igneous rocks, and it is likewise met with in many crystalline schists, in which it is the product of hypogene metamorphic action. *Albite* is a common constituent of some crystalline schistose rocks and certain crystalline limestones. As a secondary product it is occasionally met with also in igneous rocks. *Oligoclase* occurs both in the older and younger eruptive rocks — in hypogene rocks and in true volcanic rocks. *Andesine* is met with rarely in crystalline schists, but is a common constituent of some eruptive rocks, such as andesite. *Labradorite* is an essential constituent of such rocks as gabbro, basalt, &c. It occurs also in metamorphic rocks, sometimes in large crystalline masses. It often shows fine chatoyant reflections, receives a fine polish, and is occasionally employed in jewelry. *Anorthite* is not common as a rock-former. It occurs in some basalts and andesites, and sparingly in a few crystalline schistose and granitic rocks.

The felspars which occur in rocks that contain much free silica (quartz) are generally orthoclase and microcline, but with these are frequently associated the highly silicated felspars, albite and oligoclase. The chief habitat of the basic plagioclase felspars are basic igneous rocks.

Common felspar or orthoclase, under the name of *Petunse* or *Petuntze*, is employed by the Chinese (along with some of the quartz associated with it) in the manufacture of porcelain. It is used with other materials as a flux, and alone to form an enamel or glassy covering, without which the porcelain would absorb moisture and grease. *Kaolin* (Chinese) is the name given to the fine clay which results from the decomposition of felspar, as in the case of the highly weathered granites of Cornwall. *Adularia* is a transparent variety of orthoclase, often showing pearly opalescent reflection, and sometimes a play of colours. The finest specimens of this variety are cut as ornamental stones, and known as *moonstones* (some moonstones, however, appear to belong to albite and oligoclase): another kind, found among rolled stones in Ceylon, and remarkable for the reflection of a pearly light, has occasionally been confounded with Cat's-eye (q.v.). *Sunstone*, or *aventurine felspar*, is somewhat similar to the variety of quartz called *Aventurine* in the play of light which it exhibits—a property which seems to be due to disseminated crystals or plates of hematite or göthite. Aventurine felspar is not always orthoclase, some of it belonging to albite and oligoclase. *Amazon-stone* is a bright verdigris-green orthoclase, fine specimens of which come from Pike's Peak, Colorado. *Peristerite* is a whitish adularia-like albite. *Saccharite* is a granular massive variety of andesine.

Felstone, a rock-term now disused. It comprised a number of rocks composed chiefly of felspar, sometimes orthoclase, and sometimes plagioclase. These rocks are now referred to quartz-porphyry and porphyrite.

Felt, a fabric formed without weaving, by taking advantage of the natural tendency of the fibres of wool and certain kinds of hair to interlace with and cling to each other.

The property of felting or matting which the fibres of wool and hair of various animals have arises from their structure. When one of these fibres is examined by the microscope, it is found to be minutely notched or jagged, the barbs pointing to the tip of the hair. This serrated edge, and also a tendency to curl, cause these animal fibres to interlock, and so felt or mat when they are intimately mixed and rubbed in a moist state upon each other. Some fibres of this kind, however, such as human hair and horse-hair, are too nearly smooth or too rigid for felting purposes. Among the materials most suitable for felting are the wool, fur, and hair of such animals as the sheep, goat, ox, hare, rabbit, musquash, and beaver. Some of these are used chiefly for felt

hats (see HAT). Felted cloth is made principally from wool, but less valuable substances are mixed with it.

The making of felted fabrics is a very ancient art in some parts of Asia, and to this day the thick *nümüds* or *nammads* of Persia and Turkestan are remarkable not only for their durability, but for their beautiful ornamentation, produced by a felted inlay of coloured wools. It is said that thick felts made up into boots and gaiters form the only foot-covering capable of resisting the cold of a Siberian winter.

The first successful mechanical process for the manufacture of felt was invented by Mr J. R. Williams, an American, in the decade 1820–30, Mr Wells, also an American, being associated with him. Williams took out a patent for the process, or for a modification of it, in England in 1840, and about this time a large factory was erected by some capitalists at Leeds to manufacture felt cloth under the patent. The company speedily attained great prosperity, but in the full tide of its success the mill was destroyed by fire. Williams, whose whole property was in the concern, which was not insured, soon afterwards died of grief.

By the above process, essentially, felt cloth is still made. The wool is first formed into a thin lap on a carding-engine (see under Wool, WOOLLEN CLOTH MANUFACTURE). A number of these laps are piled upon each other till a sufficient thickness is obtained. At this stage the future piece of felt cloth is in a loose, open condition, sometimes called a fleece. It is then submitted to pressure in a machine with an upper and a lower series of rollers, between which it passes. Some of these are solid, and some are hollow and contain steam. It is by the rubbing action of these rollers, the upper series of which oscillate, that the fleece, under the influence of steam and moisture, becomes converted into a compact cloth. Fabrics so made are entirely held together by the interlocking of the fibres of wool.

There are other kinds of machines for making felted cloth. In one of these a heavy oscillating table is employed instead of rollers, by which several fleeces are felted at one time. Another, designed by a German engineer, is so constructed that the preparatory operations of opening and carding the wool, as well as the damping, pressing, and rubbing of the lap or fleece, are made continuous—i.e. all are done on one machine. In this case, rollers arranged in a vertical frame are used for consolidating the fleece into felt.

Such felt goods as druggets, carpets, and table-covers are usually printed with patterns in colours. The manufacture of felt for various purposes is extensively carried on in England, on the continent of Europe, and in the United States. Among the kinds made, besides those for furniture and dress purposes, are felts for polishing glass and marble, for saddle-cloths, for lining india-rubber fabrics, for parts of shoes, gun-wads, and hammers for piano-keys. Mixed or coated with asphalt, pitch, or tar, a coarse felt is used for covering roofs, vessels, and iron buildings. For these same purposes it is also combined with Asbestos (q.v.), this mixed kind of felt being likewise used for covering steam-boilers and pipes. The 'blankets' used on paper-making machines, though not strictly felts, are woven fabrics highly felted.

Felton, CORNELIUS CONWAY, president of Harvard College, was born in West Newbury, Massachusetts, in 1807, and studied at Harvard, where, after filling several minor posts, he became in 1834 Eliot professor of Greek, and in 1860 president. He died 26th February 1862. He published translations of modern European works, and editions of Greek classics; his chief work, however, was his posthumous *Greece, Ancient and Modern* (2 vols. Boston, 1867), mostly made up of lectures delivered before the Lowell Institute.

Felton, JOHN (*c.* 1595–1628), the assassin of the Duke of Buckingham (q.v.).

Feltre (ancient *Feltria*), a town of Northern Italy, near the Piave, 19 miles SW. of Belluno by rail. Pop. 3715.

Felucca, a class of small merchant-vessels used in the Mediterranean. They have two masts, carrying lateen sails, and frequently have a rudder at each end, to be applied as occasion demands. Formerly feluccas were also employed in war and piracy.

Feme Coverte (*fœmina viro co-operta*), in the law of England, a married woman. See HUSBAND AND WIFE. *Feme sole* is an unmarried woman.

Femern, an island (area, 71 sq. m.) in the Prussian province of Sleswick-Holstein, flat, fertile, and well cultivated, but with a harsh climate. Agriculture, fishing, and stocking-weaving form the principal employments of the inhabitants (9800).

Femgerichte. See VEHMGERICHTE.

Femoral Artery, the chief artery of the thigh. See ARTERIES.

Fences, in Agriculture, serve in general the threefold purpose of inclosing animals on pasture-grounds, of protecting land from straying animals, and of affording shelter from cold winds. In countries where wood or stones are scarce, and more especially where the land has been long settled, hedges formed of various kinds of plants are common. These, when grown upon good soil, and when well kept and managed, give a clothed and picturesque appearance to the landscape. The hawthorn or white-thorn is the favourite hedge-plant in Britain. See HEDGE.

Stone walls, when well constructed, form the best fences. The form and mode of building varies with the nature and quality of the stones. In Aberdeenshire the walls or dykes surrounding the fields are constructed of granite boulders that are found strewn over the surface of the country. The Silurian of the southern counties of Scotland supplies durable but irregularly shaped whinstone, which forms a lasting but rough fence.

In new countries, where wood is abundant, the fences are all of this material. The snake-fence, named from its zigzag form, is made by merely laying trees above each other, in such a manner that their ends overlap and cross, and require no additional fixing. As wood becomes more valuable, it is made into posts and rails. The posts are driven into the ground from two to three yards apart, and from four to five rails are nailed across, according to the purpose it is meant to serve. The stob and rafter fence is made by driving the posts in the ground at a distance of from three to four inches apart, and binding the whole by a rafter or rail nailed across the top. This is one of the strongest of wooden fences, but requires more material than the other. In America split rails, roughly sharpened at either end, and let into wide openings cut in the posts, are in common use.

Iron or wire fencing has come much into use of late. Vast stretches of waste land in Britain, as well as pastures in Australia, have been inclosed by means of wire-fencing. Strong wires are stretched on straining-posts firmly secured in the ground 200 yards apart. Intermediate or lighter posts—standards for support, or hangers in the hollows to keep down the wires, as the case may be—are put in at from two to three yards' distance. After the wires are fully stretched they are fixed to the smaller posts; when of wood, by means of staples, or threaded through, when of iron. Barbed

wire is now extensively used in fencing cattle, both in Britain and elsewhere. The only danger of serious injury from the use of barbed wire is when an animal runs close to and in the line of the fence; a horse can thus saw the skin and flesh through, and lay the shoulder-joint open in a few seconds. The corrimony wire-fence is an elegant and inexpensive form, in which the standards are placed 1 rood apart, and the wires are kept in their position by being tied with cross wires at distances of 3 yards apart.

In Scotland the landlord is held bound to put the fences on the farm in due repair on the entry of the tenant, independently of any stipulation in the lease; whilst both in England and Scotland the tenant must maintain the fences and leave them, with the exception of ordinary tear and wear, in the state in which they were given over to him. A tenant who erects a temporary fence (e.g. a wire-fence), can, unless he makes a special agreement to the contrary, remove the same as a temporary fitting, provided the ground on which it stood is left in the original natural condition.

Fencible, a word meaning defensive, and applied to regiments raised for local defence, or at —and only for—a special crisis. The word is still retained in the title of the Royal Malta Fencible Artillery.

Fencing may be generally described as the scientific handling of a sword or bayonet in attack or defence, though the term is usually limited to the use of the rapier. It is taught in every gymnasium, and in the British army every officer on joining is put through a course of gymnastics of which it forms a part. Non-commissioned officers are taught at the Aldershot Gymnasium, and then appointed instructors in the various garrisons where gymnasiums exist, and to all cavalry regiments, the troopers of which are also trained by them.

FENCING WITH THE RAPIER OR FOIL is admitted to be the best exercise that can be taken. Every muscle of the body is brought into play by it, and hand and eye are trained to act in unison. No description can pretend to teach it. Even an instructor who is not thoroughly capable does more harm than good in attempting to teach fencing, as bad habits are acquired which it is most difficult to unlearn; and, unless every movement is accurately and properly made, there is no science and very little interest in its practice.

The foil in practice used as a substitute for the rapier should have a tapering blade about 32 inches long, and square in section, with a gutta-percha button on the point, and a weighted pommel to the hilt, so as to balance it properly. Masks of wire netting are absolutely essential to protect the face, and leather gloves, jackets, and aprons should also be worn.

Except in Spain, where one straight cut at the head is allowed, the only attack with the rapier or foil is by *thrust* and *longe* (or *lunge*)—i.e. straightening the elbow so as to bring the sword and arm into line, and then striding forward about 18 inches with the right foot. The defence is by slight movements of the sword hand, which cause the *faible* (upper half) of the assailant's blade to glide along the *forte* (lower half) of the defender's foil, and outside it, so as to pass clear of his body, while his point is always kept towards the front, ready to *ripost* (longe after parrying) without an instant's delay. The proper positions and movements when *on guard*, *engaged*, *longeing*, *parrying*, *advancing*, and *retreating* must be most carefully learned from an instructor, and assiduously practised, as well as the various *attacks*. A reproduction (fig. 1) of the diagram given by Captain Chapman in his excellent little book, *Foil Practice*, shows the four lines of attack and the nine parries usually taught. It will be sufficient to mention that a *counter parry* describes a circle

Fig. 1.

under or over the adversary's foil before throwing it off, and to add the following explanation of terms used in fencing. When the nails are uppermost the sword hand is said to be in *supination*, when under, in *pronation*. The thrusts, like the parries are called quarte (or carte), tierce, &c. The *flanconade* is an attack made by the assailant *binding* his blade round the adversary's and longeing at his body under his arm. An attack may be a combination of any of the following movements preceding a longe: *disengage*, when swords are crossed, changing from one line of attack to another by passing under the adversary's sword; *cut over*, the same change by whipping over his sword; *one*, *two*, a double disengagement; *double*, both blades horizontal, and circling round parallel to one another; and *beat*, a side-blow of one blade on the other. If a second thrust is made after longeing, and without springing up to guard again, it is called a *reprise*; and, if made to take advantage of a wide parry not followed by a ripost, a *remise*. *Time thrusts*, like cross-counters in boxing, parry a thrust by a thrust.

The system of fencing compiled by Mr Archibald Maclaren, of the Oxford Gymnasium, is that used in the British army, and differs from others in teaching only four parries—viz. quarte, tierce, seconde, and semicircle. All are formed in the usual manner, except the last, which, by raising the hand slightly and elevating the blade as high as the face, guards both the upper and lower openings on the inner or left side, carrying the adversary's blade over the right shoulder, and leaving him completely exposed to the return thrust. In Spain and Italy the left hand is used as an auxiliary in parrying, and in Italy is aided by a dagger, or a cloak.

THE BROAD-SWORD EXERCISE differs from fencing with the foil, in that the weapon employed is intended to cut as well as thrust. For practice a stout, straight stick is used, called a 'single-stick,' having a buffalo-hide or basket handle to protect the knuckles.

The position and movements of the combatant are very similar to those for fencing with the foil.

There are seven cuts, with seven corresponding guards, and three thrusts, as shown on the accompanying diagram, which represents a target placed opposite a pupil, with its centre in a line with the centre of his breast.

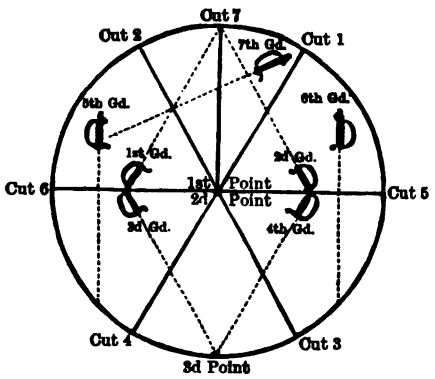


Fig. 2.

The cuts cross the whole circle through the centre along the *thick* lines. Nos. 1, 3, and 5 are inside cuts, and may be directed against any part of the left side, and inside of the right leg; 2, 4, and 6 are outside cuts, attacking the right side, and right leg on the outside. No. 7 is a vertical cut, aimed at the head. The dotted lines show the several guards. The points or thrusts are shown by the black dots. The 'parry' consists in bringing the wrist nearly to the right shoulder; whence, as centre, a circular sweep of the sword is made from left to right.

Cavalry Sword Exercise differs from the foregoing, which is not suitable for horsemen. It has four cuts on each side, two at a mounted, and two at a dismounted adversary. Each cut has a corresponding point and guard.

The Bayonet Exercise taught in the British army has been assimilated to Maclaren's system of fencing. The guards are formed in as nearly as possible the same manner, except that, of course, the rifle is held in both hands, one at the grip, and one in front of the back-sight. The latter remains almost stationary, while the movements of the other form the parries. A new and most effective thrust, called the *throw*, has been introduced. When making it, the forward hand quits the rifle, which is thrown forward to the full extent of the other arm.

As to the relative values of the sword, rapier, and bayonet, the first, requiring for each cut two motions, one up and the other down, cannot but be much slower in its action than either of the other two; while the last, from its weight, is exhausting and clumsy. The second, on the other hand, has none of these objections, and in skilled hands is by far the most deadly weapon.

See Captain Chapman's *Foil Practice;* Maclaren's *System of Fencing* (1864); Captain A. Hutton's *Cold Steel* (1889); the Manuals of Sword and Bayonet Exercise published by the War Office; and *Fencing, Boxing, and Wrestling* in the 'Badminton' series, by Grove, Pollock, Armstrong, and Prévost (1889).

Fen Country. See Bedford Level.

Fénelon, François de Salignac de la Mothe, was born August 6, 1651, in the château de Fénelon, province of Périgord, now included in the department of the Dordogne, of a family which has given many celebrities both to the church and to the state in France. His education was conducted at home up to his twelfth year, when he was transferred to Cahors, and afterwards to the Plessis College in Paris. In his twentieth year he entered the newly-founded seminary of St Sulpice, where he received holy orders in 1675. Unlike too many ecclesiastics of his own rank at that period, he gave his whole heart to his sacred calling, being for some time employed in the parochial duties of the parish of St Sulpice; and in the year 1678 he was named director of an institution recently founded in Paris for the reception of female converts to the Roman Catholic faith. During his tenure of this office he wrote his first work, *De l'Education des Filles;* and the success with which he discharged his duties towards the young converts led to his appointment as head of a mission, which, on the revocation of the Edict of Nantes in 1685, was sent to preach among the Protestant population of Saintonge and Poitou. In 1689 he was named by Louis XIV. to the highly confidential post of preceptor of his grandson, the young Duke of Burgundy. In the discharge of this delicate trust he sought to impress on his pupil's mind the great principles of truth and justice upon which the prince's responsibilities are founded, and to show the hollowness and futility of all earthly glory, power, and happiness which do not rest upon this foundation. To this wise design of the preceptor we are indebted for many works still popular in educational use; for the *Fables*, for the *Dialogues of the Dead*, for the *History of the Ancient Philosophers*, and for the germ at least of the *Telemachus*. As an acknowledgment of these great merits, he was presented by the king in 1694 to the abbey of St Valery, and in the following year to the archbishopric of Cambrai.

It is to this period of Fénelon's life that the history of the unhappy controversy about Quietism (q.v.) belongs. Two separate schools of Quietism are to be distinguished. In one of these the common mystic principle of the absorption of the soul in the love and contemplation of God led to the conclusion that the soul, in this state of absorption, suffered no contamination from the material actions of the outer man, and that no acts of virtue, not even of prayer, were any longer required (see Molinos). The other school, while it maintained the theory of passive contemplation and love, yet repudiated the dangerous and immoral consequences which were deduced therefrom. It was exclusively the latter and less objectionable form of Quietism the professors of which for a time claimed, although not the patronage, yet at least the indulgent consideration of Fénelon. He formed in the year 1687 the acquaintance of the celebrated Madame Guyon (q.v.). Fully convinced of the unfairness of much of the outcry which was raised against her, and which made her responsible for all the principles of the grosser Quietism of Molinos, his generous mind was perhaps attracted to her cause by the very injustice of her opponents. He advised her to submit her works to the judgment of Bossuet, who was then in the zenith of his fame, and with whom Fénelon was in the most friendly relations. In the condemnation of the book of Madame Guyon by this prelate Fénelon acquiesced; but, as she made a formal submission to the church, he refused to join in any condemnation of herself personally. Nevertheless, when a commission was appointed to examine the whole affair, he signed their report. It was not thought enough to publish a condemnation of her several works, but Bossuet prepared a special exposition of the true doctrine of the church on these questions. To this work Fénelon refused to give his approval, and even composed his own *Explication des Maximes des Saints sur la Vie intérieure* in explanation and defence of certain at least of Madame

Guyon's doctrines; he cheerfully agreeing to the stipulation of the Archbishop of Paris that the *Maximes* should be kept back from publication until the completion of the rival treatise of Bossuet, *Instruction sur les États d'Oraison*. An unfortunate violation of this engagement, committed without the knowledge, and in the absence of Fénelon, was the last of a long train of causes which led to the painful and unedifying rupture between these two great prelates. Fénelon's book was received with much clamour, that of Bossuet was universally approved; and in the controversy that ensued all the displeasure of the court, which Fénelon had provoked by covert strictures in his works of fiction, was brought to bear against him. He was ordered to submit his book to the judgment of an ecclesiastical tribunal, of which Bossuet was a member. He refused to accept Bossuet as judge; and in the end he appealed to the judgment of the holy see. Bossuet published a succession of pamphlets; several of the bishops who had espoused the side of Bossuet issued pastorals in the same sense; and Fénelon defended himself vigorously against them all.

The last blow against the ancient friendship of the great rivals was struck by Bossuet in his celebrated *Relation sur le Quiétisme*. Fénelon was wounded to the heart; but his most masterly defence was written, printed, and published within little more than a fortnight from the appearance of Bossuet's *Relation*. From this point the controversy assumed a more personal and therefore a more acrimonious character; and it was maintained on both sides till the long-delayed decision of the pope brought it to a close, March 12, 1699, by a brief, in the usual form, condemning the *Maximes des Saints*, and marking with especial censure twenty-three propositions extracted from it. The conduct of Fénelon under this blow constitutes, in the eyes of his fellow-churchmen, one of his highest titles to glory. He not only accepted, without hesitation, the decision of Rome, but he took the very earliest occasion to publish from his own pulpit the brief of his condemnation. The jealousy with which the political principles of Fénelon were already regarded was heightened about this time into open hostility by the appearance of his *Télémache* (see TELEMACHUS), printed from a copy surreptitiously obtained by his servant, which the king regarded as but a masked satire upon his own court. Louis's anger knew no bounds. Fénelon was strictly restrained within his diocese; and measures were taken to give the condemnation of his book every character of publicity. From this date Fénelon lived exclusively for his flock. He founded at Cambrai a seminary for his archdiocese, which he made his own especial charge. He was assiduous in preaching and in the discharge of the other duties of his office; and the fame of his benevolence, charity, and enlightened liberality is attested by the order issued by the Allies in the campaign of 1709 to spare the palace and the stores of the Archbishop of Cambrai. The only later controversy in which he appears is the revival of the Jansenistic dispute, in which Fénelon engaged earnestly on the side of orthodoxy. He died January 7, 1715, and was buried in his cathedral of Cambrai (q.v.).

The works of Fénelon are very voluminous, and embrace every variety of subjects—theology, philosophy, history, literature ancient and modern, and oratory, especially the eloquence of the pulpit. His correspondence is very extensive and most interesting. Of his mature discourses two only have reached us in a finished state. They are of the very highest order of sacred eloquence. His work on the temporal power of the medieval popes presents that doctrine in its most amiable form; and even his spiritual writings in general are not unfrequently read by Christians of all denominations.

See Bausset's edition of the Works (22 vols. 1821-24), his *Histoire de Fénelon* (1808; new ed. 1862), the *Correspondence* (1727–29), and Marten's edition of the Works (3 vols. Paris, 1874); German Lives by Hunnius (1873) and Wunderlich (1873); the somewhat one-sided English Life, by Mrs H. L. Lear (1876); and *Fénelon à Cambrai*, by E. de Broglie (1884). It should be added that Douen, in *L'Intolérance de Fénelon* (Paris, 1872), has endeavoured to establish by documents that both in his management of the institute for the converts and in his measures in Poitou, Fénelon frankly accepted the policy of persecution, and was guilty of inexcusable severity and even cruelty. See an article in the *Quarterly Review* for 1885.

Fenestella, or FENESTRELLA, a genus of Polyzoa, resembling the recent 'lace coral,' very common in Palæozoic rocks, from the Lower Silurian to the Permian.

Fenians, a political association of Irish or Irish-Americans for the overthrow of the British authority in Ireland, and the establishment of a republic. The name is traced to the ancient Irish military organisation called Fionna Eirinn, which took its appellation from the celebrated hero of Irish legend, Finn (or Fionn) MacCumhail. This renowned body was designed as a national militia, and its origin has been ascribed to Sedna II., who reigned in Ireland about 400 B.C. In time of peace it consisted of three bodies, each formed on the model of a Roman legion, and consisting of 3000 men; but in war it was capable of being enlarged to any required limit. Candidates for enrolment were required to be of an honourable family, to be irreproachable in morals, and to bind themselves to observe the laws of justice and morality; they were required to be of a certain height, and strong, supple, and vigorous of body. The generally historical character of the institution is unquestionable; and it subsisted until the reign of Carbry, son of Cormac MacArt, by whom the body of Fionna Eirinn was disbanded; and the members, having in consequence transferred their allegiance to Mocorb, king of Munster, suffered an almost total extermination in the battle of Gavra, 284 A.D. This formed the theme of many a bardic poem from the days of Oisin (known in Gaelic legend as Ossian), son of Finn MacCumhail, downwards.

The modern Fenian movement adopting the name of this ancient military association had its first seat in America, where the Irish population had largely increased since the famine of 1846–47. Many of the emigrants being driven from their homes by arbitrary ejectment, or from inability to pay rent, carried with them a sense of wrong; others had been sympathisers if not participators in the insurrection of 1848; and almost all were deeply imbued with general political and social discontent. The most openly active seat of the organisation was in the western states, especially Chicago; but the movement was directed from New York, and possessed ramifications in almost every city of the Union. It was conducted by a senate, and consisted of 'circles,' each directed by a centre. The duty of the centres was to enrol members, who bound themselves, generally by oath, 'to be faithful to the Irish Republic as at present virtually established;' to instruct and practise them in military exercises; to raise funds for the purposes of the association, especially for the purchase of arms and munitions of war; and to extend the organisation by every means at their disposal. Agents were sent into Ireland, and to the chief seats of the Irish population in England; and, opportunely, the termination of the civil war in America set free a large number of men with

military training and experience. In this, unlike almost all similar movements, pains had been taken to exclude the Catholic clergy, by whom the Fenian confederation had from the first been steadily resisted, from all knowledge of its character and objects, as well as of the names or number of its members in the several localities.

By degrees the movement acquired solidity, and the British government ascertained that Fenianism, however corrupt in some of its sources, and however wild and extravagant in its aims, was nevertheless a reality with which it had become necessary to grapple. The Habeas Corpus Act having been summarily suspended, all the known leaders in Dublin and in the provincial districts of Ireland (most of them Irish-Americans) were at once placed under arrest. The 'Head Centre,' James Stephens, was one of those arrested. The chief journal of the conspiracy, *The Irish People*, edited by O'Donovan Rossa, was suppressed and seized; additional troops were moved into Ireland, and other measures of repression were vigorously carried out. Many of the prisoners, convicted of treason, were sentenced to penal servitude. By these energetic measures public tranquillity was maintained in Ireland, but the embers of discontent continued to smoulder among the poorer peasantry and the working population of the towns; and a certain prestige was given to the fallen cause by Stephens' escape from prison. His return and that of other exiles to America renewed the agitation in that country. In the early summer of 1866 a raid was attempted into Canada, which proved an utter failure; and it was followed in the spring of 1867 by an utterly abortive attempt at insurrection at home, beginning with the seizure of the castle and military stores at Chester. The attempt was defeated by the treachery of one of the conspirators. A partial insurrection, however, took place in the county of Kerry; and a few weeks later a more extensive movement was attempted in the counties of Dublin, Louth, Tipperary, Limerick, and Cork. But most of the parties dispersed or were made prisoners after a single night's campaign. The rest betook themselves to the mountains, and after a few days of exposure and hardship were either captured or dispersed. The leaders were tried at a special commission held in the spring of the year 1867, some being convicted, but none executed; and tranquillity for a time seemed to be restored in Ireland. In September 1867 an attack was made, in open day, on a police-van in Manchester; the officer in charge was killed, and the prisoners, who were suspected Fenians, were released. A few weeks later a still more daring attempt was made to blow down Clerkenwell Prison wall, with the same object.

In 1871 the United States government frustrated another Fenian raid on Canada by the apprehension of its leaders and the seizure of its arms. Later developments of the Fenian spirit appeared (1883–85) in the *Skirmishing Fund*, raised to promote the free use of dynamite for the destruction of English public buildings and English commerce, and in the extreme party of the *Clan-na-Gael;* and some of the 'invincibles' who were to 'make history' by removing tyrants, as in the Phœnix Park assassination (1882), had been Fenians. Some also of those who were leaders in the Home Rule and Land League agitations had formerly been members of the Irish Republican Brotherhood.

See the section on the history of IRELAND in this work; and J. Rutherford's *Secret History of the Fenian Conspiracy* (2 vols. 1877).

Fennec (*Canis cerdo, famelicus, chama*), little African foxes, of elegant habit and active, courageous disposition. The ears are remarkably large. Fennecs are found apparently throughout Africa, and are sometimes hunted. In diet they show an interesting though not unique fondness for sweet vegetable food, such as dates. Quite distinct is the decidedly larger African Fox (*Otocyon megalotis*). See FOX.

Fennel (*Fœniculum*), a genus of umbelliferous plants, allied to Dill (q.v.), but distinguished by the cylindrical, strongly-ribbed fruit. The flowers are yellow. All the species are aromatic, and have much-divided leaves with thread-like segments. The best known is the Common Fennel (*F. vulgare*), a native of the south of Europe and of some parts of England. It is a biennial, 3 or 4 feet high, and is cultivated in gardens, chiefly for the sake of its leaves, which are boiled, and served up with mackerel, with salmon, and occasionally with other kinds of fish, or are employed to form a sauce for them.—Sweet Fennel, Italian Fennel, or Cretan Fennel (*F. dulce*), is a plant of much humbler growth, an annual, much cultivated in the south of Europe, but too tender for the climate of Britain. The young sprouts from the root are sweeter and less aromatic than those of Common Fennel, and when blanched form a very agreeable salad and potherb. The fruit (seed) is longer and paler than that of Common Fennel, has a more agreeable odour and flavour, is a favourite aromatic condiment of the Italians, and is used in medicine as a carminative and aromatic stimulant. *Oil of Fennel*, an aromatic, stimulant, and carminative essential oil, is also made from it.—Cape Fennel (*F. capense*), found in the interior of the Cape of Good Hope, has a thick, aromatic, esculent root.—The Panmuhooree of India (*F. panmorium*) is a species cultivated for its sweet, warm, and aromatic fruit, which is much used as a carminative, and in curries.—The Giant Fennel of the south of Europe is a plant of a different genus (Ferula), and abounds in a fetid juice; it is indeed closely allied to asafœtida. It forms a favourite food of buffaloes in Apulia, where it particularly abounds. The dry, dead stem is full of a white pith, which is used in Sicily as tinder.

Fennel (*Fœniculum vulgare*): *a*, a flower.

Fens. See BEDFORD LEVEL.

Fenugreek (*Trigonella*), a genus of Leguminosæ, allied to clover and melilot. The Common Fenugreek (*T. fœnum Græcum*) is a native of the south of Europe, and of some parts of Asia; it is much cultivated in India as a fodder-plant, and derives its name since classic times (*Fœnum Græcum*, 'Greek hay,' of which the English name is a corruption) from its use as fodder in Greece. On account of its strong smell it must, however, be mixed with other plants. The seeds also have a strong, peculiar smell, and an oily, bitter taste; the flour made from them is used for emollient poultices, but only in veterinary practice. The

seeds of Fenugreek were formerly held in great esteem in medicine, and are still largely consumed by women in the East, especially in Egypt. An Indian species (*T. incisum*) is used as fodder, and the legumes of another (*T. esculenta*) are esteemed as food.

Fenwick, SIR JOHN, was born about 1645, and, after serving in the army, in 1688 entered parliament as Tory member for Northumberland. He afterwards entered ardently into the conspiracy known as the Assassination Plot (see ASSASSINATION), and in 1696, being committed to the Tower, made an artful confession involving several Whig leaders in the Jacobite intrigues. Since the only witness against him had been spirited out of the country, the Whig party, furious at these charges, secured the passing of a bill of attainder against Fenwick, under which he was beheaded, 28th January 1697.

Feodosia, or THEODOSIA. See KAFFA.

Feoffment (*infeudare*), the oldest and for a long period the only method for the conveyance of land known in England. Feoffment consisted in the formal conveyance of the land from the feoffor to the feoffee, the former stating distinctly the measure of the estate conferred, whether it was in Fee (q.v.), in tail, or for life. Where no mention of the duration of the estate was made, the gift was presumed to be for life. This conveyance of the land, in order to be complete, required to be accompanied by Livery of Seisin, which was of two kinds—viz. in deed and in law. In the former case, the parties being actually upon the land, the feoffor, by delivery of a twig or a turf, testified his conveyance of the land. In livery in law, the parties being in sight of the land, the feoffor referring to the land gave possession to the feoffee 'in name of seisin.' This mode of feoffment was ineffectual unless the feoffee entered into possession during the life of the feoffor. Livery in deed might be effected by attorney; but livery in law only by the parties themselves. When the practice of embodying the transaction in a deed was introduced it became customary, but not essential, to indorse on the deed the fact that livery of seisin had been made. By the statute of Frauds, passed in 1678, it was declared that no estate created by livery of seisin, unless accompanied by writing, signed by the party or his agent, should be of any effect, except as an estate at will. A feoffment is now void unless accompanied by deed. The law formerly gave so great an effect to a feoffment that a party could in some cases convey a greater estate than he had; the parties wronged by his act being disseised of their estates unless they could recover them by entry on the land or by action. But a feoffment now has no tortious operation. Feoffment was the form adopted for conveying the legal estate in land to trustees or 'feoffees to uses' (see USES). It must be observed that the practice of feoffment above described, and which has existed in England from time immemorial, differed materially from the old form of investiture in use in strictly feudal times, and from that which still prevails in Scotland. In England the transaction was simply a conveyance by the actual holder of the land to a new tenant, testified by certain ceremonies, but requiring no confirmation by the lord to complete it. In Scotland no transfer of heritage is complete without the formal confirmation of the superior; acceptance by the superior, and the performance of the pecuniary services attendant on that acceptance, are still preserved. See the article INFEFTMENT or SASINE, and for Feudal System, see the article FEUDALISM.

Ferae Naturae (Lat., 'of a wild nature') is the term given by Roman law to those animals which are wild or not domesticated, including game animals—deer, hares, pheasants, &c. See GAME-LAWS.

Ferdausi. See FIRDAUSI.

Ferdinand THE CATHOLIC, V. of Castile, II. of Aragon and Sicily, and III. of Naples, was born at Sos in Aragon, 10th March 1452, the son of John II. of Navarre and Aragon. By his father he was formally associated in the government of Aragon in 1466, and appointed king of Sicily in 1468; in 1469 he married, at Valladolid, Isabella, sister of Henry IV. of Castile. On Henry's death in 1474 most of the nobles refused to acknowledge the legitimacy of his daughter Juana ('La Beltraneja'), and proclaimed Isabella and her husband Ferdinand joint-sovereigns, who, in 1479, emerged victorious from the civil war that ensued. In that year also Ferdinand became king of Aragon on the death of his father, and the two kingdoms of Aragon and Castile were united in the persons of Ferdinand and Isabella; the latter, however, as long as she lived, maintained control and authority in Castilian affairs. The reign that followed is one of the greatest in the history of Spain, which was in a few years advanced to the first rank among the nations by the military, administrative, and diplomatic skill of its sovereigns, and of the distinguished body of ministers and generals that surrounded them.

Ferdinand's political talents found plenty of scope in the distracted condition of affairs which met him on his accession—the kingdom split into factions, feuds raging between the great houses, and robbery and outrage rife in every quarter of the country. The effectual suppression of the banditti he accomplished by reorganising the *santa hermandad*, or 'holy brotherhood,' a kind of militia-police, composed of the citizens and the country-people. Moreover, a principal aim of Ferdinand and Isabella was to break the power of the feudal aristocracy, and good use was made of the *hermandad* in carrying out this design. The establishment of the Inquisition in 1478–80, although primarily and mainly intended to further 'religious' ends, likewise helped to lessen the nobles' influence; and Ferdinand also strengthened his power by vesting in himself and his successors the grand-mastership of the military orders of Calatrava, Alcantara, and Santiago. In all his schemes he was ably seconded by his queen and by the celebrated Cardinal Ximenes.

The year 1492 was the most brilliant in his reign. It opened with the fall of Granada, which marked the end of the long struggle with the Moors; and in August Columbus set sail from Palos. Although the free exercise of their religion was guaranteed to the Moors, an edict for the expulsion of the Jews from the conquered kingdom was immediately signed; and, a few years after, the privileges secured to the Moors were treacherously withdrawn, baptism or exile being offered as alternatives. By these two barbarous and unwise acts the most industrious and civilised inhabitants of the Peninsula were driven from it. The discovery of America, however, for a time gave Spain almost unchallenged supremacy along both shores of the Atlantic, and Ferdinand turned his attention to European affairs. From France he recovered by treaty the counties of Rousillon and Cerdagne (now the Pyrénées Orientales), which his father had mortgaged to Louis XI.; in 1495 he formed the Holy League, with the pope, the emperor, and the states of Milan and Venice (Henry VII. of England was persuaded to enter the league nearly sixteen months later), under which Gonsalvo de Cordova drove the French out of Naples; and in 1500–1 the French king was induced to join him in

the conquest and partition of Naples, only to be overreached by the Catholic king, and compelled to yield up the kingdom to him entirely three years later.

In 1504 Isabella died, and Ferdinand at once had his insane daughter Juana proclaimed queen of Castile, and himself regent; but Juana's husband, the Archduke Philip of Austria, threatening an appeal to arms, the king threw up the regency, and in 1505 married Germaine de Foix, a niece of Louis XII. of France. Philip died in September 1506, only three months after his landing in Castile; whereupon Ferdinand resumed the administration, which he retained till his death, although his position was greatly changed after Isabella's death, and he was compelled to reverse all his former policy—make an alliance with France, and buy off French claims on Naples—besides being frequently in great straits for money, so that he was for some time unable to send the second portion of the dowry required to secure the marriage of his daughter Catharine with Henry, Prince of Wales. Nevertheless, he took part in the famous league of Cambrai formed against Venice in 1508, conquered Oran in Africa in 1509, and in 1512 seized a favourable opportunity to make himself master of the long-coveted kingdom of Navarre—thus becoming monarch of Spain from the Pyrenees to the Rock of Gibraltar. He died at Madrigalejo, 23d January 1516, and was succeeded by his grandson, best known in history as the Emperor Charles V. Ferdinand's ability, both as a general and as a statesman, has been variously estimated; but at least his skill and shrewdness as a negotiator were unsurpassed in an age of cunning and unscrupulous diplomatists. A characteristic anecdote relates that, on hearing of a complaint made by Louis XII. that he had cheated him once, he promptly answered: 'He lied, the drunkard! I cheated him three times.' Yet to Ferdinand and Isabella Spain owes her unity and greatness as a nation, and under them the foundations were laid of the unrivalled and imperial influence which, in the brilliant reign of their successor, she exercised over Europe. See Prescott's *History of the Reign of Ferdinand and Isabella* (3 vols. Boston, 1838).

Ferdinand I., emperor of Germany from 1556 to 1564, was born at Alcala in Spain in 1503. He was the son of Philip I., and brother of Charles V., whom he succeeded in the empire in 1556, having been previously elected king of the Romans (1531). Already, in 1521, Ferdinand had married Anna, daughter of Ladislaus, king of Bohemia and Hungary; and when her brother Louis fell in 1526 in battle with the Turks, leaving no issue, he claimed the crown in right of his wife. This involved him in a long and bloody struggle with a rival, John Zápolya, who laid claim to Hungary, and who, as well as his son Sigismund, was supported by Soliman, sultan of the Turks. Ferdinand at last gained the upper hand, bought off the Turks by a yearly tribute, and finally secured Hungary and Bohemia to the House of Austria. When he was elected emperor the concessions he had made to the Protestants caused the pope, Paul IV., to refuse to acknowledge him. That pope dying, his successor, Pius IV., was more complaisant; but the electors resolved that for the future the consent of the pope should not be asked; and this was carried out. Ferdinand made several attempts to reconcile his Protestant and Catholic subjects, and urged, though fruitlessly, the reformation of abuses on the Council of Trent. He died in 1564, leaving the reputation of a prudent and enlightened ruler, and was succeeded by his son Maximilian II. See Bucholtz, *Geschichte der Regierung Ferdinands I.* (9 vols. Vienna, 1831–38).

Ferdinand II., emperor of Germany from 1619 to 1637, was born at Gratz, 9th July 1578. He was grandson of Ferdinand I., his father being Charles, Archduke of Carinthia and Styria, the younger brother of Maximilian. His mother, Maria of Bavaria, early inspired him with hatred against the Protestants, and he was educated by the Jesuits at Ingolstadt, along with Maximilian of Bavaria. It is said that at Loretto he took a solemn oath before the altar of the Mother of God to reinstate Catholicism as the sole religion of his dominions at any cost. As soon as he succeeded to the government of his own duchy of Styria, he set about putting down Protestantism by force. He attempted the same in Bohemia and Hungary, of which countries he had been elected king during the lifetime of his cousin, the childless emperor Matthias; but though at first unsuccessful, and even in danger of losing his dominions, he ultimately managed, with the aid of the Catholic League and of the Elector John George I. of Saxony, to subdue them. Bohemia lost all its privileges, and by merciless hanging, confiscation of property, and the banishment of innumerable families, was reduced to obedience, while by the introduction of the Jesuits, and rigorous persecution of Protestants, he re-established Catholicism. His measures were less entirely successful in Hungary. Meanwhile Ferdinand had been elected emperor of Germany (1619). The war that had already been begun was now transferred to a wider area, and took the character of a religious war—the famous 'Thirty Years' War' (q.v.). The two imperial generals, Tilly and Wallenstein, were opposed by a confederacy of the Protestant states of Lower Saxony, with Christian IV. of Denmark at their head; but the confederates were defeated by Tilly at the battle of Lutter, in Brunswick, and forced to conclude peace at Lübeck in 1629. Confident in the ascendency which he had acquired, Ferdinand in the same year issued an edict of restitution for the whole of Germany, taking away from the Protestants nearly all the rights they had acquired by a century of struggles; and the troops of Wallenstein and of the League were immediately set to work to carry out this edict in several places. But his further success was soon arrested by the dismissal of Wallenstein, on which the diet of the empire at Ratisbon had insisted, by the opposition of Richelieu, and by the arrival upon the troubled scene of the great Protestant hero, Gustavus Adolphus of Sweden. After the murder of Wallenstein, at which the jealous Ferdinand connived to his eternal disgrace, the imperial commander, Gallas, by the victory of Nordlingen (1634) detached Saxony from the Swedish alliance; but the ability of the Swedish generals, for whom Austria had none that were a match, and the open part that France now took in the contest, brought back the balance of victory so far to the Protestant arms, that ere the wretched Ferdinand died, February 15, 1637, he had lost all hope of ever attaining the object he had pursued with such unreasoning and relentless constancy. His reign is one of the most disastrous in history; for Germany owes him nothing but bloodshed, misery, and desolation. See Hurter, *Geschichte Ferdinands II.* (11 vols. Schaffh. 1850–64).

Ferdinand III., emperor of Germany from 1637 to 1657, was the son of Ferdinand II., and was born at Gratz, 11th July 1608. He was not so much under Jesuitical and Spanish influences as his father. Having accompanied the armies in their campaigns after the death of Wallenstein, he had witnessed the miseries of war, and was inclined for peace; but the conflicting interests of the individual belligerents hindered any unity of view, and made it necessary to proceed with the struggle. Thus was this miserable war protracted, ever

extending in circuit, and increasing in devastation from the growing licentiousness of the soldiery. At last, in 1643, a congress met at Münster to arrange terms of peace, which was concluded in 1648, and is known as the Peace of Westphalia. At the diet of the empire (1653–54), the last presided over by an emperor in person, Ferdinand effected important alterations in the administration of justice. He died 2d April 1657, shortly after concluding an alliance with Poland against Sweden, and was succeeded in the German empire by his son Leopold I.

Ferdinand I., emperor of Austria from 1835 to 1848, was born at Vienna, 19th April 1793, and died at Prague, 29th June 1875. See AUSTRIA.

Ferdinand I., king of the Two Sicilies, was the third son of Charles III. of Spain, and was born 12th January 1751. When his father ascended the Spanish throne in 1759 Ferdinand, though a minor, succeeded him on the Neapolitan throne, under a regency, as Ferdinand IV. After his marriage, in 1768, with Maria Caroline, daughter of the Empress Maria Theresa, he fell completely under her influence, and lost all his former popularity. The queen and her favourite minister Acton (q.v.) ruled the kingdom. Ferdinand joined the coalition of England and Austria against France in 1793, and in 1798 occupied Rome, but soon fled panic-stricken before the French to Sicily on board Nelson's fleet. The French thereupon entered Naples, and set up the short-lived Parthenopean Republic, but were soon obliged to abandon the city and make room for the return of Ferdinand, who contrived to establish his power under the shadow of Nelson's ships. At length, however, in 1801 Ferdinand was forced to enter into a treaty with the First Consul. A subsequent violation of this treaty compelled him in 1806 again to take refuge in Sicily, under the protection of the English. A French army marched into Naples, and took possession of the kingdom, which Napoleon bestowed first on his brother Joseph, and afterwards on Murat. Ferdinand was reinstated by the Congress of Vienna, and entered Naples, after Murat's flight, in June 1815, and in the December of next year united his two states into one, and assumed the title of king of the Two Sicilies. His queen had already died in 1814. He had sworn before his recall to grant a constitution, and a popular movement in 1820 compelled him to renew his pledge, but with the help of an Austrian army the year after he shamefully broke his word and established a rigorous reign of despotism. He died January 4, 1825, and was succeeded by his son Francis I., who died in 1830. See J. Cordy Jeaffreson, *The Queen of Naples and Lord Nelson* (2 vols. 1889).

Ferdinand II., king of the Two Sicilies, grandson of the preceding, son of Francis I. by his second wife, Isabella Maria of Spain, was born at Palermo, 12th January 1810. He succeeded his father in 1830, and after a brief period of promise soon showed himself as corrupt and worthless a king as his predecessors. His first wife, a daughter of Victor Emmanuel I., dying in 1836, he married Maria Theresa, daughter of the Archduke Charles of Austria, and consequently gave himself more and more up to Austrian counsels, which saw danger for the whole peninsula in liberal measures. Henceforward Naples became the scene of incessant conspiracy, insurrection, bloodshed, and political prosecutions. Ferdinand yielded to the storm of 1848, and granted a constitution to both parts of his dominions, but the Sicilians mistrusted, and with reason, the king's pledges, and declared that he and his family had forfeited the Sicilian crown. Ferdinand followed the constitution so far as to call the promised national parliament together, but quickly dismissed it, impatient of any interference with his authority. He subdued the revolt in Sicily by the inhuman bombardment of its chief cities that earned him the epithet of 'Bomba,' which will live in history to his eternal dishonour. He now completely set aside the new constitution, while all who had taken any part in state reforms were subjected to those cruel persecutions which the Letters of Mr Gladstone in 1851 held up to the execration of the world. Bomba died 22d May 1859, and was succeeded by his son Francis II., the weak and cowardly 'Bombino,' whose reign of cruelty quickly fell before the victorious enthusiasm of Garibaldi and the triumphant progress of Italian unity. See Nisco, *Ferdinando II.* (Naples, 1884).

Ferdinand III., Grand-duke of Tuscany, and Archduke of Austria, was born at Florence, 6th May 1769. On his father's succeeding his own brother on the imperial throne in 1790, he succeeded to the government of Tuscany. Here he inaugurated many judicial, economical, and legislative reforms; encouraged commerce, founded hospitals, and opened up good roads through the state. A lover of peaceful progress, he remained strictly neutral in the first coalition against France, and was the first sovereign in Europe to recognise and treat diplomatically with the French Republic in 1792. Next year the combined menaces of Russia and England constrained him to relinquish his neutral policy and become a passive member of the coalition formed against France, but on the French occupation of Piedmont in 1795 he speedily reassumed friendly relations with France. In 1797, in order to save his states from annexation to the Cisalpine Republic, Ferdinand concluded a treaty with Bonaparte on most unfavourable terms, undertaking to pay a war-levy to France, and to transfer to the Museum of Paris some of the chief masterpieces of the Florentine galleries, among them the 'Venus de' Medici.' The continued intrigues of France in his states drove him into an Austrian alliance, which furnished Bonaparte with a pretext for declaring war simultaneously against Austria and Tuscany. In 1799 Ferdinand retired to Vienna, leaving the French troops in occupation of Tuscany, and in 1801, at the peace of Lunéville, he was forced to renounce all claim on Tuscany. The peace of Paris, however, reinstated him in Tuscany in 1814, and even restored his art-treasures. He died 17th June 1824, leaving his states to his son Leopold II.

Ferentino, a town of Italy, 55 miles by rail SE. of Rome. Portions of its ancient walls are built of limestone in the cyclopean style. Pop. 7679.

Ferghana, a province since 1876 of Russian West Turkestan, formerly the khanate of Khokand, lies among the western ranges of the Tian-Shan mountain complex. Area, 28,222 sq. m., four-fifths of which are mountainous, the Tchotkal Mountains being in the north, and the Ala-tau and the Trans-Alatau chain in the south. The rest of the province consists of the fertile irrigated plain of the Syr Daria (Jaxartes), which traverses Ferghana from north-east to south-west. The inhabitants are estimated to number 676,000 (538,800 settled agriculturists and 137,200 nomad shepherds), and consist of Aryan Tajiks and Sarts (mostly settled), and Turkish Uzbegs, Kipchaks, and Kara-Kirghiz (principally nomads). The chief towns are Khokand (the former capital), Marghilan (the present capital), Namangan, and Andijan.

Ferguson, ADAM, a Scottish philosopher and historian, was born June 20, 1723, at Logierait, in Perthshire, of which parish his father was minister. He studied at the universities of St Andrews and Edinburgh, and was appointed in 1745 for his

knowledge of Gaelic chaplain to the famous Black Watch, in which capacity he was present at the battle of Fontenoy, and is said to have charged the enemy sword in hand among the foremost. In 1757 he succeeded David Hume as keeper of the Advocates' Library in Edinburgh, and was next appointed professor in the Edinburgh University, first of Natural Philosophy (1759), and subsequently (1764) of Moral Philosophy—a subject much more to his mind. While holding this office he accompanied the young Earl of Chesterfield (1774) on his travels on the Continent, and acted as secretary to the commission sent out by Lord North to try to arrange the disputes between the North American colonies and the mother-country (1778–79). The state of his health compelled him in 1785 to resign his professorship, in which he was succeeded by Dugald Stewart, who had previously been his deputy; but he was appointed to Dugald Stewart's own chair of Mathematics, and allowed to discharge its duties through Playfair. He next travelled on the Continent, and after his return lived a while at Neidpath Castle in Tweeddale, then farmed fourteen years at Hallyards in the vicinity. His last years he spent at St Andrews, where he died 22d February 1816. Ferguson gave up at fifty the convivialities of his time, and reaped the benefit in the unusual health and mental vigour he enjoyed to the last. Scott and Lord Cockburn have left graphic descriptions of the fine old man that reveal a love for his own virtues no less than mere admiration for a monument of the past. It was in his house that the boy Scott had his one memorable glimpse of Burns. Ferguson's writings are his *Essay on Civil Society* (1766), *Institutes of Moral Philosophy* (1772), *History of the Progress and Termination of the Roman Republic* (1782), and *Principles of Moral and Political Science* (1792). His *History of the Roman Republic* was long a standard authority on its subject, was translated into both French and German, and was recommended by Carlyle in his rectorial address at Edinburgh as 'particularly well worth reading.' See Memoir by John Small (1864).

Ferguson, JAMES, a self-taught Scottish astronomer, was born near Rothiemay, in Banffshire, 25th April 1710. His father being a poor day-labourer, he enjoyed only three months of instruction at school, and his subsequent acquirements were the result of his own insatiable thirst for knowledge. His natural bent was chiefly towards practical mechanics and astronomy; and while keeping sheep, to which he was sent at ten, he was constantly busy in making models of spinning-wheels and mills, and at night in mapping the stars with a stretched thread and beads strung upon it. After working some years at cleaning clocks, making sun-dials, and the like, he took to drawing patterns for embroidery and copying pictures and prints with pen and ink. He then supported himself and his parents by drawing portraits, first in Edinburgh, and after their death in London; his leisure time being all the while given to making orreries, and to other astronomical pursuits. In 1748 he began lecturing on astronomy and mechanics with great acceptance. In 1761 he received from George III. a pension of £50, and he was elected F.R.S. two years later. He now gave up portraits, and devoted himself to lecturing throughout the country, and to writing on his favourite subjects with an assiduity unbroken by unhappy domestic circumstances. He died in London, 16th November 1776. Ferguson's principal works are *Astronomy explained upon Sir Isaac Newton's Principles* (1756; 13th ed. revised by Sir David Brewster, 2 vols. 1811), and *Lectures on Mechanics, Hydrostatics, Pneumatics, and Optics* (1760; also edited by Brewster, 1805). See the Life by Dr Ebenezer Henderson, with an Autobiography (1867; 2d ed. 1870).

Ferguson, PATRICK, inventor of the breech-loading rifle, was born in 1744 at Pitfour, Aberdeenshire, and, entering the army in 1759, served in Germany and Tobago. In 1776 he patented his rifle, firing seven shots a minute, and sighted for ranges of from 100 to 500 yards; and with it he armed a corps of loyalists, who helped at the battle of Brandywine (1777) to defeat the American army. He himself had a chance there of picking off an officer, but 'let him alone, disgusted with the idea of firing at the back of an unoffending individual, who was acquitting himself very coolly of his duty.' Next day he learned that the officer was Washington. Three years later, on October 7, 1780, Major Ferguson fell, defending King's Mountain, South Carolina, with 800 militia against 1300 Americans. This affair, which was not unlike that of Majuba Hill, turned the tide of southern warfare. See James Ferguson's *Two Scottish Soldiers* (Aberdeen, 1888).

Ferguson, ROBERT, the 'Plotter,' was born about 1637, near Alford, in Aberdeenshire, and in 1662 was ousted as a Presbyterian from the Kentish vicarage of Godmersham. As Shaftesbury's right hand, as Monmouth's 'evil genius,' he played for ten years a leading part in every treasonable scheme against the last two Stuart kings, and twice had to flee the kingdom. But after the Revolution, of which in 1706 he published a History, he changed sides, and conspired as busily for the losing Jacobite cause. He died, wretchedly poor, in 1714. His younger brother, James, commanded a brigade at Blenheim, and died very suddenly at Bois-le-Duc in 1705. See *Ferguson the Plotter* (1887), by James Ferguson, and his *Two Scottish Soldiers* (1888).

Ferguson, SIR SAMUEL, poet and Celtic scholar, was born at Belfast in 1810, educated at Trinity College, Dublin, and called to the bar in 1838. He gave himself more to Irish antiquities than to law, and in 1867 was appointed the first Deputy-keeper of Records in the Four Courts, in which capacity his qualities of organisation and arrangement were conspicuous. As president of the Royal Irish Academy he gave a powerful impetus to the scientific study of early Irish art, and its *Transactions* contain many invaluable papers from his pen. In 1878 he was knighted, and in 1886 the genial, humorous, and kindly *doyen* of Irish antiquities passed away. His fine musical and spirited poems, which were steeped in the truest patriotism, early began to appear in the magazines, and filled the volumes, *Lays of the Western Gael* (1865); *Congal, a Poem in Five Books* (1872); *Poems* (1880); and *The Forging of the Anchor* (1883). His edition of *Leabhar Breac* appeared in 1876; his *Ogham Inscriptions* in 1887.

Fergusson, JAMES, D.C.L., F.R.S., 'the historian of architecture,' was born at Ayr in 1808, and after spending some years as an indigo-planter in Bengal, explored nearly every corner of India, sketching and studying the rock-temples, which were illustrated in his earliest works. His invaluable *History of Architecture* (4 vols. 1865–76) appeared first as a *Handbook* in 1855. He published works on fortification, particularly on the defences of Portsmouth, and was a member of the Royal Commission on the defences of the United Kingdom. His other works include *The Palaces of Nineveh and Persepolis Restored* (1851), *Tree and Serpent Worship* (1869), and a *History of Rude Stone Monuments* (1872). He died 9th January 1886.

Fergusson, ROBERT, a Scottish poet, was born at Edinburgh, 5th September 1750, the third son of an industrious clerk from Aberdeenshire. A bursary for boys of his name enabled him to get

a good education at Dundee grammar-school and St Andrews University, where he took to writing verses, and discovered his disinclination for the clerical life to which he had been destined. Medicine proving equally distasteful, he found employment at Edinburgh in the office of the commissary clerk, contributing the while to *Ruddiman's Weekly Magazine* poems which quickly gained him such local reputation as unhappily proved his ruin. His society was eagerly sought, and in that convivial time he was led into excesses which permanently injured his health. At last he fell into a religious melancholy, which became complete insanity after an injury to the head received in a fall down-stairs. He died on the 16th October 1774, and was buried in the Canongate churchyard, where fifteen years later Burns, at his own expense, erected a memorial-stone with a poetical inscription over his grave. His poems were collected in 1773. There are editions by T. Ruddiman (1779), D. Irving (1800), Robert Chambers (1840), and A. B. Grosart (1851). As a poet Fergusson possessed vigour, fancy, fluency in versification, and an original vein of comic humour, but lacked imagination, energy, and passion. Such poems as 'The King's Birthday,' 'Braid Claith,' and 'Leith Races' are remarkably happy in hitting off the ludicrous side of local manners; 'The Farmer's Ingle' has a more lasting interest as the prototype of 'The Cottar's Saturday Night.' Burns had an admiration for his predecessor entirely out of proportion to his merits, and his earliest poetry was written under the shadow of 'his elder brother in the Muses.'

Fergusson, Sir William, surgeon, was born at Prestonpans, Scotland, on 20th March 1808. He studied medicine in the schools of Edinburgh, and was subsequently (1836) elected a surgeon in the infirmary. But in 1840 he left Edinburgh for London, having accepted the chair of Surgery in King's College, together with the post of surgeon in the hospital attached to the college. In 1866 he was made a baronet, in 1867 serjeant-surgeon to the Queen, and in 1870 he became president of the Royal College of Surgeons, London. He died in London on 10th February 1877. As a surgeon he proved himself a fit rival to Liston and Syme, performing his operations with great boldness, skill, celerity, and coolness. He especially distinguished himself in cases of stone, cleft palate, diseased leg and arm bones, diseased jaw, tumour, and hare-lip. See H. Smith, *Sir W. Fergusson, a Biographical Sketch* (Lond. 1877).

Feriæ, the ancient Roman term for holy days during which political and legal transactions were suspended, and slaves enjoyed a cessation from labour. Feriæ were thus *dies nefasti*, the opposite of the *dies fasti*. Days which were consecrated to a particular divinity, on which any public ceremony was celebrated, and the like, were feriæ. In contradistinction to these, which were *feriæ publicæ* or public holidays, there were *feriæ privatæ*, which were observed by single families in commemoration of some particular occurrence of importance to them or their ancestors. Birthdays, days of purification after a funeral, and the like, were also observed as family feriæ. See Fasti.

Feringhee, a name applied in the East to Europeans, whose land is vaguely called *Feringistan*. The term is a corruption of Frank, and dates from the Crusades.—In Bengal the mixed descendants of the Portuguese, while differing only in religion from the natives, are especially distinguished by the title of *Firinghis*.

Ferishtah. Mohammad Kasim Hindu Shah Firishta, or Ferishtah, a celebrated Persian historian, was born towards the end of the 16th century, at Astrabad, on the Caspian Sea. At a very early age he went with his father to India, where we find him, when twelve years old, at Ahmednagar, in the Deccan. Here he afterwards became captain in the bodyguard of Murtaza Nizam Shah; and when this king was deposed by his own son, Ferishtah went to Bijapur (998 A.H., 1589 A.D.), where the reigning monarch received him with great honour. His death is supposed to have taken place shortly after the year 1612. His great work is the *Tarikh-i-Firishta*, or History of the Mohammedan power in India, which he finished in 1018 A.H. (1609 A.D.). Twenty years were spent in its preparation, and the number of books used for and partly embodied in it amounts, according to Ferishtah himself, to thirty-five. It consists—besides a preamble or introduction on the Progress of Mohammedanism in India, and a final treatise on the geography and the climate of India—of twelve divisions, treating of the kings of Ghizni and Lahore, Delhi, the Deccan, Guzerat, Malwa, Candeish, Bengal and Behar, Multan, Sindh, Cashmere, Malabar, and of the saints of India. Written with an impartiality, simplicity, and clearness rare in an Eastern work, this history has become a standard work on the subject, into which it was the first to enter at length. Single portions of it were translated by Scott and others; but the whole work, edited first by Colonel Briggs (2 vols. fol. Bombay, 1831), was also translated by him (4 vols. Lond. 1832).

Ferman'agh, a county of Ireland, in the south-west of the province of Ulster, 45 miles long by 29 broad; area, 714 sq. m., of which 166 are arable, 368 pasture, about 100 uncultivable, and 72 water (including Upper and Lower Lough Erne). The surface is mostly a succession of mountains and hills, culminating in Belmore (1312 feet); the rocks include limestone, with many cavities and underground watercourses, millstone grit, and old red sandstone. Some coal, iron, and marble occur. The principal river is the Erne, which traverses the county in the direction of its longest axis. The soil in the low grounds is a deep rich loam, but in the limestone and sandstone districts it is cold and thin. The climate is mild and moist, though healthy. The chief products are oats, barley, wheat, potatoes, turnips, and hay; the chief exports, oats, butter, and eggs; and a little coarse linen is manufactured. Fermanagh is divided into 8 baronies and 23 parishes. It returns 2 members to parliament. Pop. (1851) 116,047; (1861) 105,768; (1871) 92,794; (1881) 84,879; (1891) 74,037, of whom 41,149 were Roman Catholics. Enniskillen is the county town. Among the antiquities are a round tower and St. Mary's Abbey on an island in Lough Erne, Danish raths, and ruined castles.

Fermat, Pierre de, a French mathematician, was born at Beaumont de Lomagne, near Montauban, in 1601, and at an early period, in conjunction with his friend Pascal, hit upon a very ingenious mode of considering figurate numbers, upon which he subsequently based his doctrine of the calculation of probabilities. Fermat employed himself greatly with the properties of numbers, and made many acute discoveries in regard to their composition and analysis. He also squared the parabola in a much simpler way than Archimedes at an earlier period had done, and made many other discoveries in geometry. His method of finding the greatest and least ordinates of curved lines was analogous to the method of the then unknown differential calculus. In addition to his scientific attainments Fermat possessed an extraordinary knowledge of ancient and modern languages. He died at Toulouse, 12th January 1665. A collection of Fermat's works appeared at Paris in 1670–79.

Fermentation (Lat. *fervēre*, 'to boil'), a change brought about in organic liquids by the

agency of a ferment. Ferments are of two classes, *soluble* and *organised*. (1) *Soluble ferments, or zymoses.*—This class is of less importance than the other. When isolated, the ferments are white, amorphous substances, freely soluble in water and in glycerine, and usually insoluble in alcohol. They are found in grain which has germinated (malt), in saliva, gastric juices, &c., and also usually occur along with organised ferments like yeast. The commonest soluble ferment is Diastase (q.v.), occurring in malt. Others of considerable importance are ptyalin, found in saliva; pepsin, in gastric juice; synaptase, in bitter almonds; myrosin, in mustard, &c. These all resemble one another very closely in properties, and all have the power to cause substances like starch and cane-sugar to combine with water, forming glucose and analogous uncrystallisable sugars, thus:

Cane-sugar. Water. Dextrose. Levulose.

$$C_{12}H_{22}O_{11} + H_2O = C_6H_{12}O_6 + C_6H_{12}O_6.$$

Diastase converts the starch contained in barley first into dextrine, then into glucose or grape-sugar, thus:

Starch. Water. Glucose.

$$C_6H_{10}O_5 + H_2O = C_6H_{12}O_6.$$

The same effects can be produced by boiling these bodies with dilute acids. Soluble ferments act most rapidly at a temperature of 75° C. (167° F.), and are destroyed by boiling. Their action is impeded or entirely stopped by many substances such as borax, citric and tartaric acids, and some antiseptics; on the other hand, prussic acid, mercurial salts, alcohol, chloroform, ether, and essential oils have little effect on soluble ferments.

(2) *Organised Ferments.*—The chemical changes induced by these always depend on the life-process of minute organisms (see article GERM) which feed upon sugar or other substances in solution, and excrete the product of the fermentation. Fermentation nearly always consists of a process of breaking down of complicated organic substances like sugar into simpler ones like alcohol and carbonic acid. Economically, alcoholic fermentation is of far greater importance than any other. It is caused by the so-called yeast-plant (*Saccharomyces cerevisiæ*) in solutions containing uncrystallisable sugar (glucose). The sugar may be originally in various forms. In malt extract for beer it exists as glucose or dextrine; in grape-juice for wine manufacture, chiefly as glucose; in potatoes for making potato-spirit or 'marc,' as starch; or, finally, as cane-sugar itself. The latter two, when fermented, are first converted by the soluble ferment which accompanies yeast into glucose, and that is then transformed by the yeast itself into alcohol, carbonic acid gas, and small quantities of glycerine, succinic acid, and other substances.

Brewers' yeast contains an enormous number of one-celled organisms (*Saccharomyces cerevisiæ*), on which its activity entirely depends. Under the microscope these are seen to be colourless, nearly transparent, roughly spherical bodies of a diameter of about 0·00035 inch. When the conditions are favourable—i.e. nourishment plentiful, and temperature about 80° F., the yeast-cells multiply very rapidly by budding. When food is deficient they may multiply by the formation of spores. Fermentation of grape-juice to form wine depends on organisms of the genus Saccharomyces, of which there are many species not yet very sharply defined. The various species are found in different kinds of wine must, or even in different positions in the same fermenting-vat.

Putrefaction and rotting are very much akin to fermentation, and all depend on the presence and growth of minute organisms.

The following are some of the varieties of fermentation which possess considerable importance or interest:

Acetous Fermentation.—It has long been known that wine under certain circumstances absorbed oxygen from the air and turned into vinegar. This is now known to be due to the conversion of the alcohol into acetic acid by an organism, the *Mycoderma aceti*. The wine is allowed to trickle slowly through barrels filled with beech-shavings, through which fresh vinegar has previously been poured in order to impregnate the shavings with the 'mother of vinegar,' which contains the Mycoderma. Under the microscope the *M. aceti* appears as very minute elongated rods (diameter about 0·00008 inch) united into chains.

Lactic fermentation is the cause of the souring of milk. It is caused by a definite rod-like organism or bacillus, which reaches the milk from the air. The life-conditions of this ferment are almost the same as those of the yeast ferment, but there are certain substances attacked by the one and not by the other, and *vice versâ*. During lactic fermentation the sugar of milk is converted into lactic acid, which ultimately causes the curdling of the milk.

Butyric Fermentation.—This is one of a large number of processes of fermentation usually roughly classed as putrefaction, on account of the foul smell produced during the action. It is caused by an organism (*Fermentum butyricum*) which has the power of breaking down such substances as sugars, starches, tartaric and citric acids, and albumenoid substances, producing butyric acid and carbonic acid.

Ammoniacal Fermentation is also one of the processes which form part of putrefaction. Most organic substances containing nitrogen yield ammonia as one of the products of putrefaction. This process is of great importance in nature, as by it nitrogenous animal matter, contained in manure, is converted into salts of ammonia, which can be absorbed by earth. They are then acted on by the nitrifying organism which is found in all fertile soils, and by it slowly oxidised into nitrates, which can then be absorbed by the roots of plants.

Conditions of Fermentation.—As all fermentation, except that produced by soluble ferments, is caused by living organisms, the *optimum* conditions of fermentation are (1) sufficiency of nourishment and moisture; (2) temperature about blood-heat (98° F.); (3) absence of poisonous substances. Deficiency of nourishment or water may kill a ferment, or may cause it to form spores, which then resist drying, and may even exhibit vitality after boiling, which is instantly fatal to all active ferments. A low temperature renders ferments inactive, a temperature much above 100° F. is fatal to their life. All antiseptic or disinfectant substances (see ANTISEPTICS), such as corrosive sublimate, chlorine, fumes of burning sulphur, eucalyptus-oil, act by impeding or destroying the life of the ferments. Many of the products of fermentation are themselves antiseptics, as in the case of alcohol, so that alcoholic fermentation always arrests itself when the spirit has reached a certain strength. Some ferments cannot live in presence of air, others require it; while others again are indifferent to it. For further information, see *Fermentation*, by Schützenberger (Inter. Sc. Series), and the article 'Fermentation' in Thorpe's *Dictionary of Applied Chemistry*.

FERMENTED LIQUORS are alcoholic beverages made by fermentation of saccharine fluids and juices; the principal being the different kinds of *ale* or *beer*, made by fermentation of an infusion of malt—chiefly of barley, but also sometimes of other kinds of grain—and *wine*, made by fermentation of grape-juice. *Cider* is made by fermentation

of the juice of apples; *perry*, of that of pears; *palm-wine*, by fermentation of the sap of different kinds of palm. Fermented liquors, commonly called wines, are also made from the juice of various kinds of fruit, as currant-wine from that of the red currant; and from the juice of some roots, as parsnip-wine from that of the parsnip, &c. The sap of the American Aloe, or *Agave* (q.v.), yields the fermented liquor called *Pulque*, much used in Mexico. A wine is made from the sap of the birch, and that of some other trees is used for a similar purpose. *Mead* is a fermented liquor made from honey. From every fermented liquor a kind of *spirit* may be obtained by distillation. See BEER, WINE, &c.

Fermo, a town of Italy, is situated on a rocky height 4 miles from the Adriatic, and 36 SSE. of Ancona. It is well built, is surrounded with ancient walls, and has been the seat of an archbishop since 1589. Formerly Fermo possessed a university. Pop. 6692. Its port, Porto San Giorgio (pop. 3114), on the Adriatic, has some trade in corn, silk, and wool. In the immediate vicinity of Fermo are the ruins of the ancient *Firmum*.

Fermoy, a clean, well-built town in County Cork, Ireland, on the Blackwater, 19 miles NE. of Cork city. Its origin dates from the 12th century, when it was the seat of a Cistercian abbey; but the present town was the creation of a Scotch merchant toward the close of the 18th century. It contains a Catholic cathedral, St Colman's College, and barracks for 3000 men. The river is crossed by a noble stone bridge, erected in 1866. The town has a trade in flour and agricultural produce. Pop. (1861) 8705; (1881) 6454; (1891) 6469.

Fern. See FERNS.

Fern, MALE, *Aspidium* (*Nephrodium*) *filix-mas*, a name given by old herbalists in contrast to the Lady Fern, *Asplenium* (*Lastræa*) *filix-fœmina*, which, from the aspect of their foliage and common association in woods, they imagined to represent the two sexes. The large subterranean rhizome contains a volatile oil, to which the long-established medicinal value as a vermifuge (particularly in tapeworm) is due.

Fern, SWEET (*Comptonia asplenifolia*), an ill-named shrub of the sweet gale order (Myricaceæ) (see CANDLEBERRY), a native of the mountain-woods of North America, forming a small bush with linear, pinnatifid, fern-like leaves. Its leaves have a powerful aromatic fragrance when rubbed. It is tonic and astringent, and is used as a domestic remedy for diarrhœa.

Fernandina, a port of entry and capital of Nassau county, Florida, on an island 28 miles NNE. of Jacksonville, forms a terminus of the railway connecting the Atlantic with the Gulf of Mexico, and has a considerable transit trade with the West Indies, Charleston, and Savannah, its shipments of lumber exceeding 100,000,000 feet in a year. It is the seat of the episcopal bishop of Florida, and a popular bathing resort. Pop. 2803.

Fernando Noronha, an island of Brazil, in the Atlantic Ocean, in 3° 50′ S. lat. and 32° 25′ W. long. About 5½ miles long by 1¼ wide, and of volcanic formation, its general elevation is 600 to 700 feet. It is well cultivated by the Brazilian convicts, some 2000 in number, who inhabit it. Off its north-east point lie several smaller islands.

Fernando Po, an island on the west coast of Africa, in the Bight of Biafra, with an area of 671 sq. m., forms geologically a continuation of the Cameroon Mountains of the mainland. The island, oblong in shape, with steep, rocky coasts, and disposed in a NNE. direction, is bisected by 2° 39′ N. lat. Its northern half is almost entirely occupied by the volcanic peak (9300 feet) known to the English as Mount Clarence, to the Spaniards as Pico Santa Isabel; and its southern half contains a short range lying E. and W. The island is covered with luxuriant vegetation. The average annual temperature at Santa Isabel, the capital (pop. 1500), is 78° F. The island is inhabited by the Bubis, a Bantu tribe, who number 20,000 to 25,000 in all, and by some negroes. Maize and yams, cacao, coffee, palm-oil, and palm-wine are the principal products. Discovered by the Portuguese Fernão do Pao in 1472, the island has belonged successively to Spain (1777–1827), England, and Spain (since 1841). See *Bulletin Par. Geog. Soc.* (1886).

Ferney, a village of 1131 inhabitants, in the French department of Ain, 4½ miles NW. of Geneva, and 2 miles W. of the lake. It is celebrated as the place where Voltaire (1694–1778) resided during the last years of his life. He purchased the estate in 1758, and from that time was known variously as the seigneur, the philosopher, and the patriarch of Ferney. During these years Voltaire acted as a dictator of letters throughout French-speaking Europe, and his château was a kind of pilgrimage resort for all sorts and conditions of literary and political celebrities.

Ferns (*Filices*), as the most abundant and beautiful, most varied and typical class of higher (i.e. Vascular) Cryptogams, are of special interest alike to the botanist, the horticulturist, and the lover of nature. While Linnæus included under his Filices all the Vascular Cryptogams, since Jussieu the equisetums, rhizocarps, club-mosses, and selaginellas have been separated off as distinct classes (see HORSETAIL, RHIZOCARPS, LYCOPODIUM, SELAGINELLA, ISOETES), as have more recently also the Ophioglosseæ (see MOONWORT).

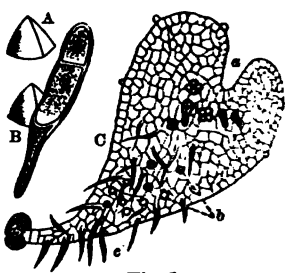


Fig. 1.
Germination of Prothallium: A, spore; B, germinating spore; C, under surface of prothallium, showing archegonia, *a*; antheridia, *b*; rhizoids, *c*.

Since what we familiarly call the fern-plant is

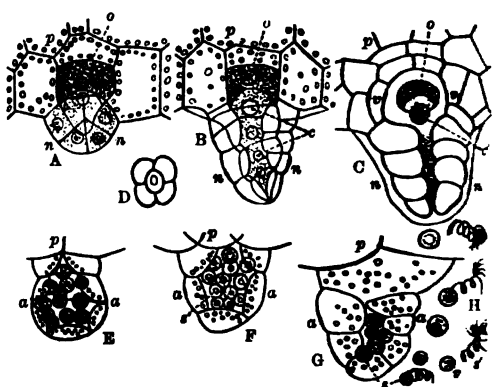


Fig. 2.
A—D, archegonia; A—C, longitudinal sections; D, transverse section of neck; *p*, prothallium; *n*, neck of archegonium; *c*, neck canal cells; *v*, venter of archegonium; *c'*, ventral canal cell; *o*, oosphere. E—G, antheridia in transverse section; *p*, prothallium; *a*, antheridium; *s*, spermatocytes. H, spermatozoids, *s'*, escaping from their vesicle, *v*, which contain starch grain.

only the spore-bearing member of an alternation of generations, it is convenient for the compre-

hension of the life-history of the group, and still more for comparison with that of the other above-named Vascular Cryptogams, and of these with Gymnosperms (q.v.) and Phanerogams (q.v.), to begin with the familiar fern-spore, and trace its history round to the spore again, although necessarily only in the briefest outline. In fig. 1, A, this double-walled and characteristically formed and marked spore is represented; in B it is germinating into a short filament which soon broadens into

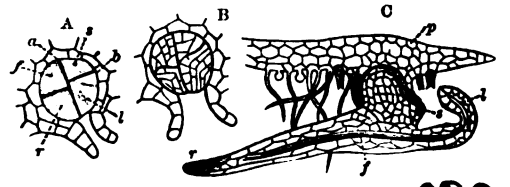
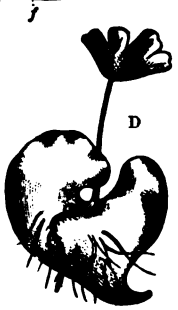


Fig. 3.

A, fertilised oosphere, showing first *a*, and secondly *b*, division-walls, mapping out the inclination of growth of the stem, *s*; foot, *f*; root, *r*; and first leaf, *l*. B, embryo at later stage. C, vertical leaf-stalk through prothallium, *p*; a young fern, *f*; *l*, first leaf; *s*, stem; *r*, root. D, prothallium with young fern attached to it.



a thin, flat, bilobed cellular expansion, the *prothallus*, C. This develops unicellular root-hairs from the under surface, and grows to a size varying on the average from $\frac{1}{32}$th to $\frac{1}{8}$th of an inch in diameter, resembling most nearly a small thallus of Liverwort (q.v.). It leads a perfectly independent existence, usually for several months, but sooner or later develops organs of sex, of which both are most commonly present upon the same prothallus. Near the apex of the prothallus we find the female organs or *archegonia*, each archegonium being a flask-shaped group of cells, of which the deepest central cell enlarges greatly to become the ovum, which fills the body of the flask, while those above it undergo mucilaginous degeneration and disappear, so leaving the neck of the flask as an open way of access to the ovum from the exterior (fig. 2, A–D). The male organs (*antheridia*) arise as epidermic papillæ among the root-hairs, and segment into spheroidal groups of cells inclosing a large central cell, which soon segments into a group of smaller cells (see fig. 2, E–G). These undergo rejuvenescence, and escape in the ciliated state as free-swimming *antherozoids*, which (the prothallus growing in damp situations) find their way towards the archegonia. One antherozoid suffices to fertilise an archegonium, and, however many archegonia may

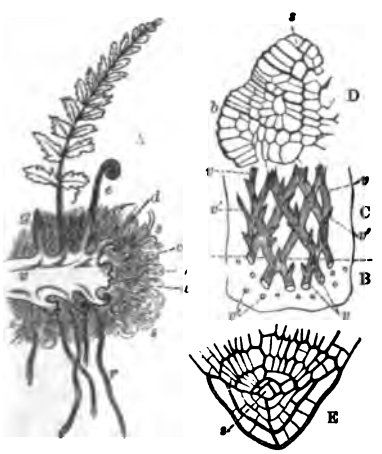


Fig. 4.

A, section along Rhizome of Aspidium, showing vascular bundles, *v*; stages of leaf development from apical buds to dead leaf stalk, *a*—*g*; scale hairs, *s*; and roots, *r*. B, transverse section of fern-rhizome, showing outside the smaller bundles, *v'*; passing out to the leaves and main bundles, *v*. The anastomosing of these, forming the netted cylinder, is shown in elevation in C. D, tip of developing leaf of Ceratopteris; *s*, apical cell; *b*, lateral lobe of leaf. E, longitudinal section of root-tip of Pteris; *s*, apical cell, developing root-cap below.

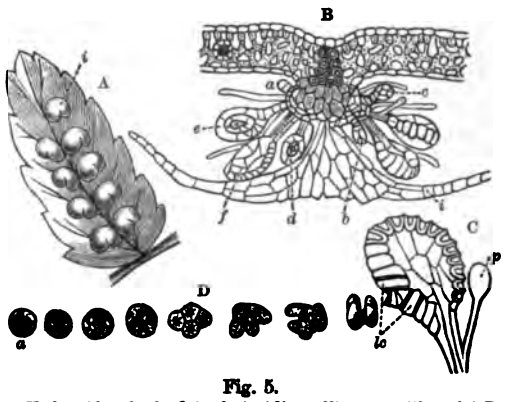


Fig. 5.

A, Under-side of a leaflet of *Aspidium filix-mas*, with sori, *t*. B, transverse section, with a sorus consisting of the sporangia in different stages of development, *a*—*f*, and the indusium, *t*. C, sporangium, with annular lip-cells, *lc*, and paraphysis, *p*. D, development of spores from mother-cell, *a*.

be fertilised, the small prothallus is only able to bear a single fern-plant. The fertilised ovum segments into four portions (fig. 3, A–B) of which two segment to form the so-called *foot*, by which the young fern remains for a time attached to and supported by the parent prothallus (fig. 3, C); another goes on dividing to form the first root, while the remaining one gives rise to the stem and leaf. As the fern grows up it soon exhausts the prothallus, which dies off and disappears, and the fern gradually assumes the familiar vegetative development characteristic of the group.

The fern-stem grows forward by an apical cell (fig. 4, D); the root-tip, too, has its apical cell, which also develops a root-cap (fig. 4, E). In the mass of embryonic tissue produced by the segmentation of the apical cell we soon distinguish (*a*) an external *dermatogen* layer which gives rise to the epidermis and its outgrowths, (*b*) internal strands of tissue of which many cells undergo characteristic modifications and give rise to the future fibro-vascular bundles, the whole lying imbedded in (*c*) the less modified ground tissue, which for the most part remains parenchymatous, but may in part become lengthened and hardened (as sclerenchymatous and prosenchymatous tissue), mainly for the purpose of increased mechanical strength. The fibro-vascular bundles form a meshwork anastomosing where bundles are given off into the leaves; they are closed and definite—i.e. contain no cambium and are

Fig. 6.

A, Tasselled variety of Male Fern (*A. filix-mas*, var. *Cristata*). B, Fertile frond of Royal Fern (*Osmunda regalis*).

consequently incapable of continued growth, save by addition in length at the growing-point. Their structure is concentric, the bast surrounding the wood. The axis forms most commonly a short root-stock; this, however, in some genera grows erect to a considerable height, giving us the characteristic and beautiful somewhat palm-like type of vegetation of the tree-ferns (see TREE-FERN). The leaves are developed in a close spiral succession just behind the growing-point, and are of slow growth, usually requiring two years to develop. Even in the expanded leaf growth may continue for a long time, the indefinite growth of the twining leaf of Lygodium being only the extreme case of this. Their characteristic *circinate vernation*—i.e. inrolled spiral or crozier-like folding in the bud—is very characteristic, and, as this must arise by a greater growth of the dorsal than the ventral surface, so the expansion of the leaf can be readily observed to be due to the temporary reversal of the disproportion, equilibrium being only reached with maturity. The leaf is sometimes entire, but is more frequently pinnate, bipinnate, or decompound: this arises, however, in a totally different way from the pinnation of the leaves of phanerogams (see LEAF), being due to a dichotomy with unequal development of either fork alternately. The leaf-stalk or *rachis* is thus a false axis. The mode of origin is well revealed by reference to those tasselled varieties (fig. 6, A) which so frequently appear in widely distinct species in cultivation, exuberantly vegetative conditions admitting of the almost equal development of many successive secondary axes.

The process of asexual reproduction is in most ferns carried on by all the leaves indifferently (whence the attempt formerly so prevalent, but botanically unnecessary, to distinguish them from ordinary leaves as *fronds*). In many cases, however, this becomes restricted to particular portions of the leaf, apical in the common royal fern (*Osmunda regalis*, fig. 6, B), or median as in *O. interrupta*, or even to special fronds, as in the common hard fern (*Blechnum spicant*) or the parsley fern (*Allosorus crispus*). In such cases the vegetative development of the spore-bearing fronds is of course greatly checked, and we have a distinct foreshadowing of the stamens and carpels of the phanerogams (although the spores have not as yet themselves acquired any character of distinct sex, much less the sporangia and the leaves which bear them). The fern may also exceptionally bud directly from the prothallus without archegonia (*apogamy*), or the prothallus from the frond without spores (*apospory*). Many ferns (particularly *aspleniums*) also multiply directly by budding upon the fronds.

At fig. 5, A, we have a fertile pinna of the common male fern (a name which of course refers merely to an old misinterpretation of the contrast of its rough foliage with that of the lady fern), showing the patches of spore-cases, or *sori*. The same figure (B) gives a section of a sorus, with developing sporangia under its epidermic cover or *indusium*. These are simply multicellular epidermic hairs, B, C, of which the central cell of the head segments and re-segments into spores (D). The spore-case is ruptured when ripe in various ways at once of practical interest and of high systematic importance, and the spores are thus diffused in great numbers to take their scanty individual chance of germinating as new prothallia.

Systematists vary somewhat as to the orders into which to divide this very large class, which includes about 70 genera and about 3000 living species, besides a great number of extinct forms. A convenient enumeration of these, however, may be taken as follows:

A. Sporangia thick-walled and without ring, arising in the leaf-tissue, and not as epidermal hairs (trichomes). I. Marattiaceæ—4 genera, with about 30 species in tropical America, Asia, and Oceania: Marattia, 10;* Angiopteris, 7.

B. Sporangia epidermal, with ring. (*a*) Ring indistinct. II. Osmundaceæ—2 genera, 11 species, scattered through all regions: Osmunda, 7 (see ROYAL FERN); Todea, 4. (*b*) Ring well developed; 6 orders, distinguished by details of sporangial structure—viz. III. Schizæaceæ—4 genera, tropical: Schizæa, 14; Antimia, 30; Lygodium, 30; Mohria, 2. IV. Gleicheniaceæ—3 genera, tropical, 40 species: Gleichenia, 8; Mertensia, 30. V. Hymenophyllaceæ (see FILMY FERNS)—3 genera, 200 species, chiefly tropical: Hymenophyllum, 80; Trichomanes, 90. VI. Cyatheaceæ, chiefly Tree-ferns (q.v.)—6 genera, with about 170 species, chiefly of southern tropical and warm temperate zones: Alsophila, 60; Hemitelia, 30; Cyathea, 40; Cibotium, 6; Dicksonia, 20. VII. Parkeriaceæ—2 genera, with only 2 species, *Ceratopteris thalictroides*, eaten as a vegetable in tropical Asia, and *Parkeria pteridioides*, found swimming in tropical American waters. VIII. Polypodiaceæ. While the preceding families contain only the genera above named, or at most one or two others, the Polypodiaceæ constitute the great majority (nine-tenths) of the whole group, and are widely distributed through all regions of the globe, although chiefly in warm climates. Of their families and leading genera a brief summary is therefore convenient.

(1) Sorus not covered by indusium. (*a*) Acrostichaceæ, with sporangia uniformly scattered upon the back of the frond or part of it—3 genera, 200 species, mostly tropical American, East Indian, and Australasian: Acrostichum, 170; Platycerium, 5, of which some species are cultivated, the stag's-horn ferns familiar in greenhouses. (*b*) Polypodiaceæ, or Polypodies (800 species), with sori variously arranged. (i.) Sori in streaks following the veins: Gymnogramme, 74, of which *G. chrysophylla* and *G. tartarea*, both West Indian, are cultivated as the Golden Fern and Silver Fern, names which well describe the characteristic beauty of the mealy wax which is so copiously secreted by glandular epidermic cells as to cover the lower surface. Sori in round or elliptical patches: Polypodium, 150, mostly tropical (see POLYPODIUM); Phegopteris, 70 (Beech Fern). Sori linear: Ceterach, of which the common Scaly Fern, *C. officinarum*, was long in repute as an astringent medicine. (ii.) Sori along the edge of the frond: may be continuous and uncovered (Notochlæna), or covered by a false indusium produced by the infolded edge of the frond, which is continuous in Pteris, 120 (see BRACKEN), discontinuous in Allosorus, 34 (Parsley Fern), while in Adiantum, 108 (see MAIDENHAIR FERN), the patches of sori are developed upon an inturned edge.

(2) Sorus covered by indusium. (*c*) Aspleniaceæ, or Spleenworts (400 species), mostly tropical, with long or linear sori, with indusium arising laterally from above a vein: Blechnum, 50 (the Hard Fern); Asplenium, 300 (the Spleenworts); Scolopendrium, 8 (see HART'S-TONGUE). *Diplazium esculentum* furnishes an edible rhizome in the East Indies. (*d*) Aspidiaceæ, or Shield Ferns (250 species), with dorsal sori of rounded shape, with shield-shaped or kidney-shaped indusia: Aspidium (Nephrodium), a large genus (220 species), including the Male Fern (see FERN, MALE) and many other well-known forms. Minor genera are Cystopteris, 9 (the Bladder Fern); Woodsia, 11; Struthiopteris, 3. (*e*) Davalliaceæ, with sporangia on a tooth, or in a furrow of the leaf edge—4 genera, with 200 species, almost all tropical: Davallia, 112.

* The numbers following generic names indicate the approximate number of known species.

Fossil Forms.—We have a few fossil ferns even from the Silurian strata (Eopteris), while the Carboniferous rocks have yielded about 200 species, of which some were tree-like (Protopteris, Caulopteris, Pecopteris, perhaps also Neuropteris), while others (Sphenopteris, Hymenophyllites, &c.) appear to have formed great part of the undergrowth of the Carboniferous forest. Their remains also appear through the Secondary and Tertiary formations, approximating more nearly to those of our own day, and in the Tertiary indeed sometimes referable to existing genera (Alsophila, Lygodium, Osmunda). See PALÆONTOLOGY. From the imperfect preservation of the sori and sporangia, the precise systematic position of fossil ferns can rarely with much certainty be determined.

Uses of Ferns.—Like other perennial stems and root-stocks, those of ferns contain a store of starch, and this becomes in many species of economic importance to communities which have not reached the agricultural stage. Foremost among these is rhizome of *Pteris esculenta*, the Tara (q.v.) of the Maoris, to which may be added *Aspidium edule* of Nepal, while the *Cyathea medullaris* in New Zealand, *Angiopteris erecta* in the South Seas, and other tree-ferns yield a kind of sago. Survivals of this use of ferns, or reversion to it in time of famine, also occur among more advanced peoples (see BRACKEN), and developing fern fronds are occasionally still eaten as a kind of salad in northern countries. Before the epoch of chemical manufactures the common ferns were a convenient source of potash, and their fronds are still often gathered as bedding for cattle. Their astringency gave them also a place in medicine, but the syrup known as *Capillaire* (see MAIDENHAIR) and the occasional use of male fern as a vermifuge alone survive in modern pharmacy. The characteristic beauty of their foliage has, however, given them in recent times a place in horticulture so important, especially in England, as to be sometimes compared to the historic Tulipomania (see TULIP) itself. The hardy ferns succeed well on shady rockwork, and the exotics under glass; their propagation, either by division of the root-stock (Davallia, &c.) or by sowing tolerably fresh ripe spores in saucers, kept moist and shaded under a glass (Pteris, Adiantum, &c.), is also easy. Many can be grown under a large bell-glass in rooms, or better in Wardian cases.

Various superstitions attach to ferns—the root of some kinds, for example, was in some places credited with the power of opening locks. By 'watching the fern' in solitude during the night of St John's Eve (24th June) one might hope to meet fairy benefactors, and receive a purse of gold; but the most widespread superstition is that fern seed, properly gathered, renders the bearer invisible. On the same eve of St John the fern puts forth at dusk a small blue flower, which soon disappears; and the wonderful seed, quickly ripening, falls at midnight, and should be caught in a white napkin. Fern seed is in some places a 'wish-seed,' enabling the bearer to attain his utmost wishes.

For guidance to the abundant literature on ferns, see Goebel's, Van Tieghem's, or other text-book of botany; the several works on ferns by Sir W. J. Hooker (*British Ferns, Garden Ferns, Filices Exoticæ, Species Filicum*); Heath's works (*The Fern World, Fern Paradise, Fern Portfolio*); also, for systematic studies, Smith's *Historia Filicum*; or general, for beginners, Moore's *British Ferns*. For information as to particular genera and species and their culture, see Nicholson's *Dictionary of Gardening*. See also De Bary (transl. by Bower and Scott, 1885).

Fer Oligiste is a mineralogical term applied to a variety of anhydrous red oxide of iron, Fe_2O_3, otherwise called *Specular Iron Ore*. See IRON.

Ferozabad, &c. See FIROZABAD, &c.

Ferrandi'na, a town of Italy, on a height above the Basento valley, 43 miles ESE. of Potenza by rail. Pop. 7325.

Ferrar, NICHOLAS, born in 1592, at fourteen entered Clare Hall, Cambridge, of which in 1610 he was elected fellow. He studied medicine, and travelled five years on the Continent (1613–18), then engaged in the business of his father, a London merchant, and in 1624 was returned to parliament. But in 1625 he retired to Little Gidding in Huntingdonshire, and founded there the religious community familiar to every reader of Mr Shorthouse's *John Inglesant;* next year Laud ordained him deacon. With his brother and brother-in-law and their families the community numbered some thirty persons, who with constant services and perpetual prayer combined the occupation of fine bookbinding. Nicholas himself died on 4th December 1637, worn out by asceticism; but the 'Arminian Nunnery,' which received two visits from Charles I. (in 1633 and 1642), was not broken up by the Puritans till ten years after his death. See the two lives of Ferrar, one by his brother John, edited by Mayor (Camb. 1855).

Ferrara, a city of Italy, capital of the province of the same name, is situated in the marshy delta of the Po, 30 miles from the Adriatic, and 29 NE. of Bologna by rail. First made a walled city in 604, it still is fortified with walls, bastions, ditches, and a citadel. The old castle or ducal palace of the Estes, built in the Gothic style in the 14th and 15th centuries, with corner towers, moats, and heavy machicolations, is the most conspicuous secular building in Ferrara. After the extinction of the Este family it was until 1860 the residence of the papal legates. The most notable churches are the cathedral and those of San Francesco, San Benedetto, and Santa Maria in Vado, which contain paintings by native artists (Garofalo, Dosso Dossi, &c.) and others (Guercino, Seb. Filippi). The university, founded in 1264, reorganised in 1402, closed in 1794, and reopened in 1824, has three faculties (medicine, jurisprudence, mathematics), nineteen professors, and less than forty students. Its excellent library (100,000 vols., rare incunabula, and 1000 MSS.) contains original works of Tasso, Ariosto, and Guarini. Ferrara is specially remarkable for its art associations. Under the patronage of the Dukes of Este it produced a good school of painters; in literature it is closely associated with Tasso, Ariosto, and Guarini, who, as well as Savonarola, was born at Ferrara. At the period of its greatest prosperity Ferrara had about 100,000 inhabitants; now, however, it presents a decayed appearance, and in 1881 had only 30,695 inhabitants. After passing through various vicissitudes Ferrara became subject to the house of Este about the close of the 12th century, and remained in their hands until the extinction of the family in 1598, when it passed to Pope Clement VIII. In 1860 Ferrara was incorporated in the kingdom of Italy.

Ferrara, ANDREA, a broadsword-maker of the 16th century, respecting whose personal history nothing is certainly known beyond the fact that he was established at Belluno in North Italy in 1585, where, along with his brother, he enjoyed great repute as an armourer. According to a tradition long current in Scotland, he was a Spaniard by birth; but the probability that he was an Italian and a native of the city of Ferrara is quite as strong. It is claimed for him that he tempered sword-blades by the same method as that employed by the smiths of Damascus. See *Cornhill Magazine*, vol. xii. (1865).

Ferrari, GAUDENZIO, Italian painter, was born at Valduggia, in Piedmont, in 1484. A scholar of

Andrea Scotto, he also caught some inspiration from Da Vinci and Raphael. The chief characteristics of his style are correct and vigorous delineation, strong but often hard colouring, considerable power of invention, and skill in the arrangement of drapery. He executed innumerable paintings both in fresco and in oil, the greater part of which are possessed by the Lombard galleries. His most comprehensive work, the frescoes at Varallo, in Piedmont, represents the Passion; another good specimen of his work, the 'Martyrdom of St Catharine,' is in the Brera Gallery at Milan. He died at Milan in 1549. The chief of his pupils was Andrea Solario. See Colombo, *Vita di Ferrari* (Turin, 1881).

Ferrari, PAOLO, Italian dramatist, was born at Modena in 1822, and produced his first comedy, *Bartolommeo il Calzolajo*, in 1847. Of his many later works, *Goldoni* (1852) and *Parini e la Satira* (1857) rank as the finest examples of modern Italian comedy, and are distinguished—as, indeed, are most of his plays—by a piquancy and sparkling dialogue, as well as cleverness of construction and occasional sharp contrasts, such as have been mostly identified with French comedy. A collection of his *Opere drammatiche* was published at Milan in 14 vols. (1877–80). In 1860 he became professor of History at Modena, and afterwards in the Academy at Milan, where he died 10th March 1889.

Ferrates are combinations of ferric acid, $HFeO_2$, a weak unstable compound of iron and oxygen, with bases. See IRON.

Ferrers, LAWRENCE SHIRLEY, EARL, the last nobleman who died a felon's death in England, was born in August 1720, and succeeded to the peerage as fourth earl in 1745. He was subject to ungovernable paroxysms of passion, in the fury of one of which he killed his old land-steward in January 1760, for which, being tried by his peers in Westminster Hall, he was hanged at Tyburn on the 5th May following.

Ferret (*Putorius furo*), a half-tamed albino variety of the polecat (*P. fœtidus*). It is slightly smaller than the wild form, measuring about 14 inches in length without including the tail, and has white or yellowish fur and the usual red—i.e. unpigmented eyes. Like some other albinos, it is delicate and requires to be carefully housed in cold weather. The variety is virtually constant, except when the ferrets breed with polecats, which they will readily do; then a 'variety-hybrid' with intermediate colouring results. The ferret has been for long in human hands, for Aristotle knew it, and the Romans used it as we do. It seems to have originated in Africa, or in southern Europe—e.g. Greece—and may have been reared by the ancient habit of keeping a polecat to hunt for mice, before the days of the domestic cat. In spite of its long training, it is hardly tame, far less affectionate, and needs to be looked after lest it go chicken-hunting on its own account. Even infants are not safe from its deeply ingrained thirst for blood. It is used both in Europe and America to kill rats, to hunt out rabbits, and even to catch fowls, which it can kill very neatly with a single bite on the neck. Like its relatives, it is brave as well as bloodthirsty, and will attack a large rat without hesitation. In hunting rabbits it is often allowed to work its will in the warren, the terrified inmates being shot or snared as they bolt. Frequently, however, the ferret has a long string attached, so that it may be pulled out. In other cases it is muzzled, and sometimes even belled. Without muzzle or leash there is always a risk of losing the ferret, for if hungry he may gratify his natural inclinations on the first rabbit and fall asleep after his meal, or he may get so excited over his work that he will refuse to come out for days. In time, however, desire for water brings him to the surface again; for blood, as Jefferies remarks, causes great thirst. The ferret generally breeds twice a year, each brood consisting of six or nine, which the mother sometimes devours. See ERMINE, POLECAT, WEASEL.

Ferret (*Putorius furo*).

Ferridcyanogen, or FERRICYANOGEN, a compound radical supposed by chemists to exist in ferricyanic acid and the ferricyanides. It cannot exist in the free state. The most important of the ferricyanides is that of potassium, also called red prussiate of potash. It is prepared by passing a stream of chlorine gas into a solution of potassium ferrocyanide till the liquid turns dark red; on evaporation the salt is obtained in crystals. The reaction is as follows:

Potassium Ferrocyanide.		Chlorine.		Potassium Chloride.	Potassium Ferricyanide.
$2Fe(CN)_6K_4$	+	Cl_2	=	$2KCl$ +	$Fe_2(CN)_{12}K_6$

The chief use of potassium ferricyanide is for the manufacture of Turnbull's blue, an important dye. This substance is formed when a solution of a ferricyanide is mixed with that of a ferrous salt (green vitriol, for instance); it consists of ferrous ferricyanide, $Fe_3K_3(CN)_{12}$. Ferric salts yield no precipitate with ferricyanides. Strong acids separate ferricyanic acid, $H_6Fe_2(CN)_{12}$.

Ferrier, DAVID, a distinguished physician and scientist, was born at Woodside, Aberdeen, in 1843, and educated at the university there, where he graduated with the highest honours in 1863, and soon after gained the inter-university distinction of a Ferguson scholarship. After a period of study at Heidelberg he settled as a student of medicine at Edinburgh, and graduated in 1868 at the close of an exceptionally distinguished course. In 1872 he was appointed professor of Forensic Medicine at King's College, London, and afterwards became physician to its hospital, and also to the National Hospital for the Paralysed and Epileptic. He was elected Fellow of the Royal Society in 1876, of the Royal College of Physicians the following year, and was made LL.D. by Aberdeen in 1883. Dr Ferrier's chief scientific work has been in the region of the brain, and its relations to such diseases as epilepsy, his name being especially famous for a brilliant series of experimental researches into the localisation of its functions, which have made him a *bête noire* to the anti-vivisectionists at any price. In 1876 he published *The Functions of the Brain*, which was followed by *The Localisation of Cerebral Disease* (1878), and 'The Effect of Lesion of Different Regions of the Cerebral Hemispheres' (with Professor Yeo) in part ii. of the *Royal Society's Transactions* for 1884 (see BRAIN). He was one of the founders, and is still an editor, of the well-known journal, *Brain*.

Ferrier, JAMES FREDERICK, metaphysician, was born in Edinburgh, June 16, 1808. His father was a brother of Miss Ferrier, the novelist; his mother, a sister of Christopher North. He was educated by Dr Duncan at Ruthwell, at the Edinburgh High School, and at Greenwich by Dr

Burney, next entered the university of Edinburgh, and passed thence to Magdalen College, Oxford, where he graduated B.A. in 1831; next year he was admitted to the Scottish bar, but never practised, while the dominant influence of Sir William Hamilton made him a metaphysician. In 1842 he was elected to the chair of History in the university of Edinburgh, and in 1845 to that of Moral Philosophy in the university of St Andrews. Ferrier early attracted notice by some metaphysical essays, which appeared in *Blackwood's Magazine;* and in 1854 he published the *Institutes of Metaphysics*, in which he endeavours to construct a system of idealism in a series of propositions demonstrated after the manner of Euclid. He afterwards edited the collected works of his uncle and father-in-law, Christopher North. His own *Lectures on Greek Philosophy* were edited in 1866, with a life prefixed, by his son-in-law, Sir Alexander Grant. Ferrier died at St Andrews, June 11, 1864.

Ferrier, SUSAN EDMONSTON, Scottish novelist, was born in Edinburgh in 1782. Her father, James Ferrier, one of the principal clerks of the Court of Session, and the colleague in that office of Sir Walter Scott, lived on terms of intimacy with the wits and literati of his day in Edinburgh, and Miss Ferrier's talents and quick powers of observation were early called into play in the midst of the literary society in which her youth was passed. Her first work, *Marriage*, begun in 1810 in concert with Miss Clavering, but soon relinquished by the latter, appeared in 1818, and this was followed by *The Inheritance* (1824), and *Destiny* (1831). The merit of these tales, which are characterised by genial wit, a quick sense of the ludicrous, and considerable ability in the delineation of national peculiarities, is sufficiently proved by the fact that by some Scott was credited with the authorship. Miss Ferrier enjoyed the esteem and friendship of Sir Walter, who repeatedly gave expression to his appreciation of her talents, praised her portraits of society, and called her his 'sister-shadow,' and derived consolation from her sympathy in the season of gloom which darkened the close of his life. She figures in Lockhart's *Life of Scott*, and amongst her papers was found an article, 'Recollections of Visits to Ashiestiel and Abbotsford,' published, along with a Memoir, in Bentley's edition of her works (6 vols. 1881). She died at Edinburgh, November 5, 1854.

Ferro, or HIERRO, the most western of the Canary Islands (q.v.). This island was selected as a first meridian by a scientific congress called together at Paris by Richelieu in 1630. The meridian chosen, 20° W. of Paris, and 17° 39′ W. of Greenwich, is not, however, that of the west coast of Ferro, which really lies 20° 1′ 45″ W. of Paris. Nevertheless it has been universally agreed to regard it as lying exactly on the 20th meridian W. of Paris. This first meridian is still used by some European nations. See LATITUDE AND LONGITUDE.

Ferrocyanogen, a compound radical supposed by chemists to exist in ferrocyanic acid and the ferrocyanides. It cannot exist in the free state. The most important of the ferrocyanides is the potassium salt; it is prepared in the following manner. A mixture of potassium carbonate, iron filings, and animal matter, such as dried blood, horn clippings, &c., is heated to redness in iron pots. Potassium cyanide is thus formed. The mass is extracted with water, the cyanide combines with iron, forming ferrocyanide, which dissolves, and may be purified by recrystallisation. The chief use of potassium ferrocyanide is for the preparation of Prussian blue—ferric ferrocyanide (see DYEING and CALICO-PRINTING)—which is formed on the addition of a ferric salt to solution of the ferrocyanide. A ferrous salt produces a white or light-blue precipitate of ferrous ferrocyanide. By the action of dilute sulphuric acid on potassium ferrocyanide, prussic acid is produced; if strong sulphuric acid be used, the ferrocyanide is completely decomposed, yielding carbonic oxide gas, and sulphates of iron, potassium, and ammonium. Hydrochloric acid causes the separation of ferrocyanic acid, $H_4Fe(CN)_6$, in small white crystals insoluble in hydrochloric acid. Most of the metallic ferrocyanides are insoluble, and many have characteristic colours. Iron cannot be detected in either ferro- or ferricyanides by any of the common reactions. Potassium ferrocyanide is not poisonous. The chemistry of these compounds is not yet thoroughly understood.

Ferrol, a Spanish seaport in Galicia, stands on a narrow arm of the sea, 11 miles by water and 33 by rail NE. of Corunna. A poor fishing-town until 1752, it now is one of the strongest fortified places in the kingdom, and possesses one of its three largest arsenals (with dockyards, naval workshops, &c.), while the annual trade reaches about £500,000. The harbour is safe and capacious, and has a very narrow entrance, defended by two forts. The town has manufactures of naval stores, linen, cotton, and leather, and exports corn, brandy, vinegar, and fish. The inhabitants (23,969 in 1884) are engaged principally in the arsenal and in the sardine fishery. In 1805 a French fleet was defeated by the English off Ferrol. The town was taken by the French in 1809 and 1823, and in 1872 was the scene of a republican rising.

Ferrotype, or ENERGIATYPE, a photographic process, first made public by Robert Hunt in 1844, in which the negative was developed by a saturated solution of protosulphate of iron, with mucilage of gum-arabic, and fixed by soaking in water to which a small quantity of ammonia or hyposulphite of soda had been added.

Ferry, a passage by boat across water. Common rowing-boats are generally used for ferrying foot-passengers, but when horses and carriages have to be taken across, a flat-bottomed barge, with an inclined plane at one end, to rest upon the shore, for landing and embarking, is generally used. This may also be rowed across, but is usually drawn by a cable. The rope stretched across the river passes through rings or over pulleys attached to the barge, and the ferrymen move the barge across by pulling the rope. The rope restrains the barge from drifting in the direction of the stream. With a small boat this difficulty is obviated by the ferryman rowing obliquely, as though he were steering for a point higher up the river. Rafts are sometimes used for ferrying; and steam ferry-boats of various kinds and sizes are familiar to everybody.

Flying-bridge is the name given to a kind of ferry-boat which is moved across a river by the action of the combined forces of the stream, and the resistance of a long rope or chain made fast to a fixed buoy in the middle of the river. The boat thus attached is made to take an oblique position by means of the rudder; the stream then acting against the side tends to move it in a direction at right angles to its length, while the rope exerts a force in the direction towards the buoy. The course of the boat is analogous to the path of a rising kite. The holder of the kite corresponds to the buoy, the wind to the tidal stream, and the tail to the rudder. Flying-bridges may be used for military purposes. In the case of a wide river the rope or chain requires to be of considerable length, and must be supported by movable buoys or by small boats. Such flying-bridges are familiar to

those who have sailed up the Rhine. In some cases, instead of an anchor laid in the stream, two shears or masts are erected, one on each bank, and firmly secured by guys. A stout hawser is then stretched tight from the top of one mast to the top of the other. There is a large iron ring or 'grummet,' to which is fastened one end of the boat rope, the other end being made fast to the boat or boats of which the bridge is composed.

Ferry, JULES FRANÇOIS CAMILLE, French statesman, born at Saint Dié in the Vosges, April 5, 1832, was admitted to the Paris bar in 1854, and speedily identified himself with the opponents of the Empire. His hostility was carried into journalism, and a series of articles in the *Temps*, in which he analysed the accounts of the prefect who was then rebuilding Paris, were republished as the *Comptes Fantastiques d'Haussmann* (1865). In 1869 he was elected to the Corps Législatif, where he voted against the war with Prussia; and during the siege of Paris by the Germans (1870–71) he played a prominent part as central mayor of the city. He was minister to Athens in 1872–73, and in 1879 became minister of Public Instruction, in which capacity he brought forward an education bill containing a clause, which was levelled at the Jesuits, shutting out members of 'unauthorised religious communities' from the schools. The clause was twice thrown out in the senate, but the expulsion of the Jesuits was effected by decrees founded on laws long since fallen into disuse, and brought about the dissolution of the ministry in September 1880. M. Ferry then formed a cabinet, which remained in office until November 1881. In February 1883 he again became premier, and boldly embarked on a policy of 'colonial expansion,' involving a war in Madagascar and the invasion of Tonquin, where a disaster to the French troops brought about his downfall in March 1885. In 1890 he was made senator. Died March 17, 1893.

Fertilisation is that essential process of sexual reproduction in which the male element (spermatozoid, antherozoid, pollen-tube) comes into contact and more or less complete union with the female element or ovum (see REPRODUCTION), and through which the subsequent division and differentiation of the ovum becomes effectively possible (see EMBRYOLOGY). The term is, however, often more loosely employed to denote those preliminary processes by which the male fertilising element is brought into conditions for beginning fertilisation proper. Hence, while the zoologist speaks commonly of the fertilisation of the ovum, but of the fecundation of the female animal, the botanist, in speaking of the fertilisation of the flower, is referring to the wind or insect agencies by which the pollen is brought to the stigma, and of the details of floral structure and mechanism adapted to these, the term fecundation thus being more frequently applied to the subsequent and essential process. See FLOWER.

Fesa, or FASA, a town of Persia, in the province of Fars, about 60 miles SE. of Shiraz, with a population of 18,000. It has manufactures of silken fabrics, and some trade in tobacco.

Fescennine Verses, one of the oldest forms of popular poetry in Italy, consisted of dialogues in rude extempore verses, generally in Saturnian measure, in which the parties rallied and ridiculed one another. The making of them formed a favourite amusement of the country-people on festive occasions, especially at the conclusion of harvest and at weddings. But, degenerating into extreme license, the practice had at last to be regulated by law. The Fescennine verses are usually considered to derive their name from the Etrurian town Fescennium.

Fesch, JOSEPH, Cardinal and Archbishop of Lyons, was born 3d January 1763, at Ajaccio. Of Swiss parentage, he was the half-brother of Letizia Ramolino, the mother of Napoleon Bonaparte. During the French Revolution he became commissary to the Army of the Alps under his nephew in Italy. The First Consul having resolved on the restoration of the Catholic worship, Fesch resumed the clerical habit—for he had originally taken holy orders—and was active in bringing about the concordat with Pope Pius VII. in 1801. He was now (1802) raised to be Archbishop of Lyons, and in the following year to be cardinal. In 1804 he was sent as French ambassador to Rome, where he ingratiated himself with the pope by his adroit management and ultramontane sentiments. Two years later he was appointed associate and successor of Dalberg, Prince Primate of the Confederation of the Rhine. At a national conference of clergy assembled at Paris in 1810 he gave utterance to views which lost him the favour of Napoleon, who was still further exasperated against him on account of a letter which Fesch wrote to the pope, then (1812) in captivity at Fontainebleau, and which was intercepted. After this he lived in a sort of banishment at Lyons. At the approach of the Austrians in 1814 he fled to Rome, where he spent nearly the whole of the rest of his life. His resistance to the will of his nephew, and indeed his whole conduct, seems to have been actuated by sincere zeal for what he considered to be the interests of the church. He died at Rome, 13th May 1839. Of his large collection of paintings he bequeathed a part to the city of Lyons; the rest were sold at Rome after his death.

Fescue (*Festuca*), a large and widely diffused genus of grasses, very nearly allied to Brome-grass (q.v.), and including many of the most valuable pasture and fodder grasses—e.g. Meadow Fescue (*F. elatior*, var. *pratensis*), with the allied Tall Fescue (var. *arundinacea*), Sheep's Fescue (*F. ovina*), of which as many as eight varieties are enumerated, but of which, besides the common form, (var. *vulgaris*) only Hard Fescue (var. *duriuscula*) is of agricultural importance. Red Fescue (*F. rubra*) has also the important varieties, creeping (var. *genuina*), tufted (var. *fallax*), various-leaved (var. *heterophylla*), and violet (var. *violacea*). See GRASSES, and PASTURE; and Stebler's *Best Fodder Plants* (Lond. 1889).

Fess, one of the heraldic ordinaries. See HERALDRY.

Festiniog, a village of Merionethshire, North Wales, 22 miles by rail WNW. of Bala, and 3¼ S. of Blaenau-Festiniog. Standing amid waterfalls and mountains (the loftiest Moelwyn, 2529 feet), it is a great tourist centre. Blaenau-Festiniog, 27 miles SSW. of Llandudno Junction, and 13 NE. of Port Madoc by the 'Toy Railway' (1869), is a town of recent growth, inhabited chiefly by slate-quarrymen. Pop. of parish (1851) 3460; (1881) 11,274; (1891) 11,073.

Festivals, or FEASTS, a term denoting certain periodically recurring days and seasons set aside by a community for rest from the ordinary labour of life, and more or less hallowed by religious solemnities. These may be joyful occasions commemorating the lives of heroes, or general days of humiliation for disasters. But even when sorrow was to be expressed the mortification of the body did not always suffice, but plays, songs, dances, and processions full of boisterous mirth were resorted to—as in the festivals of Isis at Busiris, of Mars at Papremis, in the Adonia of Egypt, Phœnicia, and Greece—because the divine wrath or sorrow was, like that of man, to be changed into satisfaction. Festivals have also helped onward the progress of

civilisation itself. Besides helping to knit together into unity the body politic, they stimulated the artistic sense to emulation in music and the dramatic art, and thus laid the foundations of the greatest æsthetic triumphs. Enthusiastic, wild, metaphysical Egypt invested the countless days consecrated to her deified stars, plants, animals, and ideas, to the Nile, to Ammon, Kneph, Menes, Osiris, to Horus, to Neitha, to Ptah, with a mystery, sensuality, and mournfulness always exaggerated, sometimes monstrous. The Hindu, no longer daring to offer human sacrifices, shows his odd and cruel materialism by throwing into the waves, on his festival of rivers, some of his costliest goods, gold, jewels, garments, and instruments; while in the licentiousness and debaucheries perpetrated on the festival of Siva, the god of procreation, or on the Bacchantics of the goddess Bhavani, he exceeds even those of the Egyptians on their Neitha feasts at Bubastis, and the Greek worship of Aphrodite in her Cyprian groves.

The ancient Persians alone of all nations had no festivals, as they had no temples and no common worship. These 'Puritans of Polytheism,' who worshipped the sun only, and his representative on earth, fire, scorned show and pomp and large religious gatherings. A striking contrast to them is formed, in another hemisphere, by the ancient Mexicans, who were found to possess one of the most richly developed calendars of festivals, scientifically divided into movable and immovable feasts. As a strange and singular phenomenon among festivals we may also mention here that 'of the Dead' or 'of Souls,' celebrated among the wild tribes of North America. At a certain time all the graves are emptied, and the remains of the bodies buried since the last festival are taken out by the relatives, and thrown together into a large common mound, amid great rejoicings and solemnities, to which all the neighbouring tribes are invited.

Greece had received the types of civilisation, religion, and art from Egypt and the East, but she developed them all in a manner befitting her glorious clime and the joyous genius of her sons. At the time of the *Iliad* two principal festivals only—the harvest and the vintage—seem to have been celebrated (ix. 250); but they soon increased to a very large number. The religious part of the festival—homage offered to personified ideas—consisted mostly in the carrying about of the deity of the day to the sound of flute, lyre, and hymns, and in a sacrifice, followed by a general meal upon certain portions of the animal offered. Then followed scenic representations symbolising the deeds of the gods; after which came games and matches of all kinds—foot, horse, and chariot races, leaping, boxing, throwing, and wrestling. Separate accounts are given of some of the more remarkable Greek festivals under BACCHUS, MYSTERIES, and PANATHENÆA, and of the 'Holy Games' proper, the Olympian, the Pythian, the Nemean, and the Isthmian, under these heads. As all these festivities were provided out of the public purse the individual did not suffer more than a welcome interruption of his usual business, and under that genial sky the penalty to be paid for occasional indolence was not too heavy.

Rome adopted and acclimatised the foreign deities as she went on from conquest to conquest, exactly as, with her usual prudence and practical sense, she conferred her right of citizenship on the nations subjected to her rule. Her yoke was thus less galling to the new provinces, while at the same time the populace at home found sufficient distraction in the many ancient and newly imported festivals, with their quaint rites and gorgeous pageantry. Yet the Romans never exceeded in their festivals a hundred in a year, and in these, again, a distinct line was drawn between civil and religious ones. Some of the principal religious festivals were the *Sementinæ*, on the 25th of January—the rural festival of the seed-time; the *Lupercalia*, in honour of Pan; the *Cerealia*; the night festival of the Bona Dea; the *Matronalia*; and the *Minervalia*. To the purely civil ones belong the *Janualia*, the 1st of January and the New-year's Day, when the new consuls entered upon their office, and friends used to send presents (*strenæ*) to each other; the *Quirinalia*, in memory of Romulus, deified under the name of Quirinus; and the *Saturnalia*, in remembrance of the golden age of Saturn, beginning on the 19th of December. The celebration of these festivals was in all respects imitated from the Greeks, with this difference only, that the games connected with them became with the pre-eminently bellicose Romans terribly lifelike images of war. Their sea-fights; their pitched battles between horse and foot, between wild beasts and men; their so-called Trojan games, executed by the flower of the nobility; their boxing-matches (with gloves that had lead and iron sewed into them); circus, arena, and amphitheatre, gave, especially in later times, the greater satisfaction the greater the number of victims.

With the first and strictest monotheists, the Hebrews, the remembrance of their liberation from Egypt, and the momentous period of preparation in the desert which followed it, mingled with almost all their religious observances, and especially their festivals, and infused into them all a tone of deep and fervent gratitude; while at the same time it held ever before their eyes the cause of their nationality, and their aim and destiny 'to be a kingdom of priests and a holy people.' The Hebrew festivals, too, are of an historical, agricultural, astronomical, and political nature; but they mostly combine all these characteristics, and are always hallowed by the same religious idea. Connected with their festivals were no plays and no representations of a god's deeds, no games and no cruelty, no mystery and no sensuality, but the sacrifice of the day, and a special occupation with the divine law. The influence of the number Seven (q.v.) is seen in the recurrence of many of the Jewish solemnities. The Sabbath, the first and most important of these septenary festivals, is treated of under its own head. The most exalted of new-moon festivals was that of the first day of the seventh month, 'the day of remembrance of the sounding' or 'of trumpets' (Lev. xxiii. 24), to which in later times, when the Seleucidian era was introduced, the name of *Rosh hashana* (New Year) was given; notwithstanding that in Exodus (xii. 2) Nisan is spoken of as the first month of the year. After a period of six years of labour the earth, too, was to celebrate a Sabbath-year; what it produced spontaneously belonged to the poor, the stranger, and to animals. After a revolution of seven times seven years the year of Jubilee or Jobel was to be celebrated, in which all the Hebrew slaves were set free, and all land which had been sold in the interval was restored to the former owners, in order that the original equilibrium in the families and tribes should be maintained intact. The pre-eminently agronomical and historical festivals were the three *Chaggim*—viz. Pesach (Passover, q.v.), Schabuoth (Feast of Weeks), and Succoth (Feast of Tabernacles), on which three every male was obliged to go up to Jerusalem and offer some of the first fruits, besides the prescribed sacrifices. Post-Mosaic and exclusively historical were the feasts of Purim, of Haman, and of the Maccabees.

Only a cursory glance can be here taken of the Christian festivals, which are treated separately under their various names. They were for the

most part grafted, in the course of time, upon the Jewish and Pagan ones, but always with a distinct reference to Christ and other holy personages. The weekly day of rest was transferred from Saturday to Sunday, and called the Day of Joy or Resurrection. For a long time both Saturday and Sunday were celebrated, especially in the East. Two separate celebrations took the place of the Jewish Passover: the *Pascha Staurosimon* was the festival of the Death, the *Pascha Anastasimon* of the Resurrection of our Lord (see EASTER); and the festival of Pentecost, or the law-giving at Sinai, became the festival of the outpouring of the Holy Ghost and of the inauguration of the New Covenant.

In the course of the 4th century two new festivals were introduced: Epiphany (q.v.), which originated in the East; and that of the Nativity or Christmas (q.v.). Circumcision, Corpus Christi, the festivals of the Cross, of the Transfiguration, of the Trinity, and many others are of still later date. The veneration felt for Mary as the 'Mother of God' found its expression likewise in the consecration of many days to her special service and worship; such as that of her Presentation, Annunciation (Lady Day), Assumption, Visitation, Immaculate Conception (q.v.), and many minor festivals, over and above the month of May and the Saturdays, which in some parts were entirely dedicated to her, in order that the Mother might have her weekly day like the Son. Besides these, there were festivals of Angels, of Apostles, Saints, Martyrs (on the supposed anniversary of their death, called their birthday, *dies natalis*), of Souls, Ordinations, &c. Some were of special importance owing to special circumstances; thus St Patrick's Day (March 17th) is especially sacred to Irishmen, St Andrew's Day (November 30th) to Scotchmen, and St George's Day (April 23d) to Englishmen. In the United States we find corresponding festivals in Washington's Birthday (February 22d), Independence Day (July 4th), Decoration Day (q.v.; observed in 1889 as a legal holiday in twenty-two states), and Thanksgiving Day (usually the last Thursday of November).

Celebrated at first with all the primitive simplicity of genuine piety, most of the church's festivals were ere long invested with such pomp and splendour that they surpassed those of the ancient Greeks and Romans. Burlesque, even coarse and profane representations, processions, mysteries, and night-services were in some places, although unauthorised by the general church, connected with them, and voices within the church loudly denounced these 'pagan practices.' Ordinances forbidding mundane music and female singers for divine service were issued, the vigils were transformed into fasts, days of abstinence and penance were instituted, partly as counterpoises, but with little result. Nor did the prodigious increase of these festive occasions, and the rigour with which abstinence from labour was enforced in most cases, fail to produce the natural results of indolence and licentiousness among the large mass of the people. But it was only after the most decided and threatening demands, as by the German Diet of Nuremberg in 1522, that Pope Urban VIII. was prevailed upon to reduce the number for Catholic Christianity (1642). Benedict XIV. (1742) and Clement XIV. (1773) followed in the same direction.

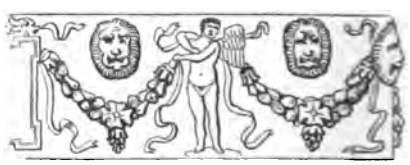
The Christian festivals have been divided variously into *feriæ statutæ* (returning annually at fixed times), *indictæ* (extraordinary, specially proclaimed), *duplicia* (double reminiscence, or of higher importance), *semiduplicia* (half double), &c. It was long the custom to recite the office of the Feria in addition to that of any feast chancing to fall on it. Hence, on the more important solemnities, a *double* office had to be recited, one of the feria, another of the feast. *Semi-doubles* were those in which the two offices were made into one. The church celebrates certain festivals till the *octave* or eighth day after they fall due. Another division is into weekly and yearly feasts, these latter being subdivided into greater and minor, or into movable and immovable. There is also a distinction made between *integri* (whole days), *intercisi* (half-days), &c.

The only trace of the ancient manner of dating a festival from the eve or vesper of the previous day—a practice discontinued since the 12th century, when the old Roman way of counting the day from midnight to midnight was reintroduced—survives in the 'ringing in' of certain days of special solemnity on the night before, and in the fasts of the vigils.

Some of the principal Mohammedan festivals (see MOHAMMEDANISM) are partly based upon those of the Jews and Christians, such as the weekly Friday (the Jewish Day of Atonement); others are the Birthday of the Prophet, that of Hussein, of Mohammed's granddaughter Zeynab, of the Night of the Prophet's Ascension to Heaven, and Bairam (q.v.). See HOLIDAY.

See BREVIARY, and works on this subject by Buxtorf, Lightfoot, De Wette, Baumgarten, Mai; also Thomassin, *Traité des Festes*; Gavantus, with Merati's Notes; and Probst, *Brevier u. Brevier-gebet*.

Festoon, in Architecture, a sculptured wreath of flowers, fruit, leaves, &c., frequently used as an ornament in Roman and Renaissance buildings. Like many of the other ornaments of classic architecture, it owes its origin to one of the sacrificial



Festoon:
St Mark's Library, Venice.

emblems—viz. the flowers with which the heads of the animals, the altars, &c. used to be decorated.

Festus, PORCIUS, Roman procurator of Judæa, who succeeded Felix (q.v.), 60 A.D., and died a few years afterwards. In 62 Paul defended himself before him. See Acts, xxv.

Festus, SEXTUS POMPEIUS, a Latin grammarian, who flourished most probably in the 2d century A.D., and is one of our most important authorities on the Latin language. His epitome of the great work (now lost) of Verrius Flaccus, *De Verborum Significatione*, was arranged alphabetically in twenty books, of which only the latter half (M—V) survives, and even that in a single deplorably mutilated MS. This came from Illyria, and fell into the hands of Pomponius Lætus, a distinguished scholar of the 15th century. It ultimately passed into the library of Cardinal Farnese at Parma, and is now preserved at Naples. The work, in spite of all its imperfections, is a grand storehouse of knowledge on points of mythology, grammar, and antiquities. We have, too, a meagre abstract of Festus's abstract, compiled by a priest Paulus in Charlemagne's time. All previous editions of Festus are of little value compared with that of K. O. Müller (1839), in which he has made use of the Farnese MS. and other sources, distinguishing the value of each.

Fetch. See DOUBLE, APPARITIONS.

Fetichism, the worship of a fetich, or more strictly the belief that the possession of a thing can procure the services of a spirit lodged within it. The fetich is an object capable of being appropriated by an individual, and counted as animate and conscious. We find fetichism flourishing not only in Africa, but among the natives of both Americas, the Polynesians, Australians, and Siberians, and indeed in the lower strata of all known civilisations. The word itself is ultimately due to the Portuguese, the first Europeans to trade on the west coast of Africa, who expressed their conception of the religion of the natives by the Portuguese word *feitiçdo*, 'magic;' but it received its currency through the medium of the French, the well-known treatise of Charles de Brosses, *Du Culte des Dieux Fétiches* (Dijon, 1760), having carried the word over Europe. Comte used it as a term to describe what he believed to be a necessary stage in the development of all religions in which all external bodies, natural or artificial, are supposed to be animated by souls essentially analogous to our own. Sir John Lubbock's definition of fetichism is closer to its modern scientific sense—'that stage of religious thought in which man supposes he can force the deities to comply with his desires.' He makes it the next stage in the ascent of religion from pure atheism through totemism and shamanism into idolatry. But it is impossible to admit this transition from fetichism to idolatry, because the latter necessarily implies the superiority of the god over the man; the former, on the contrary, the superiority of the man over the god. Idolatry is properly the worship paid to an image which is taken to be the usual or merely temporary abode of a superhuman personality. Mr Tylor's definition—'the doctrine of spirits embodied in, or attached to, or conveying influence through certain material objects'—includes the meaning, but is not expressed with his usual exactness and point.

Fetichism may be said to be *primitive* when man, personifying everything around him, chooses among these imaginary personalities an object capable of being appropriated to himself, the spirit of which becomes his protector or his slave. Again, that may be called *secondary* fetichism which implies belief in the incorporation of a spirit in some object chosen as a fetich, either by a simple act of spontaneous choice or through a magical operation. The latter is far more widespread than the former, and obviously presupposes a belief in animism in Mr Tylor's sense of the word. Any object may become a fetich, provided only it is capable of being appropriated literally or metaphorically by an individual. Such objects are flints, shells, claws, feathers, earth, salt, plants, manufactured articles, anything peculiar or unknown or not understood, trees, streams, rocks, and even certain animals, as the serpents of Whydah. All savage thinking is of course based on fancied analogies, and it is quite enough for an object to be accidentally associated with an event for it to be regarded as the cause and even the author of that event, whence its elevation to the rank of a fetich. Again, fetiches are attached to individuals, to families, or to tribes, and it is even not unusual to see them beaten and kicked as a warning when they have failed to bring the luck that was expected. Even in the crooked sixpences which we carry in our purses, and in the luck-tokens of our gamesters, there is something more than an analogy to the fetich of the savage.

See ANIMISM; Fr. Schultze, *Der Fetichismus* (Leip. 1871); Roskoff, *Das Religionswesen der niedersten Naturvölker* (*ib.* 1880); Bastian, *Der Fetisch an der Küste Guineas* (Berlin, 1884); Baudin, *Fétichisme et Fétichcurs* (Lyons, 1884); and A. B. Ellis, *Tshi-speaking Peoples of the Gold Coast: their Religion, &c.* (1887).

Fétis, FRANÇOIS JOSEPH, Belgian musician, also critic and historian of music, was born at Mons on 25th March 1784. His first appointment was that of organist and professor of music at Douai (1813). He then held successively the post of professor of counterpoint and fugue at the Paris Conservatory (1821), and that of director of the Brussels Conservatory (1833), combining with this last the office of musical director to the king of the Belgians. He died at Brussels, 25th March 1871. He wrote a considerable quantity of music, including operas and sacred music; but he is principally noticed for his works on the theory of music—*Traité de l'Accompagnement de la Partition* (1829), *Treatise on the Theory and Practice of Harmony* (1844), and *Treatise on Counterpoint and Fugue* (1824). But even more valuable than these are his *Universal Biography of Musicians* (1835–44; 2d ed. 1860–65), and *General History of Music* (1869–76). These books, although not free from careless errors, especially in chronology, and although marred by the writer's bias and partiality, are nevertheless of great value to the historian of music.

Fetwa, the decision of a Turkish Mufti (q.v.) given in writing.

Feu and **Feu-duty,** in Scots law. A feu may be described as a right to the use and enjoyment of lands, houses, or other heritable subjects, in perpetuity, in consideration of an annual payment in money, grain, cattle, or services, called *feu-duty*, and certain other contingent burdens called casualties of superiority (see CASUALTIES). Though the term feu was used by feudalists to express any relation of superior and vassal, in Scots law it was opposed to ward or military holding, and to blench or nominal holding. A feu, in short, was a perpetual lease—a feu-farm, as it was often called—by which the tenant became bound to pay a substantial consideration, and his rights under which he might forfeit as the penalty of non-payment. In the present day the disposal of land in feu is practically a sale for a stipulated annual payment, equivalent to chief rent. The system of feuing property for building purposes has several advantages over that of the long building-leases common in England. From its perpetual character it gives to the holder a greater interest in the property, and usually leads him to erect more enduring structures than he would do under a lease. For as time runs on the feu often increases in value, while the reverse must always be the case with the interest of the tenant in leasehold property. Hence the movement for leasehold enfranchisement in England, which is scarcely intelligible in Scotland. Neither does feuing interfere with the letting of property on lease or otherwise. Almost all the houses in Edinburgh and the other towns of Scotland which are let, either on leases or from year to year, are held by their proprietors in feu. Modern feu-duties are in general paid in money. When the stipulation is for a duty in grain the quantity is valued by fiar prices (see FIARS), and paid in money accordingly. Since 1874 the feu-duty, whether of money or grain, must be of fixed amount—i.e. not contingent. The original deed transferring the land in feu from the superior to the vassal is called a feu-charter or feu-contract, which is now a very simple and intelligible document. Registration has now the effect of sasine in making the vassal's right real; and, unless otherwise stipulated, the vassal is now perfectly free to transfer his property to any one without fine or composition, what were called 'charters by progress' having been abolished.

Usually the feu-charter reserves to the superior all minerals in the ground, and stipulates that the vassal shall build his house either in a particular style or of a certain value. By the Scottish statute 1597, chap. 246, it is declared that all vassals by feu-farm failing to pay their feu-duty for two years together shall lose their right; but the superior is bound to accept payment of arrears before declaring an 'irritancy'—i.e. forfeiture. For the most part, land proprietors near towns and manufacturing villages are anxious to add to their annual rental by feuing grounds for building purposes. The rate of feu varies widely, from as low as £8 to as high as £500 per acre per annum; a common rate is from £20 to £40 per acre. Whatever be the amount, it is payable by the feuar—not the tenant to whom the feuar may have let the property. When a building consists of several floors forming distinct dwellings, the feu-duty is allocated in certain proportions among the respective proprietors; the feuar to whom the lower floor belongs usually paying most. In properties of this kind each is responsible only for his own share. In the same way, when a property is sold subject to a *cumulo* feu-duty, it is necessary, with the consent of the superior, to *allocate* this feu-duty on the different portions of the subject. Occasionally feu-duties are offered for sale; and, as a safe investment, bring from twenty-five to thirty years' purchase. In such cases the vassal has an opportunity of extinguishing his feudal tenure, and becoming the superior. It is not unusual in feuing building-lands for the superior to make the roads and drains, the vassals being, of course, bound to contribute relatively to the first expense, or at least the subsequent maintenance of both. In large centres of population the feu-contract is largely superseded by the contract of ground-annual.

Feud in the middle ages meant a war waged by private individuals, families, or clans against one another on their own account. See VENDETTA.

Feudalism. The feudal system formed in medieval Europe the connecting link which united the primitive society, whose basis was entirely personal, with the modern reign of law and order. It may be described as a great military and social organisation based on the holding of land, yet containing, imbedded within itself, like fossils in the rocks, the relics of the earlier systems which in each different country had preceded it. The result of the system was the establishment of the various great European powers on the ruins of the Roman empire, and the preservation of order and discipline in the wild times of the disintegration of that empire. For a clear understanding of the feudal system, how it came to be introduced, and the changes it wrought, a glance is necessary at the social systems which preceded it, and which can for this purpose be classed under two leading types, the Teutonic and the Roman, known respectively as the Mark system and Emphyteusis. The industry of Stubbs, Seebohm, and others has thrown a flood of light on the working of the mark system in the primeval German forests, by which we can almost accurately reproduce the primitive society and trace its growth.

In the first century the tribes seem to have been purely nomadic, each kept together under the control of its head, having cattle and other belongings, but no idea of permanent possession of the land, or, indeed, of anything more than taking the pasture and fruits of the earth for the time being, and defending their temporary encampment as long as they remained there. Each chief had his personal following, called by the Romans his *comitatus*, composed principally of the younger sons of the chief families, and of men who preferred a life of adventure to peaceable cattle-feeding. The chief's council was composed of the heads of the chief families. In many of the larger tribes there were subordinate divisions, presided over by inferior chiefs, but the organisation, whether of the whole or of an individual part, was the same. Probably originally every man was free and equal, but by degrees a class rose up composed partly of prisoners taken in war and kept as slaves, partly of gamblers who, having lost all else, staked their freedom, and lost that; others, again, from mere poverty, might voluntarily surrender their freedom for subsistence, and thus a class of unfree men would gradually spring up. By degrees these nomadic tribes took to settling and cultivating the land, the influence of increasing wealth and civilisation and the knowledge of agriculture, derived from their Roman neighbours, tending largely to promote this result; but still the same broad principles obtained. A group of families would settle on an unoccupied tract of land, and the council of the heads would assign to each family a spot to build a homestead, and to put up cattle-sheds and stackyards; all the rest of the land they occupied in common. A fertile glade was chosen for a common meadow, and to each family the council allotted a share proportionate to its numbers. Each family cut and harvested its own hay, then the fences were thrown down, and the meadow became common pasture till the grass began to grow again next spring. Around the village and the meadow were the woods and wastes, always common, never divided or inclosed; these were called the 'mark,' a word meaning a boundary, and which yet lingers in the Scotch and Welsh Marches, and whence came the name of the Province of Mercia.

The next step in civilisation was the knowledge of tillage, and as arable ground could not well be re-allotted every year, a portion large or small came by degrees to be attached to each homestead, and not included in the yearly subdivision. Still, however, there was no ownership of land as we understand it. The head of each family was a member of the community, a freeman and a political unit, and in that capacity had a homestead assigned to him; this homestead was the outward badge or sign of his status as a freeman. This village was called the mark, a group of marks formed a district, called by Roman writers 'Pagus,' and by English writers a Hundred. The pagus elected a chief, who was a kind of local judge, and each pagus sent representatives to the national assembly, in whom the central power was vested. In war each pagus sent a hundred champions to the host, the nucleus of which was the chief of the tribe with his comitatus. Thus the host was simply the nation in arms, arranged according to the same divisions as in peace; and when a country was conquered they had merely to settle down in the order they stood, and recommence their mark life in a new place. The position of a Teutonic land-owner, then, was that he held his land not of any superior, but in token of his status as a freeman and head of a household; and on his death the assembly of the markmen would confer the homestead on the man on whom that headship devolved, which also, to some extent, they had the power of regulating. Such a system was it that in the 5th century the Saxons, Angles, and Jutes introduced into England; and its traces, notwithstanding the lapse of fourteen centuries, may still be found in village greens and many of the rights of common, whenever the latter are not manorial. Large grants of land were made to distinguished warriors of the comitatus, who settled down with their dependents and slaves, forming villages on their lands in analogy to the mark. The whole country was now

looked upon as one great mark, the unallotted lands forming a sort of treasury out of which grants could be made to new-comers by the great council. Theoretically, the possession of land still was the badge of a freeman; yet, as these grants of land were alienable, and could be sold, a class of landless men gradually arose, and as these had no visible sign of their status it became the rule that every landless man must commend himself to some land-owner who should be responsible to the state for him. Also, the smaller land-owners would often commend themselves to some powerful lord for the sake of honour and protection. A second stage in the progress of social organisation was thus reached; the purely personal basis was no longer the sole foundation of society, the land-owner, not the free-man, became the unit; the host was the body of land-owners in arms; but still it was open to the landless man to select his own lord, and such selection created no indissoluble tie; besides this, the freeman was still in political theory the equal of the noble, and thus the personal basis, though obscured, was not entirely lost sight of.

In the meantime developments somewhat corresponding to these were taking place in the Roman empire; long or perpetual leases of lands taken in war were granted by the state in the tenure called Emphyteusis. About the time of Constantine this tenure was also adopted by private persons and corporations, and was extended from land to houses, the person to whom the grant was made being called Emphyteuta. It may be defined as a grant of land or houses for ever or for a long period on the condition that an annual sum (canon) shall be paid to the owner or his successors, and, if not paid, the grant shall be forfeited. The emphyteuta is not legal owner, nor a mere hirer; but the agreement is determined by the Lex Zenoniana to rest neither on letting nor on selling, but to be a peculiar contract depending on agreements of its own. The emphyteuta had the usufruct of the land, was entitled to its fruits, and under certain restrictions could alienate his possession, which on his death passed to his heirs; but the ownership remained with the *dominus-emphyteuseos* or lord, and the emphyteuta was bound to pay the agreed rent, to manage the property as a good paterfamilias, and to pay all the burdens and deliver the receipts to the lord. A good account of this tenure may be found in Hunter's *Roman Law*, pages 426–429. In the later empire, by a modification of this tenure, the frontier lands on the Rhine and Danube were granted to chiefs of the German tribes on condition of their being always ready to defend the integrity of the empire, this service being taken in lieu of the canon or rent of the ordinary emphyteusis. Thus the rival systems of the German mark and the Roman emphyteusis were brought into direct juxtaposition, and when the barbarians, who for so long had hung 'poised on the edge of the empire,' broke into the Roman world, carrying their ideas of social organisation with them, it was natural that the grants of conquered lands to great warriors should be made on terms analogous to emphyteusis rather than (as happened in the earlier conquest of Britain) on the older mark system. These grants were called *beneficia*, the *beneficium* being held on condition of the performance of certain services, of which the most important was naturally military. As in England also, so on the Continent the weaker and poorer would commend themselves to some powerful lord, surrendering their allodial lands (i.e. those held in absolute ownership) to him, to be received back in a sort of emphyteusis tenure on condition of the performance of military service. Hence arose feudalism. Littré makes the Low Lat. *feudum* of Teutonic origin, and thus cognate with Old High German *fihu*, Gothic *faihu*, A.S. *feoh* (our *fee*), mod. Ger. *vieh*, cattle being originally the only wealth. It came subsequently to mean property of any kind, including land, the second part of the root being taken from the word *od*, also meaning property or pay; thus *fee-od*, *feodum*, or *feudum* means property held on condition of pay or services rendered. Guizot in *Civil. France*, iv. 41, says: 'The word (feudalism) appeared for the first time in a charter of Charles the Fat in 884.'

So now the third stage of progress was reached, when land became the sole basis of society, the sacramental tie of all public relations; the poor man depended on the rich, not as his chosen patron, but as the owner of the land he cultivated, the lord of the court to which he did suit and service, the leader whom he was bound to follow in the field (see Stubbs, i. 167). The feudal theory was that the king was the sole allodial or absolute owner of all the land in the kingdom; the chief lords held their lands from him on condition of military service; their vassals from them on similar conditions; and sub-vassals from them again, and so on in an infinite chain; each vassal owing fealty to his own immediate lord, but being bound by no tie whatever to the lord's lord. Such was the leading principle of the system which prevailed over France and Germany at the time of the Norman Conquest, which was introduced into England by William the Conqueror and his Normans, and engrafted on the Saxon mark system, but modified by the genius of William I. to suit his own theories of statesmanship. It was introduced about the same period into Scotland by various adventurous Norman knights, and engrafted on the older clan system with such modifications as suited their purpose. Thus three distinct types of feudalism arose with marked differences, as we shall see. The disruptive tendency of the continental feudalism is obvious; the system was there pushed to its logical conclusion. Thus, for instance, the Duke of Brittany was vassal of the king of France, and owed him fealty, as did the vassals of the duke to him, but between the king and the vassals of the duke there was no tie whatever. When therefore the duke chose to throw off his allegiance and rebel against the king, his vassals were bound by their feudal obligations to support him. Such a system could only result in making France a mere congeries of powerful barons bound by slight ties to a nominal head. The weakness of the Carolingian kings and the early Capets largely conduced to this, as did also the degeneracy of the people, who seem to have forgotten that they ever had rights, and who became the ready tools and subservient slaves of the ambitious nobles. In Germany, though the disintegrating tendency was equally marked, the social development was different, owing to the sturdy independence of the German people making it necessary for any chief who aimed at independent power and throwing off the yoke of the central authority to identify himself with the nationality and the aspirations of his vassals. In this way the Guelphs became practically independent lords of the vast fiefs in Swabia, and many another great chief threw off his feudal allegiance, and Germany became a collection of confederacies, the feudal lord of each being representative of the race of his vassals, as well as supreme land-owner.

William I. in introducing feudalism into England had no intention of becoming himself a mere *roi-fainéant;* he intended to be king of all England, lord of the lowest as well as the highest, not mere feudal lord of a number of practically independent chiefs. In this policy of course he had to face the opposition of his chief followers, whose object was to carve out large lordships for themselves, rendering a nominal homage to William, but practically independent of him. William's policy showed a

grasp of the principles of statesmanship rarely equalled; being obliged to reward his chief followers handsomely, he soon saw that it would be dangerous not to make large grants of land, and equally dangerous to make such grants as would enable them to set up independent kingdoms. The plan he took was to make extensive grants, but to scatter them through various counties. For instance, his half-brother Odo of Bayeux got 439 manors, but they were scattered through 17 counties; Robert of Mortain had 793 manors scattered through 20 counties. Thus, had either of these been minded to rebel, no coherence or union was possible among vassals so scattered, and in each county an attempt to collect forces for rebellion would have resulted in a collision with a powerful sheriff at the head of his *fyrd* (the army of the shire), who, being a continuation of the Saxon and popular system of government, and being royal officers entirely, might be trusted to curb the lawless barons. This, however, was not all. No sooner was William I. firmly seated on the throne, and the Domesday survey completed, than in 1086 at Salisbury he took a step which was in direct violation of the elementary feudal principles; for he summoned a great meeting to which we are told there came 'all his witan and *all* the land-owners of substance in England, whose vassals soever they were, and they all submitted to him and became his men, and swore oaths of allegiance to him that they would be *faithful to him against all others*.' Thus there was provided a direct tie between the king and all the freeholders which no intermediate tie would justify them in breaking.

We may now consider the nature of the services on condition of which land was feudally held, premising that in English nomenclature the man who held land was called a *tenant*, the land holden was his *tenement*, and the conditions of holding his *tenure*. Tenures, then, were of three kinds, answering to the three chief classes of the community, viz. free, unfree or base, and religious; and each of these might be for certain services—i.e. a fixed amount of money or labour at fixed periods—or uncertain—i.e. such amounts and at such times as the lord might require. For example, the free and uncertain tenure, usually considered the noblest of all the tenures, was on condition of following the lord when he went to battle (which might of course be every year, or not at all for a number of years), with a body of men and for a number of days in the year accurately proportioned to the size and value of the holding; this was called Tenure in Chivalry or by Knight Service. The free and certain tenure was the payment of a fixed sum of money, or sometimes the performance of some service of a peaceful and usually agricultural nature, and this was termed Free and Common Socage. The base tenures were those which depended originally on the performance of menial offices, and were in fact the tenures by which serfs allowed to squat on the lords' land held their little patches at the will of the lord; a modernised and greatly modified form of this tenure still exists in England under the name of Copyhold (q.v.). The religious tenures, under which in early times all the church lands were held, were known as Frankalmoign and tenure by Divine Service, the theory being that the prayers of holy men were all they could be called on to give by way of service to men, and the difference between the two being simply that in the former the number and times of the prayers was left to the conscience of the tenant, in the latter a certain number of masses was laid down, and if they were not duly said the lord had his remedy by distress; this last tenure became obsolete at the Reformation. Frankalmoign or free alms is still the tenure whereby in England the parson holds the church and glebe, the nearest thing to allodial ownership known in England. The necessity, especially in military tenures, of knowing accurately who the tenant was, gave rise to a number of so-called 'incidents of tenure.' Thus, on death of a tenant, the custom of the particular manor, which was pretty much the same all over the country, pointed out who by descent became his rightful successor; if the heir was a minor, another incident gave the lord the wardship of his person and lands till his majority; if a female, the lord might dispose of her hand in marriage, lest she should marry a hereditary enemy; if the tenant wished to sell his land, the lord must accept the new-comer as his tenant; and if the tenant died altogether without heirs, the land escheated to the lord. Accordingly, the lord might always know who his tenant was, and where to look for his services.

In England, though the oath at Salisbury to a large extent took the sting out of feudalism and minimised its disruptive effect, all these results and incidents developed themselves with great luxuriance and symmetry; but in or about the time of Henry II. a custom arose of commuting all the services for money to be spent in pay of mercenary soldiers, and thus another blow was dealt at the personal relationship based on land-holding which was of the essence of the feudal system. Later still, in the reign of Edward I., was passed the famous statute known as Quia Emptores (18 Ed. I. chap. 1), prohibiting any vassal from granting any land to be held in fee-simple under himself, and enacting that if he wished to sell it he must do so out and out, so that the purchaser thenceforth should hold of the same chief lord as the seller had held of before. Thus the formation of the infinite chain of lord, vassal, and sub-vassal was checked, till in process of time it has come about that nearly all freeholders in England hold directly from the crown. About the same time in France the influence of powerful kings began to absorb the semi-independent dukes and princes into the crown, but not till the following century was the result finally achieved by Louis XI. He broke the feudal power of the great Duke of Brittany, the last, as he was the most powerful of the feudatories of the crown. In this way French feudalism became a thing of the past by the absorption of all the mesne lords, finally bringing about the same end which William I. accomplished by masterly policy in England; but bringing it about by dint of the sacrifice of all the great nobles, and reducing France to the condition of a powerful king with a weak and servile people, a state of things necessarily leading to the greatest tyranny and to revolution and upheaval. Meantime in England the progress was steady and certain. Quia Emptores destroyed the disruptive force of feudalism; but the old military tenures remained in name, though in fact they were little more than excuses whereby the lord contrived to screw money out of the unlucky tenant in the guise of fines for alienation, reliefs on taking up the inheritance by the heir, heriots, first-fruits, prime seisins, &c. There were also the aids given by the tenant at certain expensive epochs of his lord's life, viz. when he was taken prisoner and required ransom, when his eldest son was dubbed a knight, and when his daughter was married—*pur ransommer son corps, pur faire fitz chevalier, et pur marier sa fille*. The extortion to which the feudal system finally degenerated, when all its original purpose was gone, was put an end to by the Statute abolishing Military Tenures, passed on the restoration of Charles II.; and from that time forward feudalism to all intents and purposes was dead in England, save only so far as it affected the forms of conveyance of land. A few

of the old tenures were preserved, probably on account of their picturesqueness and of their being too light to be any real burden, such as the tenures of grand and petit sergeanty, under the latter of which the Dukes of Marlborough and Wellington hold their lands on condition of the presentation of a flag to the sovereign.

We have seen how in France the disruptive nature of the feudal system and its tendency to create a class of petty sovereigns more powerful than their feudal lord proved the destruction of the system itself in that country in the 15th century; and how the very introduction of it into England was marked by a violation of one of its essential features, so that feudalism in its integrity never existed in England. But probably the country where the system can be most advantageously studied in its development and decay is Scotland; into this country it was introduced not by a powerful monarch like William I., but by a number of restless and ambitious Norman knights journeying north in search of adventure, who by their good swords and their Norman talent for organisation made themselves chiefs of powerful clans. The process by which this was accomplished and its general good effect on the country have been well shown by the Duke of Argyll in *Scotland as It Was and as It Is* (2 vols. 1887). From these Norman knights the great houses of Bruce, Stewart, Fraser, Grant, Comyn, and many others take their rise; but the poverty of the country and the sparseness of population, constantly reduced by devastating wars, prevented the aggrandisement of the feudal lords, and checked the disruptive tendency of the system just sufficiently to preserve its vitality to a comparatively modern period. Indeed, in the rebellion of 1745, it became evident that sufficient of the feudal spirit remained to be a source of danger to any government which chanced to be unpopular with the Highland chieftains, and also sufficient of its disruptive and disintegrating tendencies to render any enterprise depending on their support extremely precarious. Accordingly, after the suppression of that rebellion, the military tenures were abolished by legislation very similar to that which at the Restoration had abolished them in England. Nothing analogous to the oath at Salisbury ever took place in Scotland; accordingly the development of the system which made every chieftain a king in miniature, whose little realm was a sort of microcosm of the whole kingdom, proceeded unchecked. No statute analogous to Quia Emptores ever prevented subinfeudation, and accordingly to this day there may be any number of links in the chain of superior and vassal and sub-vassal; while in England, since no sub-vassal could be created after 18 Edward I., the intermediate lords have for the most part gradually dropped out, and most land-owners now hold directly from the crown, which was one result aimed at by William I., resulting in the most complete consolidation of the country.

Those who wish to see the remains of the feudal system in visible, albeit dead and fossilised form, may do so more completely on the banks of the Rhine than almost anywhere else. The castle of the feudal baron towers on its height; the village of his dependents nestles at its foot, with the church whose priest was his tenant in frankalmoign, or maybe his chaplain; the pier, it may be, which paid his dues—in fact, all the machinery of a tiny kingdom. Between one baron and another there might be friendship; there was more often feud. Over a number of the barons was some feudal lord, a prince-bishop perhaps, or a duke, and over them again the king; and in legend and story as well as in visible remains of the ancient buildings may be traced all the ramifications of the system, till the eye of fancy can without much difficulty reconstruct it again.

See Hallam's *Middle Ages* (1818); Stubbs, *The Constitutional History of England* (1874–78); Seebohm, *The English Village Community* (1883); Guizot, *Histoire de la Civilisation en France* (1845); Waitz, *Deutsche Verfassungsgeschichte* (1843–78; new ed. 1879–86).

Feu de Joie, or 'running-fire,' a discharge of musketry into the air, by a line of soldiers, in honour of a victory or other great occasion. It commences with the right-hand man of the line, and passes rapidly down it, each man discharging his rifle after a short but regular interval, till the extreme left of the line is reached.

Feuerbach, LUDWIG ANDREAS, German philosopher, fourth son of the following, was born at Landshut, 28th July 1804. After he had studied theology for two years at Heidelberg under Paulus and Daub, Hegel attracted him to Berlin, and ere long he abandoned theology for philosophy. In 1828 he became *privatdocent* at Erlangen, but failed as a lecturer, and next retired to Bruckberg, where his wife's means enabled him to live in studious quiet for more than twenty years. In 1830 he published anonymously his *Gedanken über Tod und Unsterblichkeit*—an attack on the doctrine of immortality—and during the next few years, works on the philosophers between Bacon and Spinoza, on Leibnitz, and Pierre Bayle. But these historical works only paved the way to a critical investigation into the nature of religion and its relation to philosophy, the results of which have been given to the world in several works well known to speculative theologians. The most celebrated of these is his famous work on the nature of Christianity, *Das Wesen des Christenthums* (1841), which had the honour of translation into English from the pen of Marian Evans (George Eliot). Starting from the Hegelian doctrine that the Absolute comes to consciousness only in humanity, Feuerbach denies to it any existence beyond the human consciousness, maintaining it to be merely the projection by man of his own ideal into the objective world, on which he feels his dependence. All authority above man, and consequently all moral obligation, is therefore consistently regarded as a delusion proceeding from man himself, and the highest good is explained as that which is on the whole most pleasurable. Yet even this highest good is further explained as consisting in resemblance to that ideal humanity which man creates for himself, and worships as God. A kind of ideal theism is therefore retained by Feuerbach; but when his doctrines were adopted by the mass of German communists, they degenerated, perhaps logically, into an actual atheism, which ignored any moral or social law imposed on the individual from any other source than himself. The last years of the philosopher were vexed with poverty and paralysis, from which he was relieved by the offerings of admirers, and at last by death, 13th September 1872. His works were collected, with additions and corrections to bring them into accordance with his later views, in ten volumes (1846–66). See the books on Feuerbach by Ludwig Grün (1874), Beyer (1872), and Starcke (1885).

Feuerbach, PAUL JOHANN ANSELM VON, one of the most distinguished criminal jurists of Germany, was born at Jena, 14th November 1775. From the gymnasium at Frankfort-on-Main, where his father was an advocate, he passed in 1792 to Jena to study first philosophy, then law. Already he had made a brilliant reputation by his *Kritik des natürlichen Rechts* (1796), and his *Anti-Hobbes* (1798), when he began to deliver lectures which introduced into criminal jurisprudence a new method of treatment, systematised in his *Lehr-*

buch des gemeinen peinlichen Rechts (1801; 14th ed. 1847). This celebrated work placed Feuerbach at the head of a new school of jurists, who maintain that the decision of the judge in every case ought to be determined solely by an express deliverance of the penal law, never by his own discretion, and who on that account obtained the name of Rigorists. It gave a powerful impetus to the feeling in favour of more humane and less vindictive punishments. In 1801 he was appointed professor in Jena, but in 1802 accepted a call to Kiel. In 1804 he removed to Landshut; but next year he was transferred to an official post in Munich, and in 1808 was appointed privy-councillor. The new penal code which he planned for Bavaria (1813) was taken as a basis in the emendation of the criminal law of several other countries. During this period also he published his *Merkwürdige Kriminalrechtsfälle* (1808–11). In his *Geschworenengericht* (1813) he maintained that the verdict of a jury is not necessarily adequate legal proof of a crime. Supplements were published in 1819 and 1821, and a second volume was added in 1825. In 1814 Feuerbach became second president of the Court of Appeal in Bamberg, and afterwards first president of the Court of Appeal at Anspach. In 1832 he published a work on Kaspar Hauser (q.v.). He had just edited a collection of his *Kleine Schriften* when he died suddenly at Frankfort-on-Main, 25th May 1833. An interesting life was written by his son Ludwig (2 vols. 1852).

Feuillans, CONGREGATION OF, a reform of the Cistercian order, remarkable as forming part of the great religious movement in the Roman Catholic Church during the 16th century, contemporary with and probably stimulated by the progress of the Reformation. The author of this reform was Jean de la Barrière, abbot of the Cistercian monastery at Feuillans in Languedoc (20 miles south-west of Toulouse), who, painfully struck by the relaxation of its discipline, laid down for himself a new and much more austere course of life, in which he soon found many imitators and associates among the brethren of his order. The rule thus reformed was, after considerable opposition from the advocates of the old rule, approved, with certain modifications, by Pope Sixtus V., the reformed congregation, however, being still left subject to the authority of the abbot of Citeaux; and a convent was founded for them by Henry III. in the Rue St Honoré, Paris. The subjection to the abbot of Citeaux was removed by Pope Clement VIII. in 1595; and Urban VIII. in 1630 separated the congregation into two branches, one for France and the other for Italy, each under a distinct general. The rules of both these branches were subsequently modified about the middle of the same century.

The celebrated revolutionary club of the Feuillants took its name from this order, whose convent in the Rue St Honoré was its meeting-place. It was founded in 1790 by Lafayette, Sièyes, Larochefoucauld, and others holding moderate opinions, but it soon fell before the devouring fire of revolution. At length, on the 28th March 1791, the assembly in the cloister was forcibly dispersed by a raging mob. In October 1791 the extreme right and the right in the Legislative Assembly were often called Feuillants.

Feuillet, OCTAVE, a distinguished French novelist, born at Saint-Lô, in La Manche, 11th August 1822. He was numbered for some time in the band of Dumas' literary assistants, and began his own literary career with *Le Fruit défendu*, in the *Revue Nouvelle*. From 1848 he published in the *Revue des Deux Mondes* a series of proverbs, comedies, tales, and romances, which were collected in *Scènes et Proverbes* and *Scènes et Comédies* (5 vols. 1853–56). He was elected to fill Eugène Scribe's chair at the French Academy in 1862, and was afterwards librarian to the emperor. Some of the earlier novels, as the pathetic story *La Petite Comtesse*, gave promise of power, but his popularity as a novelist really awoke with the publication of the masterpiece *Le Roman d'un Jeune Homme Pauvre* (1858), and the only less beautiful *Sibylle* (1862). These were followed by *M. de Camors* (1867), *Julia de Trécœur* (1872), *Un Mariage dans le Monde* (1875), *Les Amours de Philippe* (1877), *Le Journal d'une Femme* (1878), *Histoire d'une Parisienne* (1881), and the striking *La Morte* (1886). He wrote many successful comedies, but his dramatic faculty is more effectively displayed in his novels than in his work for the stage. Feuillet had many excellent gifts as a writer of fiction. His stories are cleverly constructed, gracefully told, and unstained by coarseness; he is thoroughly acquainted with the high circles in which his characters move; he has pathos and even passion at his command. Yet he cannot be classed as a great novelist. He never creates a really strong character; he frequently strikes a false note; he indulges in morbid sentimentalism, and has a weakness for treating dubious situations while posing as a strict moral teacher. These defects are in the main unapparent in *Le Roman d'un Jeune Homme Pauvre*, but the story, though interesting and in parts charming, yet fails to leave a powerful impression on the reader. Died 29th December 1890.

Feuilleton (Fr., lit. 'a small leaf'), the name applied to that portion of a political newspaper set apart for intelligence of a non-political character, for criticisms on art or literature, or for fiction, and usually separated from the main sheet by a line. The feuilleton was first adopted in 1800 by the Abbé Geoffroy for dramatic criticisms in the *Journal des Débats*, but by degrees the element of belles-lettres became dominant, and the result was a species of light journalistic literature, in which Jules Janin became the acknowledged king. In the years immediately preceding the revolution of February 1848 entire romances were spun out in the feuilleton, as the novels of Eugene Sue in the *Constitutionnel*. Among the later French *feuilletonistes* may be named Fr. Sarcey, P. de Saint-Victor, Alb. Wolff, Jul. Claretie, and A. Scholl. The French system has been imitated in Germany, though with less success than in France, but has hitherto found less favour in England. The more eminent of recent German *feuilletonistes* are K. Frenzel, P. Lindau, L. Pietsch, F. Gross, O. Bauck, and the humorists, Eckstein, Stettenheim, Trojan, and Dohm.

Feval, PAUL HENRI CORENTIN, a French novelist, born at Rennes, September 27, 1817. Of his many bright and vigorous novels may be named *Les Mystères de Londres* (1844), *Le Fils du Diable* (1847), and *Le Bossu* (1858). Many of his romances have had an extraordinary run when dramatised. Feval became converted to the strictest Roman Catholicism in 1876. Died March 8, 1887.

Fever (Lat. *febris*, lit. 'a trembling'), a diseased condition of the system, of which the most important characteristic is a rise in the temperature of the body. Fever should be regarded as fundamentally a symptom or group of symptoms, rather than as a disease or class of diseases, for the causes leading to it are extremely various; but it is a symptom of such importance that the term is used, with a distinguishing epithet, as the name of a number of diseases. The increase of the temperature of the body requires to be estimated according

to the state of the internal parts rather than the external; the surface of the body, and particularly the extremities, being not unfrequently cold rather than warm. In many cases where fever occurs, most characteristically in Ague (q.v.), it may be considered as passing through three distinct stages more or less marked: (1) the cold or shivering stage; (2) the hot stage; (3) the sweating stage. This description, however, requires to be qualified by the remark that, even in the cold stage of fevers, it is now well ascertained that the blood and the internal organs have an elevated temperature, as estimated by the thermometer introduced into the cavities of the body. In the cold stage of fever, accordingly, and even in the most violent ague, when the teeth are chattering with cold, and the whole surface is pale and clammy, the state of the system is well expressed by the maxim of Virchow, to the effect that 'the outer parts freeze while the inner burn.' The increase of temperature is very various in different diseases and at different times in the same case. When it is over 104° F. it may be regarded as 'high;' when over 106° it is often called *hyperpyrexia;* and when it exceeds 107° for more than an hour or two a fatal issue is almost certain.

Elevation of temperature, though perhaps the most important, is by no means the only indication of the feverish state. It is often ushered in by a chill, or a distinct shivering, or *rigor*, as it is technically called; this leads through the cold stage to the hot, which usually follows pretty rapidly, and is attended by all the febrile phenomena in their highest degree. The pulse, and usually the breathing, are quickened; the appetite is lost or impaired, and the tongue furred; there is thirst, often excessive; headache and pains in the back and limbs are often present, with restlessness and general uneasiness; there is great weakness of the muscular system; all the secretions are disordered, the urine in particular being scanty, high-coloured, and loaded with sediment; when the fever is severe, delirium often comes on, especially at night. If the feverish state continue, rapid wasting takes place, especially affecting the fat and the muscles. If the case take a favourable turn, the feverish state terminates either gradually, by *lysis*, as in typhoid fever, or suddenly, by *crisis*, as in typhus fever and acute inflammation of the lungs. In the latter case there is often what is called a 'critical discharge' from skin, kidneys, or bowels. (For the features of special feverish diseases, see under their respective titles.)

The cause of the increased temperature in fever is not yet fully understood. Increased oxidation takes place in the body in almost all cases where fever is present, and must be associated with increased evolution of heat; but calculation seems to show that this is not sufficient to account in many cases for the high temperature maintained. Whether the other factors concerned depend upon obscure chemical changes in the body, or upon some peculiar disorder of the nervous system, is at present only a subject of inquiry and speculation.

Diseases in which fever occurs are separated pretty naturally into two great groups: in one of these the fever is the greatly predominating fact, and determines the specific character of the disease, the local disease (if present) being quite subordinate, and usually secondary in point of time; in the other the opposite order prevails, and the fever is obviously secondary. Hence the distinction embodied in medical language between *idiopathic* (i.e. 'self-originating,' 'spontaneous') and *symptomatic* or secondary fevers. The idiopathic fevers are distinguished with reference to their mode of diffusion, as Epidemic (q.v.) and Endemic (q.v.); or with reference to their supposed cause, as contagious, infectious, malarious, &c.; or with reference to their incidental symptoms and their peculiarities of course and termination (the presumed *specific* phenomena attracting, of course, particular attention), as eruptive (see EXANTHEMATA) or non-eruptive, malignant, &c. For the Classification of Diseases, see DISEASE.

Among these distinctions, based upon the course of the fever, one demands particular notice, as involving an important law of febrile diseases generally, and of a large class of fevers of warm climates in particular. Periodic increase and diminution, or paroxysms of longer or shorter duration, with intervals of more or less perfect relief from all the symptoms, are characteristic of most diseases of this kind, but especially of those arising from *malaria*—i.e. emanations from the soil, educed under the influence of solar heat. The duration of the paroxysms and of the intervals, the complete *intermission*, or more partial *remission*, of symptoms, become in such cases the characteristic facts that mark the *type*, as it is called, of the fever, which is accordingly distinguished as intermittent or remittent, and, according to the length of the periods, tertian, quartan, quotidian, &c. See AGUE.

Symptomatic or secondary fever occurs in a large number of diseases. Indeed, there is no condition which rules so large a part of the physician's duty, whether in the way of distinguishing diseases or of curing them, as this constitutional state. It is specially associated with acute or sub-acute inflammations of the various organs and tissues of the body. Among the diseases where it is usually most marked some of the most important are acute rheumatism, or rheumatic fever; acute abscess; meningitis, often called brain fever; acute pneumonia, or inflammation of the lungs; peritonitis.

Hectic is only distinguished from other forms of fever by the comparative mildness of its symptoms, and its slow and insidious progress. It is specially characteristic of Consumption (q.v.) and allied diseases, and of chronic forms of blood-poisoning.

The treatment of the feverish state depends so much on the cause which produces it that it can hardly be profitably treated in a general way. Some remarks, however, on the methods in use for reducing the temperature of the body may not be out of place. In very many cases of fever no such treatment is necessary; but when the temperature is so high, or so long above the normal, as to be in itself a source of danger to the patient, special means must be adopted for its reduction. Quinine has long been in use for this purpose in many diseases besides ague and other malarial fevers, in which it is the remedy *par excellence*. But within the last few years several new drugs have been brought into use, which have the property of reducing feverish temperature in most cases, and appear to be of great value. Of these antipyrin and antifebrin, both derivatives of coal-tar, have found most favour. Ice-bags, or coils of metal tubing through which cold water is kept flowing, are sometimes applied to the surface of the body, particularly to the neighbourhood of an organ on inflammation of which the fever depends. But the most powerful and certain of all methods, the only one hitherto found effectual in certain forms of 'hyperpyrexia,' is the use of a cold wet pack, or a bath at a temperature below that of the body. Such measures, it need hardly be said, require much caution and judgment in their application, but they have been found of great value in various forms of disease.

Feverfew (*Matricaria—Pyrethrum—parthenium*), a composite perennial, common in hedge-banks and waste places, but in Britain usually as a garden escape. It is closely allied to camomile, and still more to wild camomile (see CAMOMILE),

and like these is of immemorial use in medicine as a tonic and bitter, its popular name recording its febrifugal properties. Like many other popular medicines, it has now been replaced by more potent remedies, save occasionally in the domestic practice of country districts, or in that of the herbalist. A double variety is not uncommon in gardens. The Mayweed (*M. inodora*), with leaves more resembling those of camomile, but almost scentless, and large flowers with white ray and yellow disc, is common in cornfields and waste places in America and throughout Europe. See PYRETHRUM.

Common Feverfew (*Matricaria parthenium*).

Feverwort (*Triosteum perfoliatum*), a perennial of the order Caprifoliaceæ, a native of North America, where its dried and roasted berries have been occasionally used as a substitute for coffee; its roots act as an emetic and mild cathartic. It is sometimes called *Tinker's Root*, from the physician who first brought it into notice.

Feydeau, ERNEST, a French novelist, born in 1821, whose stories depict the worst features of society in the time of the Empire. Despite the morbid tone and low morality of his works, he had unquestionable talents, and produced one novel, *Sylvie*, of much more than ordinary power. Among his other works are *Fanny Souna*, *Le Roman d'une Jeune Mariée*, *Amours Tragiques*, *Cathérine Overmeire*, *Le Secret du Bonheur*. Feydeau died in 1873.

Fez, or more properly FAZ, the second capital of the sultanate of Morocco, lies inland in 34° 6′ N. lat. and 4° 58′ W. long., about 100 miles E. of Rabat on the Atlantic. Standing in a pear-shaped valley surrounded with hills, which are clothed with orchards of orange, pomegranate, apple, and apricot trees, and with olive-gardens, whilst the plain is strewn with numerous ruined buildings, Fez presents a strikingly oriental appearance. The town itself, divided into two parts by a little stream that joins the Sebu 2½ miles to the NE. of the town, is encircled by crumbling walls, and has narrow, dirty, sunless streets. For more than a thousand years Fez has been one of the sacred cities of Islam, being especially renowned for its university and schools of learning. The university, attached to the mosque of the Cherubim, called also the mosque of Muley Edris (one of the largest and most venerated in North Africa), was founded in 859; at present it is frequented by about 700 pupils, who come from all parts of the Mohammedan world, and are taught by about forty professors. Attached to this mosque is a library, computed to contain 30,000 MSS. Besides the university there are also fourteen colleges. The extensive palace of the sultan is now partly in ruins. Although thus falling into decay, Fez is nevertheless one of the busiest commercial towns of north-west Africa; its merchants import European manufactured wares and the productions of tropical lands, which they despatch by periodical caravans to Timbuktu and the interior of Africa, and export (since 1885 very largely by way of Rabat, instead of as formerly by Tangier) the products they receive thence in return, such as fruits, gums, ivory, gold, together with those of the native industries, chief amongst which are morocco leather, fez caps, pottery, and gold and silver wares. The population is very variously estimated from 150,000 to 50,000; a native computation in 1888 puts it at only 24,000, embracing Arabs, Berbers, Jews, and Negroes. Fez was founded by Muley Edris in 808, and was the capital of the Edrisi dynasty as long as it lasted. Towards the end of the 11th century the town was made the capital of an independent kingdom, founded (1086) by the Almoravid prince, Yussuf ibn Tashfin, and from that time onwards it ranked, on account both of the veneration it was held in as a sacred city and of its learning, as one of the first cities of Islam. But from the date of its incorporation with Morocco, in 1548, it began to decay in importance. See Delphin, *L'Enseignement Supérieur Mussulmain* (1889), and De la Martinière, *Morocco* (Eng. trans. 1889).

Fez, a red, brimless cap of fine wool, fitting closely to the head, with a tassel of black or blue, worn in Turkey, Persia, Greece, Albania, Egypt, and on the shores of the Levant generally. The name is derived from the town of Fez, where such caps were first made; at present the best are manufactured in Tunis, but fezes of fair quality are prepared in Germany, France, and Switzerland. In Africa they are usually called *tarbûsh*.

Fezzan, a province of the Turkish empire, politically attached to Tripoli, to the south of which country it lies. Extending some 390 miles N. and S., and some 300 E. and W., between 24° and 29° N. lat. and 12° and 18° E. long., Fezzan belongs to the desert region of North Africa. It consists of a huge depression, fenced in on all sides except the west by low ranges of hills, and traversed by barren, stony, shelterless plateaus, between which lie long shallow valleys, containing numerous fertile oases. The northern barrier of the province is the range of Jebel es-Soda, which strikes off nearly due east from the south-east corner of the Saharan plateau called the Hammada el-Homra, and is continued towards the south-east by the Haruj el-Aswad. The Jebel es-Soda measures about 125 miles in length, and has an average altitude of 2950 feet. South of this range stretches for some 80 miles a series of low elevations, strewn with smooth stones, destitute of water, and almost entirely devoid of plant and animal life; beyond these again comes a region of sandy alluvial soil, containing saline deposits, with a tolerably good supply of water at 10 to 12 feet below the surface. South of the Hammada el-Homra Fezzan is invaded by the *edeyen* or Saharan sand-dunes; and these are separated from the Hammada of Murzuk on the south by the Wady Ladshal, a watercourse extending north-east for about 125 miles. The southern border of the province is formed by the Tümmo Hills, more than 2500 feet high, which connect the Ahaggar plateau in the north-west with the mountainous region of Tebesti in the south-east. The entire region slopes gently towards the east.

The oases, mostly depressions in the valleys, are the only cultivated spots, where a little grain and a few vegetables are raised, and where grows the date-palm, the principal source of food for the inhabitants and their domestic animals. Of these camels, poultry, and pigeons are alone kept in any great number. The climate is on the whole uniform and healthy, although malarial fever is very frequent. Fezzan is both hotter in summer and colder in winter than Tripoli; its temperature ranges from 23° to 112°, the annual mean being 70° F. The atmosphere is very dry; rain scarcely ever falls. The principal winds blow from the

south and east, but from December to April north and west winds are very prevalent. There is no industry, no export trade except in soda, obtained from extensive salt lakes north west of Murzuk, and very little commerce. Formerly, however, the Fezzan merchants occupied a very important position as intermediaries in the trade between Tripoli and Egypt with Bornu and Timbuktu; but the opening of new routes and the attempts to check the trade in slaves—the great staple of this route—have destroyed the commercial importance of Fezzan. The inhabitants, estimated by Nachtigal at about 50,000, are a mixed race, embracing Tuareg, Tibbu, Bornu, Haussa, and Arab elements grafted on the original nomadic stock. They are frivolous, pleasure-loving, and idle, but noted for their honesty and good-nature, as well as notorious for their immorality. In their manners and social customs they have borrowed largely from Arab originals; in religion they are Mohammedans of the Sunnite creed. The principal town of the province is Murzuk, a place of about 6500 inhabitants.

Fezzan is the ancient Phazania, or the land of the Garamantes, whose capital was Garama, and who were conquered by the Roman Balbus in 20 B.C. In the middle of the 7th century the country was invaded and subdued by a lieutenant of 'Amr ibn el-Asi, the Moslem conqueror of Egypt. From the 10th century onwards, with the exception of about 100 years (the 13th century), when it was held by the kings of Kanem from the south, Fezzan was ruled by native or Arab dynasties. From the 16th century its history may be epitomised as a series of struggles against Tripoli, until in 1842 it finally lost its independence, and became a Turkish province and part of the governor-generalship of Tripoli; but it has now a separate governor, who acts almost wholly independently of the governor-general of Tripoli. See Barth, *Travels in Central Africa* (vol. i. Lond. 1857), and Nachtigal, *Sahara und Sudan* (vol. i. Berlin, 1879).

Fiars (a word of controverted origin, probably connected with the French *affeurage*, 'taxation,' but possibly with *fiar*, 'the holder of a fee,' as originally confined to crown vassals). The *fiars* prices in Scotland are the prices of the different kinds of grain of the growth of each county for the preceding crop, as fixed by the sentence of the sheriff, proceeding on the report of a jury summoned for the purpose, before whom the evidence of farmers and corn-dealers is produced. The values thus officially ascertained serve as a rule for ascertaining the prices of grain in all contracts where they are not fixed by the parties; and in many sales it is agreed to accept the rates fixed by the fiars. The original use was to fix crown rents, and it was long ere the system was applied to church stipends. See TEINDS.

The form of procedure in 'striking the fiars,' as it is called, is regulated by Act of Sederunt, 21st December 1723, renewed 29th February 1728, which is itself of doubtful legality. The time fixed by this act for summoning the jury is between the 4th and 20th of February, and the verdict must be returned before 1st March, old style; which is generally considered too early, as before that time not much grain of the previous crop has been brought into the market. Later dates were afterwards fixed for Orkney and Shetland. Mr Barclay, sheriff-substitute of Perthshire, in his Digest, gives the following account of this difficult and delicate process as practised in his county. 'In Perthshire, the fiars court is held on the last Friday of February, or the first Friday of March. The jury consists of eight heritors, a few farmers, and some neutral parties, especially one or two able to check the calculations. An experienced accountant is sworn, and acts as such, but is not on the jury, and is paid a fee from the county rates. The list of the jury is shifted every alternate year, thereby giving sufficient release from duty, and yet securing persons skilled in the practice. Some years ago it was arranged to take no juror who either paid or received rents according to the fiars; but this greatly limited the choice, and was complained of, and abandoned. All considerable dealers in Perthshire victual, whether resident in Perthshire or elsewhere, are uniformly summoned, and in addition every person whose name is given in by whatever person interested.' There are, however, grave differences of procedure in the different sheriff courts. In fact the Act of Sederunt was never in operation in Haddington. The result has been an artificially severe fluctuation in values. It is obvious that the method of fixing fiars requires investigation and correction; also that all grain payments should be compulsorily converted into money. The same mode is not adopted in England under the Tithe Commutation Act (see TITHE). See Paterson, *Historical Account of the Striking of the Fiars in Scotland* (1852); *Fiars Prices*, by William Hector; *Position of Fiars Prices and Conversion of Grain Payments*, by N. Elliot (1879). For the fiars prices prior to 1776, see Bald's Tables. See also Taylor's *Tables of Value of Tithe Rent Charges* (1879), and, for elaborate tables, the annual issue of Oliver and Boyd's *Edinburgh Almanac*.

Fiasco, a term borrowed from the usage of the Italian theatre, and now naturalised in France, Germany, and England, for a failure in acting or singing, or by extension of the metaphor for a failure of any kind. In Italy it is not uncommon to hear an audience cry out, 'Olà, olà, *fiasco*,' even when the singer has only made a single false note. The word means literally 'a bottle,' and its metaphorical use may contain an allusion to the bursting of a bottle.

Fiat, in English law, a short order or warrant of a judge or public officer for making out or allowing processes, letters-patent, &c.

Fiber. See MUSQUASH.

Fibres, Textile. See FIBROUS SUBSTANCES.

Fibrin is a proteid substance which appears in the blood after it is shed, and by its appearance gives rise to the process of coagulation or clotting. Freshly prepared fibrin is a stringy, elastic, white substance. Its elementary composition is carbon, 52·6; hydrogen, 7·0; nitrogen, 17·4; sulphur, 1·2; oxygen, 21·8 = 100·0. It gives the various reactions of the proteid substances (see PROTEIDS). It is insoluble in water, and only slowly soluble in solutions of the neutral salts. It is precipitated by a saturated solution of sulphate of magnesium. It must therefore be considered as nearly allied to the globulin group of proteids.

Fibrin may best be obtained by whipping blood as it is shed with a bundle of twigs, which after a time become surrounded by masses of the fibrous elastic threads of fibrin. These may then be washed to free them from the various constituents of the blood. The mode of appearance may be well studied by allowing a layer of blood to coagulate on a microscopic slide under a cover glass, and then gently washing the cover glass to which the clot adheres with a stream of water. It will be seen to consist of a delicate reticulum of fibrils with granular-looking masses at many of the nodal points. The fibrils appear to have shot out from these granular masses.

The source of fibrin is a matter upon which our knowledge is at present imperfect. The most recent investigations tend to show that a substance belonging to the globulin group of proteids, and known as fibrinogen, which occurs in the blood-

plasma before coagulation, becomes precipitated as fibrin when the blood is shed. What is the cause of this precipitation we do not know. Formerly it was supposed that the white corpuscles broke down and set free a ferment which set up the change. More recently the possible connection of the third element of the blood—the blood platelets—with the process has been suggested by various pathological investigations. Apparently the granular nodal masses already described are composed of these platelets. Although the wet fibrin derived from blood appears somewhat bulky, when dried and weighed its amount is found to be very small—on an average only 0·2 per cent. See BLOOD.

Fibrous Substances. Such of these as are used in the arts are either of animal or vegetable origin, with the exception of Asbestos (q.v.), which is mineral. Fibres which can be spun and woven, or made into cloth or paper by a felting process, have some peculiarity of structure which fits them for such purposes. Human hair or horse-hair is not suitable for ordinary textile fabrics, because either resembles a very thin flexible rod with smooth sides, so that when an attempt is made to twist a number of them into a yarn, or form them into a felted substance, they will not hold together. Horse-hair used singly is made into cloth because it is exceptionally strong. But nearly all fibres suitable for woven or felted fabrics, such as wool, silk, cotton, or flax, have on their surface serrations or projections of some kind, or they have a proneness to twist and curl, either of which characters causes them to interlock, so that when they are spun into yarn they do not untwist again. These little prominences or projections are only seen when the fibre is highly magnified.

In addition to suitable structure, the value of a fibre for industrial purposes depends upon its strength and elasticity, and upon its capability of being bleached and dyed. Length and fineness are also considered, as well as abundance of supply.

The wool of the sheep and the shawl goat is described under WOOL and CASHMERE GOAT. See their respective heads for alpaca, mohair, fur, and silk. There are a few other animal fibres of some interest or importance, such as camel's hair, from which an excellent cloth is made, and cow-hair, which is used in considerable quantity for inferior kinds of woollen goods. A fibre of a silky nature is obtained from the byssus of a large Mediterranean bivalve shell-fish (*Pinna nobilis*), which is made into shawls and gloves.

Different parts of plants yield fibres. Only dicotyledonous plants have a true bark, and from these come the most important textile fibres of vegetable origin. These generally consist of strong, fine, flexible bast fibres from the bark sheath, of which flax, hemp, rhea, and jute are examples (see BAST). The most valuable of all, however —viz. cotton, consists of hairs which surround the seeds of the plant. In monocotyledonous plants, which also yield many serviceable fibres, these are commonly obtained from the fibrous portions of leaves and of leaf-stalks. More rarely they occur as hair-like fibres which form appendages to leaves or surround their base. Coir fibre is from the husk of the nut of the cocoa-nut palm.

Vegetable fibres consist essentially of Cellulose (q.v.), a substance which is not easily acted upon by chemical reagents such as affect allied bodies found in plants. This is an important property in connection with some of the manufacturing processes through which they require to pass.

Cotton, flax, hemp, jute, and coir are described under their respective heads; rhea or China-grass under BŒHMERIA; and New Zealand flax (*Phormium tenax*) under FLAX. The vegetable fibres noticed in what follows, though less known than those used in our principal textile industries, are nearly all of some importance commercially. Besides these there are quite a number of plants yielding fibres known to have valuable properties which have not, except in the countries in which they grow, received any industrial application.

FIBRES FROM EXOGENOUS PLANTS.—*Asclepias syriaca* (Silk Weed).—The seeds of this plant are covered with a silky down which is used for a variety of purposes, such as the stuffing of beds and for mixing with wool for certain kinds of cloth and felt. The species is a native of Syria, but is also found in North and South America, and is cultivated in some parts of Europe.

Beaumontia grandiflora is another plant yielding a hairy or silky fibre from the seeds. This is considered to be one of the best and strongest of the seed-hairs called 'vegetable silk.'

Broussonetia papyrifera (Paper Mulberry).—A fine white cloth called tapa is made in a number of the Pacific Islands by beating the bark of this tree. The bark of this and another species of Broussonetia is much used for making paper in Japan. Quite recently the fibrous portion of the bark of the young shoots of white mulberry (*Morus alba*) has been used as a textile material in Italy (see MULBERRY).

Crotalaria juncea (Sunn Hemp).—Indigenous to Southern Asia and the tropical portion of Australasia; cultivated all over India. The fibre is very suitable for cordage, considerable quantities being exported from India for this manufacture.

Daphne longifolia, D. papyracea, D. Wallichi.—The fibre of the bark of each of these Indian plants is used in the manufacture of paper and ropes.

Eriophorum comosum (*Pollinia eriopoda*) (Babar-grass, Cotton-grass).—This plant is very common in many parts of India. The down at the base of the seeds is largely used in India for making paper, ropes, and cordage.

Hibiscus cannabinus (Hemp-leaved hibiscus, Deccan hemp).—In the North-west Provinces, as well as in other parts of India, this small herbaceous shrub is largely cultivated for its fibre, which is sometimes used to adulterate jute. It is inferior to the latter in quality, being rather coarse and harsh, though strong. In India it is made into ropes and nets and largely into paper.

Humulus lupulus (Hop).—From the hop vine a useful fibre is obtained, which is turned to account for making cloth in Sweden. In England it has been made into millboard.

Pinus sylvestris (Pine-wool).—In recent years fibre obtained from the leaf-needles of the Scotch fir has, on the continent of Europe, been made into a blanket stuff for hospitals, flannels, and hosiery. It is usually mixed with cotton or wool. The material is believed to have medicinal properties.

Tilia europæa (Common Lime-tree).—The bast fibres of this tree are extensively used in Russia for mats, ropes, and other purposes.

FIBRES FROM ENDOGENOUS PLANTS.—*Agave americana* (Spanish aloe).—An excellent fibre is obtained from this plant, which grows in great abundance in all parts of tropical America. It has also been successfully introduced into some countries of the Old World. The fibre is made into ropes, twine, and netting, as well as into matting and imitation haircloth.

Agave mexicana.—A plant distinct from the last, though often confounded with it. The fibres of both are used for the same purpose. Paper was made by the ancient Mexicans from *A. mexicana* in the same way as the Egyptians made it from the papyrus.

Agave sisalana (Sisal hemp).—The fibre of this species, which grows in Yucatan, Mexico, and

Central America, is especially valuable for ship cables, as it has been found to resist the action of sea-water better than most other materials used for their manufacture. Sisal hemp is sent in considerable quantities to the United States, but some of it is also sent to Europe.

Attalea funifera (Piassava).—From this palm much of the cordage used on the Amazon River is made. The strong fibres used surround the young leaves. These are known in commerce as piassava fibre, or at least one kind of it, which is used in Europe chiefly for brushmaking. Another kind of piassava is got from *Leopoldina piassava*, also a Brazilian palm.

Bromelia ananas (*Ananassa sativa*) (Pine-apple).—In some places, such as the Bahamas and India, this plant is cultivated for its fruit, but in Malacca, Java, China, and some other eastern places chiefly for its fibre. Several species of bromelia yield useful fibres. The *B. pigna* of the Philippines yields the fine thread from which the costly pina cloth or pina muslin is made. *B. sylvestris*, called in Central America the *pita*, and in Mexico the *istle*, also produces an excellent fibre.

Carludovica palmata (Panama screw-pine).—The unexpanded leaves yield the straw of which Panama hats, so much valued for their durability, are made.

Caryota urens (Kittool).—From the leaves of this Indian palm the kittool fibre, now largely used to mix with bristles in brushmaking, is obtained. Strong ropes are made of it in India.

Copernicia cerifera (Carnauba or Carnahuba—q.v.—palm).—A Brazilian palm remarkable for the number of useful products obtained from it. In that country the fibres of its leaves are used for ropes, mats, brooms, &c.

Corypha australis (Australian cabbage-palm).—The fibre obtained by splitting the leaves is made into clothing, netting, and hats.

Macrochloa tenacissima (Esparto-grass).—Esparto fibre is now manufactured into Paper (q.v.) on a great scale. For this purpose it is extremely well suited, being fine and strong, with a tendency to curl. Until comparatively recently much of the esparto-grass of commerce was supposed to be the *Lygeum spartum*, an allied plant.

Musa textilis (Manilla hemp).—The chief use of this fibre is in ropemaking, but matting is also made from it on a considerable scale in Dundee. It is prepared from the leaf-stalks of a wild plantain growing in the Philippine Islands.

Fibre from an Acrogenous Plant, *Cibotium barometz* (Pulu fibre).—The fibre so called surrounds the stalks of the fronds (leaves) of the plant, which is a fern growing in the Sandwich Islands. This fibre, like some of those occurring as hairs on seeds, is called 'vegetable silk.' It is used in the United States and Australia for stuffing in upholstery work.

Fibro-vascular Bundle. See Leaf, Stem, Bark, Vegetable Physiology, &c.

Fib'ula, a clasp or buckle (see Brooch, Buckles). For the bone so called, see Leg.

Fichte, Johann Gottlieb, a distinguished German philosopher, was born at Rammenau, near Bautzen, in Upper Lusatia, 19th May 1762, of a family distinguished for their simple piety, uprightness, and firmness of character. His earlier years were marked by a love of solitary musing and meditation. In 1774 he was placed at the gymnasium of Pforta, near Naumburg; and in 1780 he entered the university of Jena, where he devoted himself at first to theology, but afterwards to philosophy. During the years 1784–88 he supported himself in a precarious way as tutor in various Saxon families. Subsequently he went to Zurich in a similar capacity, where he first met Johanna Maria Rahn, who afterwards became his wife. Circumstances preventing their immediate union, Fichte in 1791 accepted a tutorship at Warsaw, in the house of a Polish nobleman. The situation proving disagreeable, it was thrown up, and Fichte proceeded to Königsberg, where he had an interview with Kant, of whom he had become an ardent disciple. At first he met with a rather chilling reception. With the view of establishing a better understanding, he resolved to write his 'Critique of all Revelation' (*Kritik aller Offenbarung*), published in 1792. Kant, on the work being submitted to him, praised it highly, and ultimately recommended Fichte to his own publisher, Hartung. In the meantime, however, Fichte's available means of subsistence being exhausted, he was forced to ask the loan of a small sum of money from Kant, which the latter refused. A temporary appointment as tutor in the family of the Count of Krokow, near Danzig, relieved him from immediate difficulties; and the high literary fame which rapidly followed the publication of the *Kritik* having opened to him a new career in life, he returned to Zurich in 1793, where on 22d October he married Johanna Rahn. In 1794 he was appointed to the chair of Philosophy at Jena, where he commenced to expound his system of transcendental idealism. His prelections were distinguished by singular earnestness and oratorical power, combined with the enunciation of the loftiest moral principle.

He now clearly broke away from the limitations of the Critical Philosophy of Kant, of which he had already declared, writing to Niethammer in 1793: 'My conviction is, that Kant has only *indicated* the truth, but neither unfolded nor proved it.' His 'Doctrine of Knowledge' (*Wissenschaftslehre*, Jena, 1795), his work on the 'Foundation of Natural Rights' (*Grundlage des Naturrechts*, 1796), and the 'Ethical System' (*System der Sittenlehre*, 1798) contain a systematic exposition of his philosophy in its earlier form, expressed in an abstract and somewhat repellent terminology which was laid aside in his later and more popular works. In 1799 an absurd accusation of atheism, fervidly but fruitlessly refuted, led to his removal to Berlin, where he delivered lectures on philosophy to a select auditory. In 1800 appeared his work 'On the Vocation of Man' (*Ueber die Bestimmung des Menschen*). In 1805 he obtained the chair of Philosophy at Erlangen, with the privilege of residing at Berlin during winter. Here he delivered his celebrated lectures 'On the Nature of the Scholar' (*Ueber das Wesen des Gelehrten*, 1805–6). In 1806 appeared his 'Characteristics of the Present Age' (*Grundzüge des gegenwärtigen Zeitalters*), and in the same year his 'Way to the Blessed Life, or the Doctrine of Religion' (*Anweisung zum seligen Leben oder Religionslehre*). In these works we find the highest expression of his philosophy in its mature form, divested of the earlier technicalities. In his relation to the public events of his time Fichte exhibited a high-toned and earnest patriotism. The victories of Napoleon at Auerstadt and Jena drew forth the famous 'Addresses to the German Nation' (*Reden an die Deutschen*). In these addresses, following out the leading idea of his 'Characteristics,' Fichte summoned his fellow-countrymen, in tones of spirit-stirring enthusiasm, to the duty handed down to them from past ages, of founding an empire of reason in which mind alone should assume the guidance of human affairs. With impassioned eloquence he pointed out the true means of national regeneration in a system of public education, of which he laid down the plan and delineated the chief features. His patriotic zeal was fully appreciated by the king, who on the restoration of peace requested

him to draw up a constitution for a new university in Berlin. In 1810 the university was opened, with a host of brilliant names, Fichte, Wolff, Müller, Humboldt, De Wette, Schleiermacher, Neander, Klaproth, and Savigny. By the votes of his colleagues, Fichte was unanimously elected rector. Here, as at Jena, he laboured with unremitting energy for the suppression of all those customs which he deemed barbarous in themselves, and incompatible with the true idea of a scholar. But his public career came to a premature close. In 1813 the war of independence broke out, and the hospitals of the Prussian capital were soon crowded with patients. Fichte's wife was one of the first who offered her services as a nurse. For five months she tended the sick with all the patient tenderness and devotion of her nature. At last she was seized with fever, 3d January 1814. After a fearful struggle she recovered; but her husband caught the infection, and in spite of all remedies sank under its influence, and died 27th January 1814. Of Fichte it may be said that he combines the penetration of a philosopher with the fire of a prophet and the thunder of an orator; and over all his life lies the beauty of a stainless purity. See *Fichtes Leben*, by his son (1831); and Dr William Smith's *Memoir*, prefixed to his translation of the *Popular Works* (4th ed. 1889).

The fundamental idea of the *Wissenschaftslehre* in its earlier form is that of a primitive act of consciousness; the *Ego*, or I, posits itself—it affirms itself, simply and unconditionally. But in this self-affirmation it necessarily posits a negative—a *Non-ego*—an opposite which is not itself. This *activity* of the *ego* is its very essence, the necessary condition of its existence. It is itself the absolutely productive, which, however, would not attain to consciousness of itself—i.e. of its infinite spontaneous activity, did it not at the same time place in contrast to itself, and as an impediment (*anstoss*) and limit to its activity, the non-ego—i.e. the objective world, or nature. The ego, in so far as it is determined by the non-ego, is the intelligent ego, and, as such, the subject of theoretical science—the science of cognition; the ego, on the other hand, as determining the non-ego, is the subject of practical science—the science of the will. Freedom, absolute, spontaneous activity, for its own sake, is not with Fichte, as with Kant, the condition and presupposition of moral action, but is itself the highest expression of the problem of the moral law. To realise this self-activity, however, the ego requires an external world of objects, in order that in them as limits it may become conscious of its own activity. Generally speaking, Fichte makes that which, from the standpoint of ordinary consciousness, we call the world merely a product of the ego; it exists only through the ego, for the ego, and in the ego. In his later and more popular writings, from 1800 onward, Fichte's transcendentalism assumes a more profoundly religious character, the centre of the system being now an *Absolute Ego*, in whose self-determination all the *Non-ego* is determined—the One Universal Being or God, of whom all finite existence is but a manifestation—the vesture of the Infinite. This transition first appears in his *Bestimmung des Menschen* ('Vocation of Man,' 1800), and is more fully developed in the *Wesen des Gelehrten* and the *Religionslehre;* and it is also set forth in a strictly scientific manner in the *Nachgelassene Werke* (1835), in which his *Speculative Logik* and his revised theory of right and morals are particularly deserving of attention.

Although Fichte never, strictly speaking, formed a school, his influence upon the subsequent development of German philosophy has been very important; and indirectly, through the writings of Thomas Carlyle, he has exercised a marked and important influence on the course of recent thought both in Great Britain and America. Fichte's doctrine of the Divine Idea of the Universe underlies Carlyle's most impressive teachings regarding human life and duty. His popular works have been translated into English by Dr William Smith; their titles are: *The Vocation of the Scholar; The Nature of the Scholar; The Vocation of Man; The Characteristics of the Present Age;* and *The Way to the Blessed Life, or the Doctrine of Religion* (4th ed. 1889). An American translation of the *Wissenschaftslehre* and the *Naturrecht*, by A. E. Kröger, appeared at Philadelphia in 1868–69 (reprinted London, 1889). An admirable monograph of Fichte, by Professor Adamson, forms one of the volumes of Blackwood's *Philosophical Classics* (1881).

Immanuel Hermann von Fichte, son of the former, was born at Jena, 18th July 1797. Occupied at first as a teacher, he was appointed professor of Philosophy in Bonn in 1836, and from 1842 to 1863 held a chair in the university of Tübingen. He was ennobled in 1867, and died at Stuttgart, 8th August 1879. He wrote works on speculative theology (1847), ethics (1850), anthropology (1856), psychology (1864), the immortality of the soul (1873). In philosophy he occupies the position of a mediator between an extreme monistic and an equally extreme individualistic metaphysic, between pantheism and deism, between Hegel and Herbart. The great aim of his speculations was to find a philosophic basis for the personality of God, and for his theory on this subject he proposed the term *Concrete Theism*, to distinguish it alike from the abstract theism which makes God almost an unreality—a barren aggregate of lifeless attributes—and, on the other hand, from the all-absorbing pantheism of Hegel, which swallows up the human and the divine in its own inapprehensible totality.

Fichtelgebirge, a mountain-system, chiefly situated in the NE. of Bavaria, once covered with pines (*Fichte*, 'pine'), and constituting a watershed between the head-feeders of the Elbe, the Rhine, and the Danube. Roughly speaking, it forms a rhomboid, lying between Hof, Baireuth, and Eger, its intersecting axes being disposed NE.—SW. and NW.—SE. The length of each axis thus measured is about 24 miles. The main chain forms the NW. fringe of the system, and at its SW. extremity wheels round so as to present a NW.—SE. strike, the average elevation of the peaks ranging from 2700 to 3200 feet. The highest summits are Schneeberg (3461 feet) and Ochsenkopf (3334). On the SW. edge the system falls away by steep gradients; but in the opposite direction its descent is much more gradual, the hills in the NE. averaging an altitude of 2000 to 2300 feet. In their northern extremities the Fichtelgebirge are connected by intermediate chains, on the one hand with the Erzgebirge, and on the other with the Thuringian Forest. Geologically they are composed principally of granite and primitive crystalline slates, with which are conjoined bands and intrusions of gneiss, micaceous slates, basalt, and some strata of the Tertiary age (*Oligocän*). The climate of the region is decidedly raw and cold; snow lies on the summits as a rule from October to May. Owing to the extensive forest tracts and the moory soil, mists are of common occurrence. The only industries carried on by the inhabitants are those connected with mining (chiefly iron and stone quarries), with the exploitation of the forests, and with the manufacture of glass. Of recent years the Fichtelgebirge have come much into vogue with tourists. See the admirable handbook by Ruchdeschel (1881).

Fici'no, MARSILIO, an illustrious philosopher of the Italian Platonic school, was born at Florence in 1433. The son of the principal physician of Cosmo de' Medici, he was appointed by that prince in 1463 president of a classical academy (founded 1440) having for its aim the diffusion of the Platonic doctrines, which Ficino held to be the basis and confirmation of the Christian system; and at his suggestion he undertook the translation of Plotinus, Iamblichus, Proclus, and Porphyry, besides a Latin but by no means literal version of Plato. On the death of Cosmo, Ficino found a no less munificent patron in this prince's grandson, Lorenzo de' Medici; and having, at the mature age of forty, decided on entering the church, he was endowed by Lorenzo with the rectorship of two churches in Florence, and a canonry in the cathedral. His theological doctrines, while undoubtedly sincere, present a strange medley of incongruous views, the natural result of his attempt to fuse the philosophy of Plato with the Christian creed. He died in 1499. His collected works were published at Basel (2 vols. fol. 1491), and consist of translations from the Greek philosophers, and original metaphysical and theological compositions, of which may be named *Theologica Platonica seu de immortalitate animorum ac æterna felicitate.* See R. L. Poole's *Illustrations of the History of Medieval Thought in Theology* (1884).

Fick, AUGUST, an eminent philologist, was born at Petershagen, near Minden, 5th May 1833, studied philology under Benfey at Göttingen from 1852 to 1856, and next acted as a teacher in the gymnasium there until his appointment in 1876 to an extraordinary professorship of Comparative Philology in the university. His chief work is his great *Vergleichendes Wörterbuch der Indogermanischen Sprachen* (3d ed. 1874–75), a stupendous monument of learning, albeit its value is somewhat impaired by the over-audacity of its reconstruction of the primitive parent-speech. Other works are *Die Griechischen Personennamen* (1874), *Die ehemalige Spracheinheit der Indogermanen Europas* (1875), and *Die Homerische Ilias, in der ursprünglichen Sprachform wiederhergestellt* (vol. i. 1885).

Fiction, LEGAL, a supposition of law that a thing is true, which is either certainly not true, or at least is as probably false as true. Fictions have existed in all legal systems. They have served many useful purposes, by enabling individuals who by the strict letter of the law would have been excluded from obtaining redress of evils to procure that remedy by a pious fraud. There are two general maxims which regulate the application of fictions—viz. that no fiction shall be allowed to operate a wrong, and that no fiction shall be admitted which in the nature of things is impossible. The Roman form of judicial procedure abounded with fictions, by which alone, in many cases, a party aggrieved could enforce his right. Thus, an heir, unjustly disinherited, by the *querela inofficiosi testamenti* feigned that his father had been mad. A stranger in Rome who had been robbed could not in early times obtain restitution without the *fictio civitatis*, whereby he feigned himself a citizen. Many of the fictions existing in Rome have found a counterpart in modern systems; thus, the *fictio longæ manus*, whereby lands at a distance were feigned to be delivered, resembles an English feoffment at law. In like manner, the *fictio traditionis symbolicæ* of keys of a warehouse to give possession of the articles contained therein, and of a deed in confirmation of the covenants contained therein. The 'fiction of the unity of the persons' was the original of the Scottish fiction that 'the heir is the same as the deceased.' But in no system of laws have fictions been so liberally adopted as in that of England. It was by means of fictions alone that the original limited jurisdiction of the courts of Queen's Bench and Exchequer was extended to ordinary suits. In the latter court every plaintiff assumed that he was a debtor to the crown, and was debarred from discharging his obligation by the failure of the defendant to satisfy his demand; in the former it was assumed that the defendant had been arrested for some supposed trespass which he had never in fact committed. The fictitious characters of John Doe and Richard Roe long contributed to make the action of Ejectment (q.v.) famous. And though these fictions have disappeared before the ruthless hand of modern legislation, yet to this day in England, in an action at the instance of a father for the seduction of his daughter, damages can only be awarded on the assumption that she was his servant, and that he has suffered pecuniary loss by deprivation of her services. In the law of Scotland fictions of law are not of frequent occurrence. For the benefit of creditors the principle that the heir is 'the same person as the deceased' is admitted; and in an action of 'Reduction-improbation' of a deed it is assumed that the document was false, whether the fact be so or not. The legitimation of natural children by the subsequent marriage of their parents is an instance of what is called a retroactive fiction. See Maine's *Ancient Law*, and Colquhoun's *Summary of the Civil Law.*—For works of fiction, see NOVELS.

Ficus. See FIG.

Fiddle. See VIOLIN.

Fideicommissum, in the Civil Law, was a conveyance of property in trust to be transferred to a third person named by the truster. *Fideicommissa*, when first introduced, were not supported by the law. The performance of them depended, therefore, on the conscience of the party intrusted, and consequently they were frequently not carried out. They were originally adopted for the purpose of conveying property either where a party, from the circumstances of the case, as inability to procure the proper number of witnesses, was prevented from executing a will, or where he desired to benefit those who by law were precluded from taking the property. To effect this purpose an actual conveyance was made to a friend, coupled with a request that the property should be transferred to another. Fideicommissa, having thus been introduced for a special purpose, were by degrees extended to conveyances of the whole inheritance, and finally were used for the purpose of settling estates in a particular order of succession, forming the earliest instances of Entail (q.v.). Fideicommissa first received the sanction of positive law in the reign of Augustus, by whom authority was given to enforce the performance of these fiduciary obligations. A special prætor was afterwards appointed for the enforcement of trusts, and the Emperor Claudius subsequently extended this authority to the consuls and presidents of provinces. Fideicommissa were either *particular* or *universal*, the former being a bequest of a particular subject, or a part only of the inheritance; the latter comprehended the whole estate. The Senatus-Consultum Trebellianum enabled a person profiting by a universal succession of this kind to sue or be sued as heir.

In Holland the principles of the civil law as to fideicommissa form an important branch of the law in regard to landed estates. An heir may be required to transfer either the whole or a portion of his inheritance. The provisions of the Senatus-Consultum Trebellianum also have been adopted. Children who have received their legal portions, and are required to transfer to a stranger the rest

of the inheritance, are entitled to retain a fourth part for themselves. Similar provision may be found in the legislation of other countries which follow the civil law. See Hunter's *Roman Law*, and the Dutch and German manuals of Civil Law.

Fidei Defensor. See DEFENDER OF THE FAITH.

Fief. See FEUDALISM.

Field, in Heraldry, the whole surface or continent of the escutcheon or shield. See HERALDRY.

Field, DAVID DUDLEY, an American jurist, the eldest son of a Congregational minister (1781–1867), was born in Haddam, Connecticut, in 1805, and was admitted in 1828 to the New York bar, at which he practised until 1885, distinguishing himself especially by his labours in the direction of a reform of the judiciary system. In 1857 he was appointed by the state to prepare a political, civil, and penal code, of which the last has been adopted by New York, and all have been accepted by some other states. In 1866, by a proposal brought before the British Social Science Congress, he procured the appointment of a committee of jurists from the principal nations to prepare the outlines of an international code, which were presented in a report to the same congress in 1873. This movement resulted in the formation of an association for the reform of the law of nations, and for the substitution of arbitration for war, of which Mr Field was the first president. After the election of 1876 he advocated Tilden's cause in the dispute over the presidency. In 1889 he received the degree of LL.D. from the university of Edinburgh. Died April 13, 1894.

His brother, STEPHEN JOHNSON FIELD, born in Haddam in 1816, was for some time a partner in Dudley's firm, and settled in 1850 in California, where he was instrumental in forming the laws of the state, and was judge of the Supreme Court in 1857–59. Appointed chief-justice in 1859, he was raised to the supreme bench of the United States in 1863, and voted with the Democratic minority of the electoral commission in 1877. In 1880 he received 65 votes on the first ballot for the presidential candidate.

Another brother, CYRUS WEST FIELD, was born in Stockbridge, Massachusetts, in 1819, and at the age of fifteen entered the employment of A. T. Stewart, in New York. In the twelve years preceding 1853 he built up a prosperous paper-manufacturing business, from which he then partly retired, only to engage with great enthusiasm in the promotion of the Atlantic telegraph. For this he secured a charter from the colonial government of Newfoundland for fifty years; and, being joined by Peter Cooper and other American capitalists, he organised the New York, Newfoundland, and London Telegraph Company in 1854, and the Atlantic Telegraph Company in 1856. Devoting himself entirely to the work of 'mooring the New World alongside the Old,' he crossed the ocean repeatedly, labouring to arouse public interest in the project; and when the first cable was successfully laid in 1858 he was hailed by his countrymen with the enthusiasm his efforts had deserved. After a few weeks' operation the cable was silent; but he continued his exertions, although the civil war for a time absorbed all attention; and on the establishment in 1866 of the telegraphic communication between the two continents, which has never since been interrupted, he received from congress a gold medal and the thanks of the nation. He also was awarded the grand medal of the Paris Exhibition of 1867. He afterwards helped to develop the elevated railway system in New York, and obtained concessions for the laying of a cable between San Francisco and the Sandwich Islands. Died July 12, 1892.

Field, JOHN, musician and composer, commonly known as Russian Field, was born in Dublin, 26th July 1782. A pupil of Clementi, he accompanied him in 1802 on a continental tour, but, settling in St Petersburg as a teacher of music, remained there from 1804 till 1823, when he proceeded to Moscow; in 1832 he returned to London. Nevertheless in the following year he once more started on a long continental tour, which terminated with his death at Moscow on January 11, 1837. Although Field wrote seven concertos, three sonatas, and numerous pianoforte pieces, he is to-day only remembered as the author of about half-a-dozen *Nocturnes*, charming little musical lyrics. Liszt wrote an essay on Field, prefixed to Schubert's edition of the *Nocturnes*, and Spohr in his *Selbstbiographie* (vol. i.) gives some account of Field himself.

Field-allowance, a daily allowance granted to officers of the British army in consideration of extra expense entailed upon them in consequence of military operations. *Ordinary* field-allowance, ranging from £1, 10s. for a general officer to 1s. for a subaltern, is allowed when troops are encamped at home or in the colonies. *Extraordinary* field-allowance is sanctioned when troops are engaged in actual warfare: it ranges for the above ranks from £2, 10s. to 1s. 6d.

Fieldfare (*Turdus pilaris*), a species of thrush, common in Britain as a winter visitor. It is a native of North Europe, breeding and spending the summer in Scandinavia and other northern countries, but migrating southwards in winter as far at least as the Mediterranean. It is very abundant in Norway, and, contrary to the ordinary habit of thrushes, is social in its nest-building,

Fieldfare (*Turdus pilaris*).

numerous nests being often seen on one spruce-tree. There are a few reported instances of the fieldfare nesting in Britain. As a winter visitor it has familiarised us with its harsh call-note, but its true melodious song is mostly reserved for the northern summer. The fieldfare is about the size of a blackbird, but has longer wings. The head, neck, and some other parts are grayish; the tail is black, with a white line on the outer feathers; the general upper surface is chestnut brown; the under surface is white, with a reddish-yellow breast streaked and spotted with black. In Britain the fieldfare feeds on worms, snails, and such like, or in severer weather on haws and other available fruits and seeds. It is sometimes tamed as a songster. See THRUSH.

Field-glass. See OPERA-GLASS.

Fielding, ANTHONY VANDYKE COPLEY, water-colour painter, was born in 1787. He came of an artistic family, for his father, T. N. Fielding, was a portrait-painter residing near Halifax, his mother

became a member of the Water-colour Society, and three of his brothers were painters in the same medium. He received his early instruction at home before being placed under John Varley; and, like Turner and Girtin, he worked in the house of Dr Monro. In 1810 he began to exhibit with the Water-colour Society, of which he was successively treasurer and secretary; and in 1831 he succeeded Cristall as president. In one year he contributed to the exhibition of the society no fewer than 56 subjects, occasionally, in addition, sending an oil-picture to the Royal Academy. His early works show breadth, freedom of treatment, and a fine sense of atmosphere; but in later life the quality of his art deteriorated, greatly in consequence of the facile methods and mannerisms—such as the excessive use of sponging and washing—which his practice as a fashionable teacher of painting had led him to adopt. He died at Worthing, 3d March 1855. His art may be adequately studied in the South Kensington Museum.

Fielding, HENRY, born at Sharpham Park, Glastonbury, April 22, 1707, was the son of Lieutenant (afterwards General) Edmund Fielding, who belonged to the younger branch of the Denbigh family. He went to Eton, which he left before November 1725. After a boyish and frustrate love-affair at Lyme Regis with a relative and an heiress, Miss Sarah Andrew (see *Athenæum*, 2d June 1883), he passed to Leyden University, where he appears to have graduated in March 1728. But he must have returned to England before this, because his first comedy, *Love in Several Masques*, was produced at Drury Lane in February. *The Temple Beau* followed two years later. From this date until February 1735 he wrote a number of comedies and farces, the best of which are *The Author's Farce* (1730), the burlesque of *Tom Thumb*, afterwards *The Tragedy of Tragedies* (1730), *Don Quixote in England* (1734), *The Mock Doctor* (1732) and *The Miser* (1733), two adaptations from Molière, and *The Intriguing Chambermaid* (1734), an adaptation from Regnard. His dramatic works in general bear signs of haste and carelessness. A brief interval in their rapid manufacture which occurred between 1735 and 1736 is supposed to have been filled by his marriage to Miss Charlotte Cradock, a Salisbury beauty and his acknowledged model for 'Sophia Western' (*Tom Jones*, book xiii. chap. i.).

For a few months Fielding appears to have led the life of a country gentleman at East Stour in Dorsetshire, where he had resided as a boy. But his wife's fortune of £1500 was not inexhaustible, and early in 1736 (probably with what remained of it) he took the Little Theatre in the Haymarket, where he brought out two very successful burlesques—*Pasquin* (1736) and the *Historical Register* (1737). The bold satire on the ministry contained in these pieces led to the precipitate passing of the Licensing Act of 1737, which made the consent of the lord chamberlain necessary to the representation of any play. This effectually closed Fielding's theatre, and in November 1737 he became a student of the Middle Temple. He was called to the bar in 1740, and travelled the western circuit. But, though he does not seem to have neglected law, he did not relinquish literature. During his studentship he edited (with James Ralph) the *Champion*, a paper of the *Spectator* type. His real *début*, however, came in 1742, not long after Richardson published his popular *Pamela*. Apt at burlesque and eminently manly, Fielding's genius saw at once how effectively ridiculous the feebler side of Richardson's morality might be made by transferring his heroine's difficulties to a male hero. Designing at first no more than raillery, his plan grew under his hand, and gradually became a novel of life and manners, with a group of characters, of which one, Parson Abraham Adams (based on the writer's friend, William Young) is immortal. His success probably revealed to him a power he had scarcely suspected, and opened a wider perspective of fiction. But for the moment his precarious means prompted no more than the publication by subscription of three volumes of *Miscellanies*, made up mainly of early work. They included another play, *The Wedding Day*, an old comedy revised for Garrick, and produced at Drury Lane without success in February 1743, some essays, some youthful verse, a clever Lucianic fragment called *A Journey from this World to the Next*, and the surpassing study in irony known as the *History of the Life of the late Mr Jonathan Wild the Great*. Despite its maturity, it had probably been written before *Joseph Andrews*, as it seems unlikely that after so signal a success its writer would have essayed a line so different.

From the preface to the *Miscellanies* it is clear that Fielding's circumstances at this date were far from good. His means were uncertain, his health already broken (he was a martyr to gout), and his beautiful wife an invalid. Shortly after April 1743, when the book was published, she seems to have died, leaving him so heart-broken by her loss that his friends feared for his reason. From the preface to his sister's novel of *David Simple* (2d ed. 1744), he still appears to have hoped for success at the bar. But in 1745 he again drifted into journalism as the author of the *True Patriot*, a government organ, succeeded in 1747 by the *Jacobite's Journal*. In November 1747 he married his wife's maid, Mary Daniel, who had remained in charge of his children by his first marriage; and a year later, by the interest of his schoolfellow Lyttelton, he became a justice of the peace for Westminster, moving into a house in Bow Street belonging to the Duke of Bedford. Thence in February 1749 he put forth a second novel, his famous *Tom Jones*, the 'labour,' he says, 'of some years.' Less than three years later came a third novel, *Amelia*. The remainder of his life was a continued struggle with ill-health and a harassing vocation, which he nevertheless followed most assiduously. His further literary efforts are confined to a few pamphlets, philanthropic and professional, and a fresh periodical, the *Covent Garden Journal* (1752). In 1754, sinking under a complication of disorders, but gallantly struggling with his magisterial duties to the last, he quitted England for Lisbon in search of health. After a voyage of many vicissitudes, narrated with the most touching and manly cheerfulness in his posthumously printed *Journal*, he reached the Portuguese capital, where he died two months later, 8th October 1754, aged forty-eight. He was buried in the English cemetery. *Luget Britannia gremio non dari fovere natum*, says the inscription on his tomb.

The only portrait of Fielding is a sketch from memory by his friend Hogarth, whose works he greatly admired. Representing him in later life, it exhibits little more than the shadow of that handsome Harry Fielding who at twenty rushed upon London from Leyden in all the ardour of health and animal spirits. He paid the penalty of his youthful appetite for pleasure by a broken and laborious middle age, endured with a courage and fortitude which command respect. Of his work his three novels now chiefly survive. His plays were hasty and ill-considered productions; and he is best in pure burlesque, or when he takes his plot ready-made. His essays and journalism are hackwork. But he is fairly what Scott calls him, the 'Father of the English Novel.' In *Joseph Andrews* he first felt his feet; in *Tom Jones* he perfected his

method and put forth his full powers. When Coleridge extravagantly praised its plot, the modern novel was yet young, and the dictum now needs qualification. But the skill and variety of the book, its close characterisation, its happiness of illustration, and the wealth of wit, wisdom, and irony cannot be contested. There are—and it is to be regretted—pages which show an artistic insensibility, and an over-indulgence to certain forms of masculine frailty which even the manners of the time cannot wholly excuse; but apart from this there is no reason to doubt the sincerity of the moral purpose proclaimed. *Amelia*, a shorter, more subdued, and less elaborated work, has also its admirers. But Fielding put his best 'criticism of life' into *Tom Jones*.

His biography has been written by Murphy (1762), Watson (1807), Lawrence (1855), and Austin Dobson in the 'Men of Letters' series (1883, revised ed. 1889). Thackeray's sympathetic lecture and Mr Leslie Stephen's valuable introduction to the *édition de luxe* of 1882 cannot be neglected.

Field-madder (*Sherardia arvensis*, order Rubiaceæ), a small purplish weed, common on cultivated lands, and said to be mischievous to sheep. The root can be used as a substitute for the closely allied true Madder (q.v.).

Field-marshal is now the highest rank of general officer in the British and most foreign armies. In the former it is a special honour only conferred on the ground of distinguished service or royal birth. In 1889 there were six officers, including the Prince of Wales and Duke of Cambridge, holding this rank. A field-marshal has no higher pay than any other general, except when commanding an army; he then receives £16, 8s. 9d. a day for staff-pay, while a general has but £9, 9s. 6d. The equivalent rank in the navy is that of admiral of the fleet. The title is not used in the United States army.

Field-mouse, a name popularly given to certain species both of Mouse (q.v.) and of Vole (see VOLA). See also SHREW.

Field-officers, in the Army, are always mounted officers—viz. majors, lieutenant-colonels, and colonels. They command, in the infantry, half-battalions (or wings), battalions, and regiments respectively; whilst the captains, lieutenants, and sub-lieutenants are called company officers. In the cavalry, artillery, engineers, and other corps, officers bearing the same titles are called field-officers, but their duties and commands are different from those of the infantry.

Fields, JAMES THOMAS, American publisher, was born in Portsmouth, New Hampshire, in 1817, and from 1839 to 1870 was a partner in the publishing firm of Ticknor, Reed, and Fields in Boston. He edited the *Atlantic Monthly* in 1862–70, and for many years lectured on literary subjects; and he wrote some books of verse, besides interesting volumes on Hawthorne and Dickens. He died in Boston, 24th April 1881.

Field-train, formerly a department of the Royal Artillery responsible for the custody and supply of artillery ammunition in the field. The duties are now performed by the Ordnance Store Department.

Field-works are intrenchments and other temporary fortifications thrown up by an army in the field, either as a protection from the onslaught of a hostile force, or to cover an attack upon some stronghold. Field-works are particularly described under the article FORTIFICATION.

Fi'eri Fa'cias, WRIT OF. The judgment or order of an English court of law, directing the payment of *money* or *costs*, may be enforced by a writ of execution called the writ of *fieri facias*—often contracted to *fi. fa.* It is, in form, a command by the sovereign to the sheriff of the bailiwick in which execution is to be levied, to 'cause to be made' (*fieri facias*) out of the goods and chattels of the debtor the amount of the judgment entered against him, together with interest thereon, as agreed between the parties, or at the rate of 4 per cent. from the day of the judgment or order, or the day from which interest is directed to run. A judgment creditor may sue out this writ immediately after entry of judgment in his favour, except where a time is limited for payment of the judgment debt which has not yet expired, or where the court has ordered a stay of execution. As between the original parties to a judgment or order, execution may issue at any time within six years from the recovery of the judgment or the date of the order.

In regard to the execution of a writ of *fieri facias*, the sheriff must seize such quantity of the goods and chattels of the debtor within his bailiwick as will, if sold, be reasonably sufficient to pay the judgment debt and interest. Seizure is effected by the sheriff or his officer taking actual possession of the debtor's movable property. In entering upon the premises where the goods and chattels are, the sheriff *must request admission*, and is liable to an action of damages if he breaks open an outer door of the judgment debtor's house. But, having once effected an entry, he may break open inner doors and chests, if necessary to his purpose. Possession of the debtor's property must be retained after seizure; and the sheriff may—and, where there is any risk of injury or rescue, ought to—remove the goods for safe custody. If the debtor do not at once satisfy the judgment debt, the sheriff may proceed to sell a sufficient quantity of the debtor's property to meet it; and then, as a matter of practice, he hands over the amount to the judgment creditor without bringing or paying it into court. The Bankruptcy Act of 1883 provides that, where the sheriff sells the goods of a debtor under an execution for a sum exceeding £20, the sale shall be by public auction, and shall be publicly advertised by the sheriff on and during the three days next preceding the sale. Seizure and sale of a debtor's goods under a writ of *fieri facias* amounts to an act of bankruptcy. An execution creditor may levy the poundage fees and expenses of execution over and above the sum recovered.

The property legally available for seizure and sale under a writ of *fi. fa.* may consist of (1) goods and chattels in the ordinary sense of the term, such as furniture belonging to the debtor; (2) money, bank-notes, bills of exchange, and other securities; (3) chattel interests in land, such as leaseholds; (4) growing crops, subject to the rent accruing due; (5) shares in ships (the only legal method of selling such shares is by bill of sale).

If goods are removed from lands or premises let on lease, the sheriff must levy sufficient to pay to the landlord the sum due for arrears of rent, provided such arrears do not amount to more than one year's rent. A sheriff may not take in execution (1) manure, hay, &c., where by the covenants of the lease the tenant is restricted from removing them; (2) the wearing apparel or bedding or tools of the debtor, where the value of the whole does not exceed £5; (3) such fixtures as the judgment debtor himself has no right to remove. At common law the writ of *fieri facias* 'bound' the debtor's goods from the *teste*, or date of issue; the Statute of Frauds provided that no purchaser should be prejudiced till the writ had actually been delivered to the sheriff for execution; while the Mercantile Law Amendment Act, 1856, enacts that a writ of *fieri facias* shall not prejudice the title to goods

acquired *bonâ fide* and for value by any person before the actual seizure thereof under the writ.

Where it appears by the return of a writ of *fi. fa.* that the debtor is a beneficed clerk not having any lay fee within the sheriff's bailiwick, the plaintiff may sue out a writ of *fieri facias de bonis ecclesiasticis*, directed to the bishop of the diocese, commanding the debtor to enter upon and hold the benefice till he shall have satisfied the plaintiff's judgment debt out of the rents, tithes, and profits thereof. See Stephen's *Commentaries* (ed. 1883, iii. p. 599); Edwards, On Execution; Snow and Winstanley, *Annual Practice, 1888-89.*—In Scotland the corresponding process for seizing and selling a debtor's goods is termed Poinding (q.v.).

Fiery Cross, an ancient summons to arms used in the Scottish Highlands, sent by swift messengers from place to place. It was a small cross of light wood, the extremities of which were set on fire, and then dipped in the blood of a goat.

Fieschi, COUNT GIOVANNI LUIGI DE', a member of one of the most illustrious houses of Genoa, was born about the year 1523. In addition to the lustre of ancestral fame, his name has attained a tragic historical celebrity in connection with a remarkable conspiracy of which he was the chief. Andrea Doria, the famous admiral, sprung from a race hereditarily at feud with that of Fieschi, having expelled the forces of Francis I. from the state, had restored the republican form of government, but at the same time, by his vigorous administration, effectually held in check the ambition of the nobles. Count Fieschi organised a plot for the overthrow of Doria (who was supported by the Emperor Charles V.) and the establishment of an oligarchic form of government. Instigated by the approval of France and Rome, Fieschi speedily enrolled a formidable array of accomplices, his three brothers among the foremost. Three galleys, under the pretext of an expedition against the Turks, were fully equipped and filled with mercenaries; and, all being in readiness, the attempt was fixed for the 2d of January 1547. Doria, in spite of repeated warnings, refused to ascribe treacherous or subversive designs to Fieschi. Complete success seemed at first to crown the conspirators; the gates of the city were forced, the fleet captured, Gianettino assassinated, Doria in flight. Fieschi had but to appear and dictate, but he was nowhere to be found. In stepping from one galley to the other in the darkness of night he had stumbled, and, falling overboard, been borne down by his ponderous armour, and miserably drowned in the harbour, or, according to some, stifled in the slime. The scheme ended here, and Doria returned. See DORIA, GENOA; and the monographs of Brea (1863) and Celesia (1864).

Fieschi, JOSEPH, known by his attempt on the life of King Louis-Philippe, was born in Corsica in the year 1790. He served in Russia in 1812, and on Murat's expedition suffered imprisonment as a thief, but in 1830 got a small government appointment at Paris. Dismissed for fraudulent conduct, he secured accomplices in an audacious plan, and invented an infernal machine with twenty-four barrels, which was fired while the king and his party were passing the house, 28th July 1835. Eighteen people were killed, among whom was Marshal Mortier, but Louis-Philippe himself escaped with a mere scratch. Fieschi was immediately seized, and, along with his accomplices, was tried, condemned, and executed on 16th February 1836. See Ducamps, *L'Attentat Fieschi* (1877).

Fie'solé (Lat. *Fæsulæ*), one of the most ancient of Etruscan cities, is situated on the crest of a hill, about 3 miles NE. of Florence. Here the Gauls defeated the Romans in 225 B.C.; and here Hannibal encamped after crossing the Apennines. The city was made a military colony for Sulla's veterans, who twenty years later lent warm support to Catiline. The place was seized by the Goths, and was not captured by Belisarius until after a long siege. Its decay began in the middle ages with the rise and growth of Florence, and it has now only about 2000 inhabitants, chiefly occupied in straw-plaiting. The sole vestige of Etruscan architecture remaining is the cyclopean wall. The amphitheatre and other remains belong to the Roman age. The town has several buildings dating antecedent to the 15th century, amongst them the cathedral, built in 1028 and restored in 1256; a pretorian palace of the 13th century; and a Dominican (1406) and a Franciscan (1350) monastery.

Fiesole, GIOVANNI DA. See ANGELICO (FRA).

Fife, a smaller variety of the flute, usually with only one key. Fifes were at one time generally used in the army and navy in conjunction with drums, for playing marches and other simple melodies. They are usually pitched in the keys of B♭ or C. Originally the fife was made with a cylindrical bore throughout, but this was many years ago superseded by the conical instrument. It is rather curious that the ancient cylindrical bore superseded as unsuitable in the fife should have been resuscitated and perfected in the modern Flute (q.v.). See BAND (MILITARY).

Fife, a maritime, almost peninsular, Scottish county, washed on the N. for 21 miles by the Firth of Tay, on the E. for 24 by the German Ocean, and on the S. for 55 by the Firth of Forth. Its extreme length is 42 miles, its extreme breadth 21, and its area 513 sq. m. The surface offers a succession of cultivated vales and hills, the most prominent eminences being the East and West Lomonds (1471 and 1713 feet), Largo Law (965), and Burntisland Bin (632). Almost the only streams are the Eden (30 miles long) and the Leven (16); whilst of seven lakelets the chief are Kilconquhar Loch (4 by 3 furlongs) and Lindores Loch (7 by 3). Fife rests on the Old Red Sandstone, with trap rocks in the north, carboniferous strata and trap in the south. Its mineral wealth includes coal (which is largely mined), shale, ironstone, limestone, and freestone. The soil is some of it very fertile, especially in the Howe of Fife, or Stratheden; and whilst barely one-fourth of the whole of Scotland is in cultivation, in Fife the proportion is nearly three-fourths. One-seventeenth is under wood. 'A gray cloth mantle with a golden fringe,' said James VI. of Fife, referring to the many towns and fishing-villages that skirt its ancient sea-margin—Inverkeithing, Burntisland, Kinghorn, Kirkcaldy, Dysart, Leven, Largo, Elie, St Monans, Pittenweem, the Anstruthers, Kilrenny, Crail, St Andrews, Ferryport, Newport, and Newburgh. Inland lie Cupar, Dunfermline, Falkland, Lochgelly, &c. Under those towns are noticed the manufactures, the chief antiquities, the illustrious natives, and the outstanding points in the peaceful history of the 'Kingdom of Fife,' which took so leading a part in the Scottish Reformation. Here, then, we need mention only the fine Romanesque church of Leuchars; the ruined abbeys of Balmerino and Lindores; Magus Muir, the scene of Sharp's murder; Cults, the birthplace of Wilkie; and Balcarres, of Lady Ann Barnard. Fife returns two members to parliament. It is seventeenth in size among Scottish counties, but fifth in rental, seventh in population—(1801) 93,743; (1841) 140,140; (1881) 174,931; (1891) 187,320 (40,000 rural). See Sir Robert Sibbald's *History of Fife* (1710), A. H. Millar's *Castles and*

Mansions of Fife (1889). *Fife Ness*, the eastmost point of Fife, is a low headland. A mile NNE. in the sea is the dangerous Carr Reef, where a light-ship was moored in 1886.—The county has since 1759 given the title of Earl of Fife to the family of Duff. The sixth earl (born 1849) married in 1889 the Princess Louise of Wales.

Fifth-monarchy Men, an extreme sect of the time of the Puritan revolution, strongly represented in Cromwell's army, who looked on the establishment of his power as the commencement of a new reign of Christ on earth, in succession to the four great monarchies of Antichrist marked out by the prophet Daniel. Their wild destructiveness quickly brought them under the iron hand of Cromwell, who with characteristic vigour crushed their rebellious intrigues with his soldiers, and their plot to murder himself, and in 1657 flung their leaders, Venner, Grey, and Hopkins, into prison. In January 1661 Venner headed another rising in London, for which he and sixteen others were executed.

Fig (*Ficus*), a genus of trees and shrubs belonging to the order Urticaceæ (sub-order Moraceæ), characterised by the remarkable inflorescence in which that normal checking of the flowering axis which reduces the elongated spike to the flat capitulum has gone so far as to render this positively concave, the apex thus coming to be at the bottom of a cup (see INFLORESCENCE). This axis almost closes upon the small internal flowers, save for a small opening at the apex, and becomes succulent and fruit-like. It is always monœcious or dicœcious. The male flowers, which in the monœcious species develop round the opening of the fig, have three or five stamens, and the female, which arise on the sides and bottom, a bilobed stigma, but the ovary contains only a single seed, which becomes stony. For fertilisation, see CAPRIFICATION, and also FLOWER. There are about 300 species, some of them very large trees. Almost all belong to tropical and subtropical countries, of the vegetation of which they often form a most important feature. They abound in India, in every jungle and hilly situation, to the most northern Himalaya, and some of them are cultivated about every village. Both *F. religiosa* (the Peepul) and *F. Rumphii* are held in veneration by the Hindus. The most notable species are the Common Fig (see below); the Banyan (q.v.); the Peepul (q.v.), Bo Tree, or Sacred Fig of India; the Sycamore (q.v.); and the India-rubber Fig (*F. elastica*). See INDIA-RUBBER. The leaves of some species are entire, those of others are lobed. Several species of fig exhibit the character, for which the banyan in particular has become celebrated, of sending roots straight down to the ground from their spreading branches, and thus multiplying the apparent stems, by which a vast canopy of branches and foliage is supported. The East Indian Caoutchouc or India-rubber Tree is remarkable for the exposure of its main roots, which rise in masses above ground, extending on all sides from the base like great writhing snakes. Some figs are creeping or trailing shrubs, with slender stems, covering heaps of stones, or ascending trees like ivy. Besides the common fig, many species yield edible fruits, although none of them are nearly equal to it in value. The milky juice of several species is bland and abundant, as of *F. Saussureana*, which has therefore been ranked among Cow-trees. In other species the milky juice is very acrid. That of the common fig produces a burning sensation on the tongue. That of *F. toxicaria*, a native of the Malayan islands, is used for poisoning arrows. Lac (q.v.) is gathered from some species. The leaves of *F. politoria* are so rough that they are used for polishing wood and ivory in India. The juice of the fruit of *F. tinctoria* is used in Tahiti to dye cloth: the colour is at first green, but being acted on by the juice of a Cordia it becomes bright red. The bark supplies cordage, of which fishing-nets are made.

The Common Fig (*Ficus carica*) is a native of the East, as the specific name (from *Caria*) imports; but it is now cultivated throughout the whole of the south of Europe, and is even found naturalised there. Its cultivation has also extended to many warm countries. In North America it is seldom to be seen farther north than Philadelphia; and it is not sufficiently hardy to be a common fruit-tree in Britain, although even in Scotland figs

Common Fig (*Ficus carica*):
a, fruit; *b*, section of fruit.

may occasionally be seen ripened on a wall; and in the south of England fig-trees are sometimes grown as standards, and a few small fig orchards exist. It seems to have been grown in England by the Romans, but was not reintroduced until 1525, when Cardinal Pole brought several trees to Lambeth from Italy. Protection is given in some way during winter. Near Paris, and in some other parts of the continent of Europe, fig-trees are so trained that the branches can be tied in bundles and laid along the ground, when they are covered with litter and earth, or, as in the case of the celebrated fig-tree of Roscoff (Finistère), the branches are trained over a vast area of pillared framework. The fig is a low deciduous tree or shrub (15–25 feet), with large, deeply-lobed leaves, which are rough above and downy beneath. The branches are clothed with short hairs, and the bark is greenish. The fruit is produced singly in the axils of the leaves, is pear-shaped, and has a very short stalk; the colour in some varieties is bluish-black; in others, red, purple, yellow, green, or white. The varieties in cultivation are numerous. In warm climates the fig yields two crops in the year—one from the older wood (midsummer shoots of the preceding year), and a second from the young wood (spring shoots of the same year); but in colder regions the latter never comes to perfection. Fig-trees are propagated by seed, by suckers, &c.; very frequently by layers or by cuttings. In Britain they are often to be seen in greenhouses, and grow well in pots. If the soil of the open border is too rich, root pruning must be adopted, although liquid manure may be given while the figs are swelling. Figs may be eaten 'green' (i.e. ripe) or dried, and the latter form an important article of food in the Levant; in more northern regions they are used for dessert, or for medicinal purposes, being applied to gumboils and other sores, and also administered

in pulmonary and nephritic affections, and to relieve habitual constipation. The pulp contains about 62 per cent. of grape-sugar. Figs are either dried in the sun or in ovens built for the purpose. Great quantities are annually imported into Britain from the Mediterranean. The best are mostly brought from Smyrna. Greece and various parts of Italy also export figs. The finest kinds are tightly packed in boxes; others are crowded into sacks of matting, or strung, by a hole in the middle, on strings of bast. In the Levant, Portugal, and the Canaries a spirit is distilled from fermented figs. In some places figs roasted and ground are used to produce the so-called fig-coffee; the excellence of the Vienna coffee is sometimes attributed to an admixture of ground figs.

The fig has been reckoned among the most valuable fruits since the earliest times; thus, it is mentioned with corn, wine, and oil as one of the leading riches of the promised land. The Athenians, too, seem to have largely subsisted upon figs, especially before the culture of cereals became general; and a fig-tree was the device of the city. It appears that special officers were appointed to denounce illicit export or engrossing of figs, the 'sycophants,' whose title came to acquire such different meaning. But it must be noted that the word 'sycophant' in this its literal sense is not found in any ancient author. See Solms-Laubach, *Domestikation des Gewöhnlichen Feigenbaums* (Göttingen, 1882).

Fi'garo, a dramatic character introduced on the Parisian stage in 1785 by Beaumarchais (q.v.) in his *Barbier de Seville* and his *Mariage de Figaro*, is first a barber and then a valet-de-chambre, and has become a type of cunning, intrigue, and dexterity. Mozart and Rossini made Beaumarchais's plays the basis of classic operas. The name has been adopted by a well-known Parisian newspaper (founded 1854).

Figeac, a town in the French department of Lot, is situated in a valley surrounded by finely wooded hills, 32 miles ENE. of Cahors. Irregularly built, with a medieval aspect, it possesses two beautiful Gothic churches, and owes its origin to a Benedictine monastery founded by Pepin the Short in 755. Figeac has cotton manufactures, dye-works, and a trade in cattle. Pop. 5782.

Fighting-fish (*Betta pugnax*), a small fresh-water fish, especially at home in Siam, where it is reared on account of its curious pugnacity. It belongs to the family Labyrinthici, which includes other interesting fishes, such as the Climbing Perch (Anabas), the beautiful Paradise-fish, the well-flavoured Gourami. When two fighting-fish are brought together they often rush immediately to combat; or it is even enough to introduce a looking-glass into the water, when the fish hastens to attack its own image. Fish-fights are a favourite amusement of the Siamese; the license to exhibit them yields a considerable annual revenue; and an extraordinary amount of gambling takes place in connection with them—not merely money and property, but children and liberty being sometimes staked. When the fish is quiet its colours are dull; but when it is excited they glow with metallic splendour, and 'the projected gill-membrane, waving like a black frill around the throat, adds something of grotesqueness to the general appearance.'

Figueira, a watering-place in the Portuguese province of Beira, at the mouth of the Mondego, 23 miles W. by S. of Coimbra. Its harbour is excellent, but difficult of access. Pop. 4470.

Figue'ras, a town in the north-east corner of Spain, on a marshy plain, 25 miles N. of Gerona by rail, with soap, paper, and leather manufactories. Overlooking the town is the strong frontier fortress of San Fernando, constructed by Ferdinand VI. In the vicinity of the town are gold and copper mines. On three occasions (1794, 1808, 1823) Figueras has been taken by the French. Pop. 11,750.

Figueras, ESTANISLAO, a Spanish statesman, was born at Barcelona, 13th November 1819. Although he joined the republican party in 1840, he was not elected to the Cortes until 1850. For taking part in republican plots in 1866 he was in the following year cast into prison; but after the expulsion of Queen Isabella he became a member of the republican committee of government. Finally the abdication of King Amadeus, in 1873, opened the way for Figueras, and he became president of the Spanish republic; but, owing to differences with his colleagues in power, he was constrained to resign office after only about four months' exercise of authority. Retiring from public life, he died at Madrid on 11th November 1882.

Figuier, LOUIS, writer, was born at Montpellier, 15th February 1819. His first appointment as professor was at the Montpellier school of pharmacy in 1846; seven years later he removed to Paris to occupy a similar post there. Amongst his books are several on the wonders, inventions, and discoveries of modern science and modern industry, a volume on alchemy, and one in defence of the immortality of the soul. Of these, *The Ocean World*, *The World before the Deluge*, *The Day after Death*, &c., have been translated into English. Figuier died in 1894. His wife Juliette (1829–1879), wrote several novels.

Figurantes is the term applied in the ballet to those dancers who do not come forward alone, but dance in troops, and also serve to fill up the scene and form a background for the solo dancers.

Figurate Numbers. The nature of figurate numbers will be understood from the following table:

	1,	2,	3,	4,	5,	6,	7,	&c.
I.	1,	3,	6,	10,	15,	21,	28,	&c.
II.	1,	4,	10,	20,	35,	56,	84,	&c.
III.	1,	5,	15,	35,	70,	126,	210,	&c.
		&c.				&c.		

The natural numbers are here taken as the basis, and the first order of figurate numbers is formed from the series by successive additions; thus, the fifth number of the first order is the sum of the first five natural numbers. The second order is then formed from the first in the same way; and so on. If instead of the series of natural numbers whose difference is 1, we take the series whose differences are 2, 3, 4, &c., we may form as many different sets of figurate numbers. The name *figurate* is derived from the circumstance that the simpler of them may be represented by arrangements of equally distant points, forming geometrical figures. The numbers belonging to the first orders receive the general name of *polygonal*, and the special names of *triangular*, *square*, *pentagonal*, &c., according as the difference of the basis is 1, 2, 3, &c. Those of the second orders are called *pyramidal* numbers, and according to the difference of the basis are triagonally, quadragonally, or pentagonally pyramidal. The polygonal numbers may be represented by points on a surface; the pyramidal by piles of balls.

Figure, in Music. See MOTIF; for Figured Bass, see ACCOMPANIMENT.

Figure-head, the ornamental figure or bust on the head of a ship, immediately under the bowsprit. Where the vessel's name cannot be represented by such a figure, a piece of timber, finished off in the form of a volute or scroll, often takes its

place on sailing-ships; on steamships the bow is usually plain. The huge figure-heads of several historical old line-of-battle ships are still carefully preserved at Millwall, including that of the 'fighting Téméraire.'

Figure-stone. See STEATITE.

Figwort, a name sometimes applied to *Scrophularia nodosa* (see SCROPHULARIACEÆ), and sometimes to *Ranunculus Ficaria*, the lesser Celandine (see CELANDINE).

Fiji. The Fiji or Viti Islands are a British dependency in the South Pacific Ocean, situated in 15°—22° S. lat. and 176° E.—178° W. long. Their nearest neighbours are the Tonga or Friendly Islands, between 200 and 300 miles to the south-east; they are about 700 miles from the French colony of New Caledonia, 1100 miles from Auckland in New Zealand, 1700 from Sydney in New South Wales, 1800 from Tahiti, and 4700 from the great American port of San Francisco. They have mail communication with Auckland once a month, and with Sydney on an average once a fortnight. The island of Rotumah, about 250 miles distant, a little to the west of north, has been since 1881 included in the colony.

The islands were sighted in 1643 by Tasman, the great Dutch sailor, whose name is borne by Tasmania. Turtle Island (or Vatoa), in the extreme south-east of the group, was discovered and so named by Captain Cook in 1773; but, like most of the South Sea islands, the Fiji Archipelago was little known before the 19th century. Since that date its history has been the not uncommon one of native dissensions, gradual European intrusion, and finally European protection. In 1804 some escaped prisoners from Australia are said to have settled in the islands. In 1835 Wesleyan missionaries first came over from Tonga to begin their wonderful work of conversion to Christianity; and trade, which had begun with dealings in such articles as bêche de mer and sandalwood, gradually led to a small white settlement.

In 1849 some damage was done to the property of the American consul; a heavy claim was in consequence preferred by the United States government against the leading chief Thakombau, which he was wholly unable to meet, and in 1858 he offered the sovereignty of the islands to Great Britain, on condition that he retained his rank and that his debt was paid. As a set-off to the payment he offered to make over, if required, to the British government the ownership in fee simple of 200,000 acres of land. Upon receipt of this offer a special commissioner, Colonel Smythe, was sent to Fiji, charged to report especially upon its prospective advantages as a naval and coaling station and as a place for cotton-growing. On his advice the offer of sovereignty was in 1862 rejected. The following years brought a considerable increase to the white population of the islands, cotton-planting being stimulated by the American civil war. About 1868 a company was formed in Australia, under the name of the Polynesia Company, to take over Thakombau's debt, and with it the 200,000 acres referred to above. In 1871 a kind of constitutional government was set up by the European advisers of King Thakombau, but the cession of the islands to Great Britain was again pressed on, and, after further inquiry in 1873, Sir Hercules Robinson, then governor of New South Wales, was sent to Fiji, and on the 10th of October 1874 formally accepted the sovereignty of the group on behalf of the British crown.

Fiji was constituted and remains a crown colony, with a governor (who is also high-commissioner for the Western Pacific), an executive council, and a legislative council, composed, in addition to the governor, of six official and six nominated unofficial members. The natives are organised in village, district, and provincial councils (the colony being divided into fourteen provinces), and have a special system of taxes, paid mainly in kind.

The Fiji Islands, over 200 in number, lie in a ring, open on the southern side. The configuration of the group is not unlike that of the West Indies. On the west and north are the two large islands of Viti Levu and Vanua Levu, with a group of small islands and reefs outside them; and on the east there is a long string of islands of small size, answering to the Leeward and Windward groups in the West Indies.

The total area of the colony (including Rotumah) is given at 7435 sq. m., being about the same size as Wales. The area of Viti Levu is over 4000 sq. m., rather smaller than Jamaica, and the area of Vanua Levu is about 2400 sq. m. Since 1882 the capital of the colony has been Suva, on the south coast of Viti Levu, where there is a fine harbour; before that date Levuka, on the little island of Ovalau, off the east coast of Viti Levu, also possessing a good harbour, was the European capital. Municipalities have been established at both places.

The Fiji Islands are of volcanic formation, the shape of the mountains (the highest of which rise to some 4500 feet) and the existence of hot springs testifying to volcanic agency; and they are surrounded by coral reefs, which act as natural breakwaters. They are singularly favoured by nature, being well supplied with harbours, and equally well with rivers, having an abundant water-supply, a rich soil, and a climate which, though tropical and somewhat enervating to Europeans (who are subject to dysentery), is not unhealthy or extreme. They suffer, however, from the ravages of hurricanes, and earthquakes occasionally occur. In 1887 at Suva the shade temperature varied from a maximum of 90° in November and January to a minimum of 62° in August, and the rainfall was about 100 inches. The rainfall is greatest and the land is most heavily timbered on the south-eastern —the windward—side of the islands; on the leeward side the face of the country is more that of open grass-land. With the exception of the bêche de mer and pearl-shell industries, the resources of Fiji are almost purely agricultural. In addition to the timber and fruit trees, the latter including

bananas, bread-fruit, &c., and in addition to the cocoa-nut palms, the vegetable products of the islands include sugar, grown with the help of imported Indian and Polynesian labour, maize, cotton, tea, and coffee. There are hardly any indigenous animals in the islands, and but scanty signs of mineral wealth.

The population of Fiji by the census of 1891 numbered 121,180, of whom over 2000 were Europeans, and over 105,000 native Fijians. The native population is said to have been larger in former years, and was certainly reduced by the outbreak of measles in 1875. The death-rate among the natives is high, an average of some years showing a rate per 1000 nearly double that of England and Wales. They are in race akin to the Papuans, being the easternmost members of that family, but an admixture of the lighter Polynesians has been brought in from Tonga and elsewhere, and has, especially in the eastern islands of the group, leavened the native Melanesian breed. The Fijians were, prior to the introduction of Christianity, notoriously ferocious cannibals, but religious after their kind, and possessing a strong belief in a future life. At the present time the Christian religion is almost universal in the islands, the adherents of the Wesleyans being estimated at over 100,000, and of the Roman Catholics at more than 10,000. Education is mainly carried on in the mission schools, with the assistance of grants in aid from government; at Suva and Levuka there are school boards, and in Vanua Levu a government industrial school. Fiji has not prospered financially of late years, and the revenue, derived mainly from customs duties and native taxation, has not covered the expenditure. In 1882 the revenue was £111,314; in 1887 only £64,916. Sugar, in spite of the depression of the industry, is far the most important export, and next to it in value come cocoa-nuts (mainly in the dried form known as copra) and fruit. The export of cotton has greatly diminished, but that of tea in 1887 showed a large increase. The total annual exports have during the decade 1877–1887 fluctuated from £170,000 to £351,000; the imports from £311,000 to £802,000. The trade of the colony, both import and export, is almost entirely with New South Wales, New Zealand, and Victoria in the order given. Fiji has become British by the force of circumstances, and not on account of its natural advantages; but it has considerable agricultural resources, it is a station from which British influence can be exercised in the South Pacific, and its excellent harbours might possibly be more utilised in the event of the Panama Canal being successfully carried out, as the islands lie not very far out of the direct route between Australia and Central America.

A good short account of Fiji, with a map, is given in the annual Colonial Office List, and much information will be gained from a blue-book presented to parliament in 1862, which gives both Col. Smythe's Report on the islands (with maps) and also the very valuable 'Report on the Vegetable Productions and Resources of the Vitian or Fijian Islands,' by Dr Seeman, who accompanied Col. Smythe on his visit. Miss Gordon Cumming's *At Home in Fiji* (1881) is but one out of several books on the colony.

Filament, in Botany, is the stalk of the stamen which supports the pollen-containing *anther*, and stands to this as petiole to leaf-blade. See FLOWER, LEAF.

Filaria. See GUINEA-WORM.

Filbert. See HAZEL.

Fildes, S. LUKE, figure-painter, was born in 1844, a native of Lancashire. He studied in the South Kensington Schools and in the Royal Academy, and became known as a woodcut designer, contributing to *Once-a-Week*, *Cornhill*, and *The Graphic*, and illustrating Dickens's *Edwin Drood*. He began to exhibit in the Royal Academy in 1868, with his 'Nightfall;' and in 1874 he produced a very popular picture, 'Applicants for Admission to a Casual Ward'—originally a *Graphic* woodcut, followed in 1877 by the powerful and pathetic 'Widower.' His more recent subjects have been portraits and figure-pictures of Venetian life, in which he has developed a stronger colour-sense than his earlier works gave any indication of. He was elected an A.R.A. in 1879, and an R.A. in 1887.

File. A file is a steel tool, having its surface covered with teeth or serratures, and used for smoothing and shaping metals and other hard substances. Files are classified and named according to their shape, size, and fineness of cut, and the purpose for which they are made. Thus, in shape they may be flat, square, round or *rat-tail*, triangular, half-round, feather-edged, &c., besides being variously bent, in order to get at intricate work. Most files are made thicker in the middle, or 'bellied,' a form which best suits the hands in the act of filing. Files generally are made of the best crucible steel, the forged and shaped blanks when ready for cutting being held upon an anvil by means of a long loop of leather-strap, into which the cutter places his foot. The face of the anvil is covered with a flat piece of pewter, the softness of which preserves the teeth on one side of the file when those on the opposite face are being struck. The cutter forms the teeth by striking with a hammer a short, stout chisel, held obliquely at an angle of about 12° or 14° from the perpendicular. If the chisel were perpendicular, a furrow like the letter V would be indented, and an equal burr struck up on each side; but as a cutting tooth somewhat like that of a saw is required, this is effected by the oblique stroke of the chisel, by which a burr is thrown up on one side only—viz. towards the tang. The cutting is commenced at the point of the file; the chisel is then drawn backwards, laid upon the blank, and slid forwards till it reaches the burr raised by the last cut; the blow is now struck, and another tooth and burr produced, which serves as a guide for the next cut; and so on. The distance between the teeth thus depends on the force of the blow and the obliquity of the cut; for the heavier the blow, the greater the ridge or burr, and the obliquity determines the distance of the cut from the burr. The skill of the workman consists, therefore, in the precise regulation of the blows.

Files are either single cut—i.e. made with a single series of parallel cuts—or, more commonly, double cut—i.e. they have two series or *courses* of chisel-cuts, which are oppositely inclined at an angle of about 55° to the central line of the file. The second course is made in the same manner as the first, but with lighter blows, and is usually somewhat finer than the first. This angular crossing converts the ridges into pointed teeth. Files used for soft metals which are liable to clog the teeth are single cut—i.e. they have but one course of cuts. Taper files have the teeth finer towards the point. Rasps for wood or horn, &c. are cut with triangular punches, each tooth being an angular pit with a strong burr, instead of a long furrow. The rapidity with which the blows are struck varies with the fineness of the file: sixty or eighty cuts are commonly made per minute. Classified according to fineness of cut, files are known as rough, bastard, smooth, and superfine. A superfine file of small size may have as many as 216 cuts per inch, while a large rough file may have not more than twenty-one cuts to the inch. The sharpness and abrading effect of files is greatly

improved by subjecting them after cutting to a sand-blast, whereby a slight recurvature of the burr, which is always present as the file leaves the cutter, is corrected, and the edge is rendered very keen.

Files have to be very carefully hardened and tempered. If heated too strongly, or made too hard, the steel is so brittle that the teeth tear off; if too soft, they wear down rapidly, and the file soon becomes useless. Great care is also required in keeping them straight, as the sudden cooling necessary for hardening is very apt to warp the steel.

Many attempts have been made to cut files by machinery, but with only partial success; the chief difficulty arises from the necessity of modifying the force of the blow to suit the hardness of the steel. It is practically impossible to supply a large number of blanks all of exactly the same hardness; and if the machine be adjusted to suit the hardness of one blank, it may strike too heavy or too light a blow for the next; whereas the workman *feels* at once the hardness of the steel he is working upon, and adjusts his blows accordingly.

File (Fr. *file*, 'a row,' from Lat. *filum*; Ital. *fila*, *filo*), in a military sense, is used to signify any line of men standing directly behind each other, as rank refers to men standing beside one another. In ordinary two-deep formations, a file consists of two men, one in the front rank and one in the rear rank. *Single-file* formation signifies one man from a single rank followed by the men on his right (or left) in succession. *Rank and file* is a term often used to mean the private soldiers of a regiment only, but it really includes also the corporals, who are therefore sometimes called rank and file non-commissioned officers.

File-fish. See BALISTES.

Filey, a rising watering-place on the east coast of Yorkshire, 9 miles SE. of Scarborough by rail, occupies a picturesque site on cliffs overlooking Filey Bay. It has a spa, and an ancient cruciform church. In 1883 a committee reported in favour of Filey as a harbour of refuge. Pop. (1851) 1511; (1881) 2337; (1891) 2481, engaged mainly in fishing.

Filiation. See AFFILIATION.

Filibusters (Span. *filibuster*, from *filibote* or *flibote*, itself derived from the Eng. *fly-boat*, a fast-sailing vessel of not more than 100 tons; by others referred, through the Fr. *flibustier*, formerly *fribustier*, to the Dutch *vrijbuiter*, 'freebooter'), another name for Buccaneers (q.v.). In more recent usage the term has been employed to designate certain lawless adventurers belonging to the United States, who have attempted violently to possess themselves of various countries of Spanish America. The plea urged by these men has generally been that such countries were a prey to anarchy and oppression, and could only attain to prosperity by annexation to the United States. The most noted of these filibusters was William Walker (q.v.).

Filicaia, VINCENZO, lyrical poet, was born at Florence, 30th December 1642. The publication of his six odes celebrating the deliverance of Vienna in 1683 by John Sobieski from the besieging forces of the Turks attracted the notice of Queen Christina of Sweden, who relieved him from harassing pecuniary embarrassments. Ultimately he obtained a post from the Grand-duke of Tuscany, and he died at Florence, 25th September 1707. Some of his patriotic sonnets are famous; but his verse, though not without beauty and spirit, is disfigured by the rhetorical tricks and false conceits of the period. An edition of his works appeared at Florence in 1864.

Filices. See FERNS.

Filigree (through Span. from Lat. *filum*, 'a thread,' and *granum*, 'a grain'), so called because composed of fine wire of silver or gold, often ornamented with small beads. The wire used is twisted into spirals and other convoluted forms, which are united and partly consolidated by soldering; and these spirals, &c. are combined to form a sort of metallic lace-work, which is shaped into brooches, ear-rings, crosses, head-ornaments, card-cases, trays, and other objects of a light and elegant character. Filigree-work is also employed for the ornamentation of articles having a solid metallic base of precious metal, or of copper, the wires being soldered down in definite patterns to the supporting plate. That filigree, as a style of jeweller's work, is of great antiquity is evidenced by remains found in ancient Egyptian tombs. That a knowledge of the art was very widespread is also manifest from the fact that it was largely practised by the ancient Greeks, the Etruscans, and the Romans. We know further that from remote ages it was practised in Central Asia and in India, where to this day it has continued in unbroken succession, and it is now a most characteristic style of work in the Central and North-west Provinces. Among the Celtic and Scandinavian tribes of early times filigree was also a favourite method of ornamentation. The Quigrich (see FILLAN, ST), and the Hunterston Brooch (see BROOCH) are magnificent examples of early northern metal-work in which filigree ornamentation on a solid basis is a prominent feature. In the jewelry of the Scandinavian races filigree still occupies an important place. The manufacture of filigree jewelry is so characteristic of Malta that the style has come to be popularly known as Maltese work.

Filioque. See CREEDS.

Fillan, ST, was the son of Feredach, a prince of Munster, and of St Kentigerna, who in 734 died on Inchcailloch in Loch Lomond. He succeeded St Mund as abbot of the monastery on the Holy Loch, but presently withdrew to Upper Glendochart (Strathfillan), 3 miles SSE. of Tyndrum, where he died on 9th January 777. In 1318 Robert Bruce re-established here an Augustinian priory; and here too was the 'holy pool of Fillan,' in which, not a century since, sick people bathed, and lunatics were plunged. The latter were afterwards left all night, bound hand and foot, in a stone coffin; and if in the morning the knots were untied there was hope of recovery. Two relics of the saint have, after strange wanderings, been reunited at Edinburgh in the Antiquarian Museum. One, his square-shaped bell of cast bronze, 12 inches high, lay in the churchyard, and was employed in that lunatic 'rope-trick,' till in 1798 an English tourist bore it off to Hertfordshire, whence in 1869 it was recovered through Bishop Forbes of Brechin. The other relic is the Quigrich (Gael. *coygerach*, 'stranger')—the bronze head of a pastoral staff (fig. 1), adorned with niello, and inclosed in a beautiful outer case of silver (fig. 2), 9 inches high, gilt, and ornamented with chased work and filigree. Both are undoubtedly of Celtic workmanship; but the case is naturally the later of the two, and seems partly assignable to the 14th and 15th centuries. Possessed of both thief-

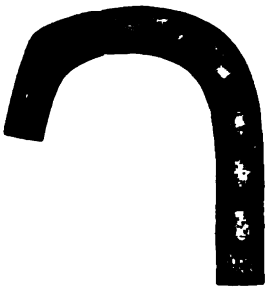


Fig. 1.—Quigrich of St Fillan.

finding and healing properties, the Quigrich from Bruce's time and earlier was in the hereditary custody of a family named Jore, Doire, or Dewar, who enjoyed certain privileges therefor. James III.'s charter of confirmation (1487) to Malice Doire was presented for registration among the public records of Scotland so recently as 1734. In 1818 the Dewars emigrated from Balquhidder to Ontario, taking with them the Quigrich, which in 1876 was, through Dr Daniel Wilson, bought for £100 by the Scottish Society of Antiquaries. St Fillans, at the foot of Loch Earn, is associated with an earlier saint, called *an lobar*, 'the leper,' whose feast fell on 20th June. See Dr John Stuart's 'Historical Notices of St Fillan's Crozier,' in *Proc. Soc. Ant. Scot.* (xii. 1877), and Dr Joseph Anderson's *Scotland in Early Christian Times* (i. 1881).

Fig. 2.—Silver Case of the Quigrich: *a*, front part; *b*, terminal plate.

Fillet, in Architecture, a small space or band, like a narrow ribbon, used along with mouldings. *a*, *a*, *a* (see fig.) are examples of fillets, both in classic and Gothic architecture.

Fillmore, MILLARD, thirteenth president of the United States, was born on 7th February 1800, at Summer Hill, New York, where his education was limited to the very imperfect instruction furnished during three months of the year by a primitive frontier school. At the age of fourteen he was bound apprentice to a wool-carder; and during the five years he laboured at this occupation he used every means at his disposal to cultivate his mind. In 1819 he began the study of law, receiving his board in return for his work in the office of a country lawyer; and during part of this time he also taught school, until in 1823 he was admitted to the Buffalo bar, where he built up a solid reputation for sound legal knowledge and sterling probity. In 1828 he began his political career, being in that year returned by Erie county to the state legislature of New York, where he joined the Whig party, and was mainly instrumental in procuring the abolition of imprisonment for debt in the state of New York. In the period 1832–42 he was four times elected member of congress; in 1844 he was defeated in a contest for the governorship of the state; in 1847 he was elected to the post of comptroller of New York; and in the following year he was made vice-president of the United States. The unexpected death of President Taylor in July 1850 left the chief magistracy vacant, and Fillmore succeeded to that office, which he held till 1853. He proved an able statesman, and his presidency was marked by the passing of some very salutary measures, notwithstanding that his party were in the minority; but his signing of and attempt to enforce the fugitive-slave law rendered him unpopular in the North. In 1856 he was nominated for the presidency by the American party, but the struggle lay between the republican and the democratic candidates, and he received the electoral vote of Maryland only. He visited Europe in 1855 and 1866. He took no active part in the civil war, although he gave his influence to the cause of the Union. After his retirement from political life he resided at Buffalo, where he died 7th March 1874. See Chamberlain's *Biography of Fillmore* (1856), and the article by General James Grant Wilson in *Appleton's Cyclo. of Amer. Biog.* (1887).

Filmer, SIR ROBERT, an extreme advocate of the theory of the divine right of kings, was born at East Sutton in Kent, in the end of the 16th century. He matriculated at Cambridge in 1604, and died probably in 1653. The germ of his theory is the proposition that the father of a family is the divinely ordained type of a ruler, and that his power is absolute. Accordingly, Filmer taught, a king's acts should be subject to no check or control whatsoever; his will is the only right source of law. Hence he is not in any sense answerable to his subjects for his doings; for them either to depose him or even to criticise his conduct is criminal and immoral. These views are expounded with most fullness in his *Patriarcha*, published after his death in 1680, and were critically examined in Locke's *Treatise on Government*. Filmer's *Freeholder's Grand Inquest* (1648) is an exposition of his ideas as to the relations that ought to obtain between the king and the houses of parliament. See DIVINE RIGHT.

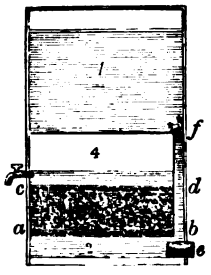
Filmy Ferns (*Hymenophyllaceæ*), an order of Ferns (q.v.), including only three genera, but as many as two hundred species. They grow in large, spreading, mossy masses on rocks and tree-stems in moist places, are chiefly tropical, rare in the southern hemisphere, still rarer in the northern. The only British species of the large genus Hymenophyllum (*H. tunbridgense*), despite its apparently local name, is one of the most widely distributed of plants, being found not only over Europe, but in South America, at the Cape, and in New Zealand. Trichomanes has ninety species, mostly tropical, only one ranging as far as southern Europe. Although chiefly distinguished by systematists on account of the minute structure of their sporangia, they are more remarkable for the exceptionally simple structure of their moss-like leaves, which consist usually of only a single layer of uniform parenchymatous cells. More rarely several layers are present, but there is never a distinct epidermis; moreover, as the plants grow in very wet places—often, for instance, in the spray of waterfalls—and as the leaves are so hygroscopic as to be constantly saturated, even when not absolutely covered with moisture, the usual air-spaces, and with them the stomata of ordinary leaves, are not developed. From this saturation with water instead of air the thin, wet, filmy foliage is thus peculiarly transparent, and so seems singularly dark-green by reflected light. To the exceptional yet beautiful appearance thus accounted for their interest to fern-growers is due.

Filter. When solid matter is suspended in a liquid in which it is insoluble, it may be separated by various means (see CLARIFICATION), one of which is filtration. The process of filtration consists in passing the liquid through some porous substance, the interstices of which are too small to admit of the passage of the solid particles, the principle of the action being the same as that of a sieve. One of the simplest forms of filter is that commonly used in chemical laboratories for separating precipitates, &c. A square or circular piece of blotting-paper is folded in four, the corner where the four folds meet is placed downwards in a

funnel, and one side is partly opened, so that the paper forms a lining to the funnel. The liquid passes through the pores of the paper, and the solid matter rests upon it. The chief advantages of this filter are its simplicity and the ease with which the solid matter may be removed and examined.

A simple water-filter for domestic purposes is sometimes made by stuffing a piece of sponge in the bottom of a funnel or the hole of a flower-pot, and then placing above this a layer of pebbles, then a layer of coarse sand, and above this a layer of pounded charcoal three or four inches in depth. Another layer of pebbles should be placed above the charcoal, to prevent it from being stirred up when the water is poured in. It is obvious that such a filter will require occasional cleaning, and renewal of the charcoal. By a small addition to this a cottage-filter may be made which, for practical use, is quite equal to the most expensive filters of corresponding size. It consists of two flower-pots, one above the other; the lower one is fitted with the sponge and filtering layers above described, and the upper one with a sponge only. The upper pot should be the larger, and, if the lower one is strong, the upper one may stand in it. The two pots thus arranged are placed upon a three-legged stool with a hole in it, through which the projecting part of the lower sponge passes, and the water drops into a jug placed below. The upper pot serves as a reservoir, its sponge stops the coarser impurities, and thus the filtering layers of the lower one may be used for a long period without being renewed, if the upper sponge be occasionally cleaned. Care must be taken to wedge the upper sponge tightly enough, to prevent the water passing from the upper pot more rapidly than it can filter through the lower one.

A great variety of filters are made on a similar principle to the above, but constructed of ornamental earthenware or porcelain vessels of suitable shape. In purchasing a filter, the buyer must not be satisfied with merely seeing that the water which has passed through it is rendered perfectly transparent—this is so easily done by a new and clean filter—but he should see that the filter is so constructed as to admit of being readily cleansed, for the residual matter must lodge somewhere, and must be somehow removed. When large quantities of water have to be filtered this becomes a serious difficulty, and many ingenious modes of overcoming it have been devised. In most of these water is made to *ascend* through the filtering medium, in order that the impurities collected on it may fall back into the impure water. Leloge's ascending filter consists of four compartments, one above the other; the upper part, containing the impure water, is equal in capacity to the other three. This communicates by a tube with the lowest one, which is of small height. The top of this is formed by a piece of porous filtering-stone, through which alone the water can pass into the third compartment, which is filled with charcoal, and covered with another plate of porous stone. The fourth compartment, immediately above the third, receives the filtered water, which has been forced through the lower stone, the charcoal, and the upper stone. A tap is affixed to this, to draw off the filtered water, and a plug to the second or lowest compartment, to remove the sediment.



Leloge's Filter:

1, 2, 3, 4, the four compartments; *ab*, the first porous stone of third or filtering compartment; *cd*, the exit filtering stone of *d*; *e*, the plug to remove for cleaning out second compartment; *f*, a loose sponge at entrance of communicating tube.

A large number of other ascending filters have been patented. Siphon filters are cylindrical pewter vessels, containing the filtering media, to which is attached a long coil of flexible pipe. When used, the cylinder is immersed in the water-butt or cistern, the pipe uncoiled, bent over the edge of the cistern, and brought down considerably below the level of the water. It is then started by applying the mouth to the lower end, and sucking it till the water begins to flow, after which it continues to do so, and keeps up a large supply of clear water. This, of course, is an ascending filter, and the upward pressure is proportionate to the difference between the height of the water in the cistern and that of the lower end of the exit tube (see SIPHON). Filtering on a large scale is effected by using several tanks or reservoirs, in the first of which is coarse material such as gravel, the water passing from this to a second, and from there through a finer filter to the main receptacle, where the filtered water is stored and drawn off for use.

A common water-butt or cistern may be made to filter the water it receives by the following means: Divide the cistern or butt into two compartments, an upper and a lower, by means of a watertight partition or false bottom; then take a wooden box or small barrel, and perforate it closely with holes; fit a tube into it, reaching to about the middle of the inside, and projecting outside a little distance; fill the box or barrel with powdered charcoal, tightly rammed, and cover it with a bag of felt; then fit the projecting part of the tube into the middle of the false bottom.

Various means of compressing carbon into solid porous masses have been patented, and filters are made in which the water passes through blocks of this compressed carbon. Most of these are well adapted for the purpose, but their asserted superiority over filters composed of layers of sand and charcoal is doubtful. A very elegant and convenient portable filter for soldiers, travellers, and others who may require to drink from turbid ponds and rivers is constructed of Ransome's filtering-stone, and is also made of the compressed carbon. A small cylinder of the stone or carbon is connected with a flexible india-rubber tube in such a manner that the cylinder may be immersed in a river, the mouth applied to a mouthpiece at the other end of the tube, and the water drawn through the filtering-cylinder.

It has been questioned whether soluble matter, such as common salt, is in any degree removed from water by filtration. Theoretically it was assumed that this is impossible, since the filter only acts mechanically in stopping suspended particles; but the results of experiments show that from 5 to 15 per cent. of the soluble salts were separated by sand-filters such as above described. Another most important matter is to ascertain to what extent soluble organic matter may be decomposed by filtration, especially by charcoal filters, and to ascertain how long charcoal and other porous matter retains its property of acting on organic matter in watery solution (see CHARCOAL). This is of the highest importance, as it sometimes happens that water of brilliant transparency, and most pleasant to drink, on account of the carbonic acid it contains, is charged with such an amount of poisonous organic matter as to render its use as a daily beverage very dangerous. A filter of animal charcoal will render London porter colourless. Loam and clay have similar properties. The separation from drinking-water of pathogenic microbes (microscopic sources of pestilence) and their germs is very

difficult, on account of their extreme smallness; but it has been effected by using porous unglazed earthenware as the filtering medium. It is, however, rather troublesome in practice, as pressure is demanded, and the very fine pores are soon clogged. They may be cleansed by raising the filter material to a red heat. A duplicate is therefore required.

When a liquid contains mucilaginous or other matter having viscous properties, there is considerable difficulty in filtering it, as the pores of the medium become filled up and made watertight. Special filters are therefore required for syrups, oils, &c. Such liquids as ale, beer, &c. would be exceedingly difficult to filter, and therefore they are clarified by the admixture of albumen, gelatin, or some substance with clarifying properties. Oil is usually passed through bags made of horse-hair or twilled cotton cloth (Canton flannel). Syrups are filtered on a small scale by confectioners, &c. by passing them through conical flannel bags, and on a large scale in *creased bag-filters*, made by enclosing a large bag within a smaller one. Thick syrups have to be diluted or clarified with white of egg, to collect the sediment into masses, and then they may be filtered through a coarse cloth strainer. Vegetable juices generally require to be treated in this manner. See BEER, WINE, SUGAR, &c.; and for filtering on the large scale, see WATER-SUPPLY.

The simple laboratory filter has to be modified when strong acid or alkaline solutions, or substances which are decomposed by organic matter, require filtration. Pure siliceous sand, a plug of asbestos, pounded glass, or clean charcoal are used for this purpose. Some recommend gun-cotton as a filter for such purposes.

Air Filters.—The extraordinary powers of charcoal in disinfecting the gaseous products evolved from decomposing animal and vegetable matter have been made available in constructing an apparatus for purifying air that is made to pass through it. A suitable cage, containing charcoal in small fragments, is fitted to the opening from which the deleterious gases issue, and is found to render them perfectly inodorous, and probably innocuous. Mechanical impurities suspended in air may be filtered out by forcing the air through a plug of cotton-wool, as in firemen's respirators.

Fin. See FINS.

Fina'le, the name given to that part of a musical composition which finishes the act of an opera; also to the last movement of an instrumental composition, as in the symphony, quartette, quintette, sonata, &c. The instrumental finale varies greatly in form, from the lively rondos of Haydn to the gigantic vocal finale, in variation form, of Beethoven's 9th Symphony. The operatic finale, as usually understood, is a concerted piece, sometimes extending to a considerable number of different movements, for one, two, or more single voices, with or without chorus. The best type is to be found in Mozart's operas. In Wagner's works there are no finales separable from the preceding parts of the acts; each act is a continuous whole.

Finance. See NATIONAL DEBT, BUDGET, &c.

Finch, a name applied to many Passerine birds included in the family Fringillidæ, but generally used with some affix, as in the familiar names bullfinch, chaffinch, and goldfinch. A finch is usually small, has a hard conical beak, and generally lives upon seeds. The distribution is almost world-wide, excepting Australia; but the majority inhabit the palæarctic region. The Buntings (Emberizidæ) and the Weaver-finches (Ploceidæ) of the Ethiopian and Australian regions are usually kept distinct. The limits of the family Fringillidæ are vague; among the more familiar members are the Chaffinch (*Fringilla cælebs*), the Brambling (*F. montifringilla*), the Canary (Serinus), the Crossbills (Loxia), the Linnets (Linota), and the Sparrows (Passer).

Finch, HENEAGE, first Earl of Nottingham and Lord Chancellor of England, was born in Kent, probably at Eastwell, on 23d December 1621. He was the nephew of Finch, the lord-keeper of Charles I. Educated at Westminster and Christ Church, Oxford, he was called to the bar in 1645. At the Restoration Charles II. made Finch solicitor-general; in this capacity he took an active part in the trial of the regicides, publishing an account of the trial in 1660. In 1670 he became attorney-general, and five years later lord chancellor. As high steward he presided at the impeachment trial of Stafford in 1680. He died in London, 18th December 1682, having gained a high reputation as a graceful orator, and as a lawyer of great integrity, wisdom, and skill. Several of his speeches were published during his lifetime.

Findhorn, a beautiful Scottish river, rising among the Monadhliath Mountains at an altitude of 2800 feet, and running 62 miles north-eastward through the counties of Inverness, Nairn, and Elgin, and past the town of Forres, till it enters the Moray Firth at Findhorn village by a triangular lagoon, 2 miles long by 2¾ wide. Its waters abound in salmon and trout. Its basin consists of gneiss in the upper part, and of old red sandstone in the lower. At one place it rose nearly 50 feet in the disastrous floods of August 1829, known as the 'Moray Floods.'

Finding of Goods. See LOST PROPERTY.

Findlater, ANDREW, editor of the first edition of this Encyclopædia, was born in December 1810 near Aberdour, in Aberdeenshire. He was the son of a small farmer, and was bred to farm-work; but he early resolved to go to the university, and in spite of having to do daily a full day's work on the farm, he contrived to qualify himself for entering Aberdeen University. There he graduated in arts, and began theology with a view to becoming a minister; but changing his intention, became a schoolmaster at Tillydesk in the parish of Ellon, and for seven years (1842–49) was head-master of Gordon's Hospital in Aberdeen. After a short residence in Canada, he came in 1853 to Edinburgh to superintend for Messrs W. & R. Chambers a new edition of the *Information for the People* (1857). His next task was the chief work of his life; he devoted himself to the preparation of *Chambers's Encyclopædia*, and ere long was its editor. A scholar of wide and varied learning, equally at home in the physical sciences, in the history of ancient religions, and in modern comparative philology, he turned his acquirements to good account, not merely in directing the Encyclopædia as a whole and fixing its form and scope, but in contributing to it many of its most important articles; and after its completion (1861–68) he superintended a revised issue (1874). He saw through the press a new edition of the *Miscellany* (1869–71) and of the *Etymological Dictionary* (1882); and wrote short but admirable manuals on Astronomy, Language, Physical Geography, and Physiography. In 1864 Aberdeen University gave him its degree of LL.D.; and J. S. Mill, while rector of St Andrews University, made him his assessor in the University Court. Many of the articles in the review columns of the *Scotsman* were from his pen. He was associated with J. S. Mill, Mr Grote, and Professor Bain in editing James Mill's *Analysis of the Phenomena of the Human Mind* (1869); and he counted Thackeray, Littré, and Dr John Brown amongst his friends. His health failing, he withdrew from active work in 1877, and died 1st January 1885.

Findlay, capital of Hancock county, Ohio, 37 miles SW. of Fremont by rail, with several foundries, flour-mills, sawmills, &c. It is noted for its natural gas. Pop. (1880) 4633; (1890) 18,553.

Findon, a fishing-village of Kincardineshire, on the coast, 6 miles S. of Aberdeen. Pop. 156. *Findon* (*Finnan*) *haddocks* were first cured here.

Finds. See TREASURE-TROVE.

Fine of Lands, in England, fictitious proceedings formerly in common use in order to transfer or secure real property by a mode more efficacious than an ordinary conveyance. The proceedings in a fine were shortly as follow: The party to whom the land was to be conveyed commenced a fictitious suit against the vendor. Leave to compromise the suit having been obtained, a covenant was entered into whereby the vendor or defendant, called the *cognizor*, recognised the right of the plaintiff, called the *cognizee*, to the lands, of which he admitted that the plaintiff was wrongfully kept from the possession. A note of the fine was entered on the rolls of the court; and the business was concluded by what was called the *foot* of the fine, setting forth the parties, the time and place of agreement, and before whom the fine was levied. The whole was embodied in indentures commencing *hæc est finalis concordia*. In order that a fine should have full effect, it required to be levied with *proclamations*—i.e. open proclamation of the transaction in court. A fine levied by a married woman had the effect of cutting off all right she might have in the lands, and was the only mode by which a married woman could convey lands; and in order to protect her from undue influence she was privately examined as to the voluntary nature of the transaction. A fine was also in use as one of the methods of barring an Entail (q.v.). The Fines and Recoveries Act of 1833 substituted a disentailing deed for the cumbrous methods formerly employed; the same act enabled a married woman to convey lands by means of a deed acknowledged with certain forms. The 'feet' of old fines are often of great importance as evidence in regard to questions of pedigree and title to property. The statute *De Donis* prohibited fines as a means of barring entails.

Fingal's Cave. See STAFFA.—For Fingal himself, see FENIANS, OSSIAN.

Finger-and-toe. See ANBURY.

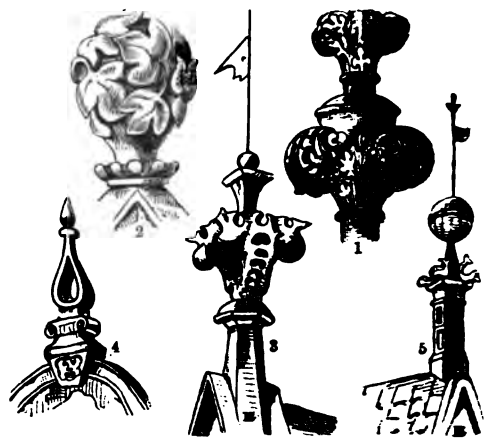
Fingers. See HAND.

Fingos, or AMAFINGU, a Bantu people in the south-east of Cape Colony, closely akin to the Kaffirs (q.v.).

Finial, an ornament, generally carved to resemble foliage, which forms the termination of pinnacles, gables, spires, and other portions of Gothic architecture. There are traces of foliated terminations, both in stone and metal, on the pediments of classic buildings (see ACROTERION), but it was not till the 12th century that the finial proper was introduced. During the latter part of that century and the whole of the 13th century, finials of the most perfect form and of infinite variety were used as the crowning ornaments of every salient point in the buildings of the period (see fig. 1). The architects of the 14th century in finials, as in other ornaments, imitated more closely the forms of natural foliage; but their finials had neither the variety of design nor the vigour of outline of those of the preceding century (see fig. 2).

In the 15th and 16th centuries the finials became more and more meagre in form, and are frequently only four crockets set upon a bare pyramidal terminal. Some variety of effect is often obtained during this period by surmounting the finial with a gilded vane. This is common in Tudor and in continental domestic architecture (fig. 3). Finials were carved both in stone and wood, and in the latter material with great delicacy and minuteness. In connection with metal-work finials of metal were used, and, whatever the material adopted, its natural capabilities were made a source of special beauty.

The finial is one of the most effective ornaments of Gothic architecture, and when that style was succeeded by the Renaissance, in the reign of Queen Elizabeth, our forefathers could not persuade themselves to part with the finials to their buildings.



Finials:
1, from Bishop Bridport's Monument, Salisbury Cathedral; 2, York Minster; 3, Maulbronn, Germany; 4, Crew Hall, Cheshire; 5, Augsburg.

We thus find in Elizabethan architecture a great variety of finials; they are, however, almost entirely of a geometric form, and without foliage (fig. 4), and are frequently, especially when terminating wooden gables, combinations of finial and vane, partly wood and partly iron (fig. 5). In the stricter classic style which succeeded the Elizabethan, some traces of the favourite finial still remain in the balls, obelisks, &c. used as terminations, and also in the shields and supporters (themselves a remnant of feudal times) which form the crowning ornament of gate-piers, pedestals, &c.

Fining, the process of clearing turbid liquors, such as beer and wine. See CLARIFICATION, BEER, WINE, SUGAR, FILTER, &c.

Finistère (Lat. *finis terræ*, 'land's end'), a department at the western extremity of France, comprehending a part of the former duchy of Bretagne, and washed on three sides by the English Channel and the ocean. Area, 2585 sq. m. Pop. (1886) 707,820; (1891) 727,012. It is traversed from east to west by two low but picturesque chains of hills, clad with fir-trees and heath, and forming fruitful valleys of meadow-land between. Its coast is very rugged and broken, its shores bristling with dangerous granite rocks, and fringed with many islands. The most dreaded headland is the Pointe de Raz, rising over 260 feet above the sea, near which, in the 16th century, were still visible the ruins of Is, the ancient capital of Cornouaille (q.v.). The temperature in general is low, the climate very humid; rain and mist are of almost daily occurrence. There are a number of coast streams, including the Odet, the Elorn, and the Aune, which forms part of the great line of communication between Brest and Nantes. The department raises more grain than even its dense population can consume, and vegetables, flax, and cider also are exported; it is noted for its small, hardy horses;

and cattle, swine, and bees are largely reared. Its argentiferous lead-mines are no longer worked, and its manufactures, which include rope-spinning, weaving, and some shipbuilding, are of little importance; its sardine-fisheries, however, employ over 7000 hands. The department is divided into five arrondissements—Brest, Châteaulin, Morlaix, Quimper, and Quimperlé—with Quimper as chief town. See BRITTANY.

Finisterre, CAPE, a promontory at the north-western extremity of Spain, off which Anson (q.v.) defeated Jonquière, and Sir Robert Calder cut off two vessels of the Franco-Spanish fleet in 1805.

Finland (Finnish *Suomi* or *Suomenmaa*, 'the land of fens and lakes'), a grand-duchy annexed to Russia in 1809, though politically a part of that country, is an independent state from an administrative point of view. Finland lies between 60° and 70° N. lat., and 20° and 32° E. long., and is bounded on the N. by Norway, on the E. by the Russian governments of Archangel and Olonetz, on the W. by the Gulf of Bothnia, and on the S. by the Gulf of Finland. Its greatest length is 717 miles, its average breadth about 185 miles. The population of the grand-duchy, which was less than 1,000,000 at the time of the annexation, rose to 1,636,915 in 1850, and to 2,232,378 in 1887, of which number about 85 per cent. are of the native Finnish race, 12 per cent. Scandinavians (i.e. descendants of the Swedes who governed the country or settled in it during the six and a half centuries that Finland formed an integral part of the kingdom of Sweden), the rest being Russians, Germans, and Lapps. Of the population in 1887 the great majority, or 2,189,074, were of the Lutheran state-religion, and 41,032 of the Russo-Greek faith. The inhabitants of Helsingfors, the capital (pop. 65,000), are mostly of Swedish descent, as is also the case at Abo and all along the south and west coasts. About 80 per cent. of the inhabitants belong to the agricultural class, being for the most part peasant-proprietors, with holdings of from 10 to 30 acres. The area of Finland is nearly 145,000 sq. m. (or rather larger than Great Britain and Ireland), the surface presenting a singular aspect.

A glance at a map shows the coast to be extremely indented, and studded with thousands of small islands, forming a perfect archipelago (Swedish *skärgård*), whilst the interior of the country is occupied with countless lakes, some of vast size, and mostly connected with each other naturally or artificially by means of canals. In fact, it is doubtful whether any country in the world is so well supplied with the means of inland navigation as Finland, 12 per cent. of the total area being occupied by lakes, and 15 per cent. by marsh and bog, the quantity of which latter is gradually being diminished by the united efforts of nature and man; for it has been proved by careful observation that the surface of Finland (which is a tableland from 300 to 400 feet above the level of the sea) is gradually rising from its watery bed, and that, too, in some places at a rapid rate. Thus, it has been calculated, by means of points fixed on the seashore, that on the Gulf of Bothnia the land has risen at the rate of 3 feet 1 inch in 100 years, and on the Gulf of Finland at the rate of 1 foot 11 inches. The largest of the lakes—besides Lake Ladoga, of which part belongs to Russia—are Lakes Saima, Enare, Kemi, Uleå, and Päijänne. The Saima consists of 120 large lakes and several thousand smaller ones, all connected, and having a natural outlet into Lake Ladoga, over the famous Imatra Falls—more correctly rapids—the finest in Europe both from the scenery and volume of water. Lake Saima is likewise connected with the Gulf of Finland by means of a splendid canal 36 miles long, with no less than twenty-eight locks. The canal, which took twelve years to complete, was designed and carried out by Finnish engineers at the cost of the state, and is a triumph of engineering skill, as it runs for many miles through granite rock, and there is a difference of 250 feet between the levels of the extremities. The surface of Finland consists of primitive rocks, as gneiss, granite, diorite, and gabbro. Neither fossils nor coal are found.

Finland has no mountains worthy of the name, the highest being Haldefjäll, in Lapland (Lapp *Haldischok*), 4126 feet high, near the frontier of Norway, and really belonging to the Norwegian range. The highest hill in the south is Türismaa, and this does not exceed 754 feet above sea-level. The average height of the interior of Finland is about 325 feet above the level of the sea. On account of this lack of mountain-ranges, the rivers of Finland are unimportant, the principal being the Kemi and Uleå in the north, and the Kymmene in the south. They are usually navigable only for a part of their length, owing to rocks and rapids, but they are well suited for floating logs from the forests of the interior to the coasts, besides which they serve as motive power for many mills, and are also rich in fish. The forests of Finland are of vast extent, covering no less than three-fifths of the land-surface. More than half of them belong to the state; for this reason it may safely be said that Finland will never exhaust its stock of timber, as the cutting of the forests is carefully regulated; whereas private owners have hitherto distinguished themselves by a reckless and extravagant system of tree-felling. The Scotch fir (*Pinus sylvestris*) and Norway spruce (*Abies* or *Picea excelsa*) are the most widespread and most productive; then come the birch, alder, ash, oak, &c., of which the three first mentioned alone grow far north, the others being found only in the centre and south of Finland. Among the fruit-trees which have been successfully acclimatised in Finland are the apple, pear, cherry, &c., but they produce no fruit in the north of the country beyond lat. 63°; currants, raspberries, strawberries, &c. thrive almost everywhere. Of cereals, rye is the most grown, then barley, oats, and wheat; this latter, however, rarely ripens beyond lat. 61°. The potato flourishes as far north even as lat. 69°; after rye it forms the staple food of the inhabitants. The fauna of Finland is very rich. Among wild animals we find the bear, wolf, fox, lynx, ermine, otter, and hare; but the elk (Alces) and beaver, which were formerly abundant, are now rare. Seals are plentiful along the coast, as also in the Saima and Ladoga lakes. All domestic animals thrive in most parts of Finland, but are replaced by reindeer in the far north. Finnish horses are remarkable for their speed, hardihood, and docility. Of birds there are 211 species—not counting the domestic sorts—including ptarmigan, blackcock, moorcock, swans, geese, ducks, many varieties of birds of prey, and most of the smaller birds common in Great Britain. We find 80 species of fish in the rivers, lakes, and seas of Finland. Of these, a kind of herring (Swedish *strömming*) is very abundant on the south and south-west coasts. Salmon, trout, perch, pike, gwyniad, &c. abound in most of the rivers, and give employment to a considerable proportion of the population. Fish forms an important element in the food of all classes, large provision of the same being salted or smoked for the winter season.

The climate of Finland is very rigorous in winter, even on the south coast, where 20° and 25° below zero (Fahrenheit) are often registered; but it is generally healthy, and, owing to the proximity of the sea, it is far milder than North Russia or any

other region in the same latitude except Sweden and Norway. The summer, though short, is occasionally very hot in June and July. The ground is generally covered with snow from the middle of November till April; then follows a brief spring, accompanied by a rapid growth of vegetation. Autumn is likewise short, September being often very fine and October wet. The long summer days, when the sun only goes below the horizon for an hour or two, have a peculiar charm. At Abo the mean temperature of the year is 40° (Fahrenheit), and at Helsingfors 39°. At the latter place February is the coldest month, with an average of 17° (Fahrenheit), and July the hottest, with 62°. In the north and north-east of Finland, of course, the winters are longer and more severe, the mercury frequently freezing in the thermometer. The annual rainfall at Helsingfors is 20 inches, the prevailing winds being south and south-east.

The emperors of Russia are at the same time grand-dukes of Finland, with considerable power, such as the right of declaring war and peace, the imposition of duties, the appointing of the senators and other high officials; nor do the various bills that pass through the House of Representatives become law till they have received the imperial sanction. The country is governed by the grand-duke, the senate, and the diet (Swedish *Landtag*). The senate consists of 20 members, appointed by the grand-duke from among the Finnish subjects recommended to his imperial majesty by the governor-general of Finland, who is a Russian subject, and commands the Russian troops that garrison Sweaborg and other strong places in the grand-duchy. The diet consists of four chambers —nobles, clergy, burgesses, and peasantry; the nobles having hereditary legislative rights, whilst the others are elected by the members of their respective classes. In the session of 1888 these chambers were represented by 125 nobles, 37 clergy, 55 burgesses, and 61 peasantry. According to law the diet must meet once in five years, but of late it has been convoked every three years.

Education in Finland is in a highly advanced state, no less than 91 per cent. of the adult inhabitants being literate, whilst of the children capable of attending school only 2 per cent. are not in receipt of instruction. There is one university, at Helsingfors, with four faculties (theological, legal, medical, and philosophical) and 1002 students (1888) in residence, against a total of 411 students in 1863. There are besides 30 lyceums, 160 elementary and *real-schuler* for boys, 50 girls' schools, 4 seminaries for the training of teachers, and 929 popular schools, besides several nautical, commercial, and agricultural schools. Formerly Swedish was the official language of Finland; but since 1883 Finnish and Swedish have been placed on the same footing. At the university and the higher educational establishments Swedish is still mostly used, but in the popular schools Finnish is the medium of instruction as a rule; Russian is almost an unknown tongue in Finland.

For administrative purposes the grand-duchy is divided into 8 counties (Swedish *län*): Nyland, Abo-Björneborg, Tavastehus, Viborg, St Michel, Kuopio Vasa, and Uleaborg. Each county has a governor at its head. The courts of law are held at Abo (the former capital), Vasa, and Viborg. The chief towns are Helsingfors (53,370 in 1886), Abo (26,448), Tammerfors (16,744), Viborg (16,639), and Uleaborg (11,578).

The railways of Finland, which with the exception of one short line all belong to the state, show a total length already of 1112 miles, whilst other lines are in course of construction. The telegraphic department is under the control of the Russian government; and telephones in the hands of private companies have been established throughout all the towns of the grand-duchy. In Helsingfors the telephone system has reached an astonishing development, few houses being without it.

The finances of the grand-duchy are in a most flourishing condition, and are quite distinct from those of Russia. The revenue in 1888 was £1,706,564, including a surplus of £290,700 from the preceding year, whilst the expenditure was only £1,534,578. The public debt of Finland amounted on 1st January 1888 to only £2,796,405, nearly all of which sum has been expended on public works, education, &c., and is more than balanced by the state property. By the law of July 1886 the French decimal system, which had previously been adopted for the Finnish currency—the mark = 1 franc, and the penni = 1 centime—was extended to weights and measures as well, the French names being retained. The rate of exchange of the Finnish mark has hardly varied during the last 20 years, and notes or gold are at par.

Finland's army consists of 5400 men in time of peace, with about 20,000 reserves. These troops are divided into nine battalions of sharpshooters and one regiment of cavalry, this latter formed in 1889. Both officers and men must be Finnish subjects, and are only to be employed for the defence of Finland, except as regards the battalion of Finnish guards, which generally accompanies the emperor and grand-duke in his wars, as was the case in the last Russo-Turkish campaign. Finland has no navy of her own, but possesses a thriving commercial marine, which in 1887 numbered 2153 vessels of 268,200 tons register. Finnish ships, however, sail under the Russian flag. The value of the merchandise exported from Finland in 1887 was £3,082,640, the principal being: timber, £1,160,000; butter, £440,000; and paper, £260,000. The imports amounted to £4,234,600, of which cereals represented £520,000; iron and steel, £440,000; coffee, £320,000; textiles, £319,000; and sugar, £240,000. Nearly half of Finland's trade is with Russia; Germany being second, and Great Britain third on the list. There were in 1889 some 1750 factories and other industrial establishments in the grand-duchy, employing 22,000 hands. Of these the sawmills are the most important. Large quantities of iron are found in Finland, and copper, tin, silver, and gold exist; gold does not pay the cost of working. The grand-duchy formerly suffered severely from occasional famines—the last was in 1868—owing to short or wet summers; but these disasters have now been obviated by means of railways, canals, and improved agriculture. Physically the Finns proper are a strong, hardy race, with round faces, square shoulders, fair hair, and blue eyes, though intermarriage with Scandinavians and Russians has in many cases caused variations. They are of a somewhat phlegmatic temperament, but are honest, hospitable, clean, strictly moral, and very religious. The love of strong drink by which they were once distinguished is rapidly giving way before the spread of education and temperance doctrines. They possess many of the characteristics of the Mongolian races, to which they are ethnically related, and have a keen sense of independence and personal freedom, serfdom never having existed in the country except in the county of Viborg when it was in Russian hands.

History.—The Finns belong, as their tongue indicates, to the great Turanian or Ural-Altaic family, which still predominates in northern and central Asia. About the end of the 7th century or the commencement of the 8th the Finns, driven as it is supposed by the Bulgarians from their

settlements on the Volga, took possession of the country they now occupy; but they found inhabitants there already, whose memory popular tradition has handed down under the names of Hiidet, Jättiläset, Jatulit, and Jotunit. Probably the modern Lapps are the descendants of those primitive inhabitants. In the 12th century the Swedes turned their attention to Finland, more especially for the introduction of Christianity; but the struggle with paganism was long and obstinate, lasting for nearly 200 years. Three separate crusades (1157, 1249, 1293) finally brought about the subjection of the country to Sweden, and the adoption of the Christian religion. The first of these crusades was led by King Erik the Holy, accompanied by Henrik, Bishop of Upsala, an Englishman by birth. The latter was soon afterwards cruelly murdered by a fanatic Finnish peasant, and Henrik the Martyr has ever since been regarded as the patron saint of Finland. For over 600 years Finland was united with Sweden, and thus received the incalculable advantages of Christianity, civilisation, a constitution, and liberal laws. The Reformed religion was introduced into Finland by Gustavus Vasa in 1528, and King John III. raised the country to the dignity of a grand-duchy. Finland, however, became the theatre of frequent bloody struggles between Russia and Sweden, culminating in the cession of the whole country to Russia in 1809 by the peace of Fredrikshamn. Alexander I., however, in annexing Finland to Russia, promised the inhabitants that their constitution, religion, and laws should be faithfully preserved, as when under Swedish rule. This promise has been ratified by succeeding emperors, and thus we find the anomaly at the present day of a constitutional state in an autocratic country. Finland is certainly the best governed, and it might be added the most prosperous, part of the Czar's vast dominions.

For further information, see Koskinen, *Finnische Geschichte* (Leip. 1873); Ignatius, *Le Grand-duché de Finlande* (Helsingfors, 1878); Jonas, *Das Grossfürstentum Finland* (Berlin, 1886); *Annuaire statistique pour la Finlande* (Helsingfors, 1888); also Senator Mechelin's *Précis du droit public de Finlande* (Helsingfors, 1886), of which an English translation by Charles J. Cooke was published in 1889 (Chapman & Hall, London).

Language and Literature.—The Finnish language is one of a group of five Ugro-Finnic tongues which constitute a branch of the great Ural-Altaic family of languages, comprising the Manchu, Mongol, Turkish, and Samoyede. The Ugro-Finnic group includes (1) the language of the Finns in Finland, and the Esthonian (q.v.), (2) the tongue of the Lapps, (3) of the Finns of Perm, (4) of the Finns of Vologda, and finally (5) that of the Ugrian Finns, to which last belong the Vogul and Ostiak dialects in Siberia, and the Magyar in Hungary (see HUNGARY). The most highly cultivated language of the group is that spoken by the Finns proper, the Suomi of Finland. The Finnish dialects are all agglutinative forms of speech, with tendencies towards true inflection, so that occasionally the difference betweeen agglutination and inflection is somewhat obscure. The nouns are not inflected, an additional word being used to denote the variations of case, number, and sex, whilst the prepositions and pronouns are suffixed to the words they modify. The verbs have only a present and past tense, another word being required to indicate the future. Rask considered the Finnish language to be one of the most sonorous and harmonious of tongues, and there is no doubt that as it is developed it will be more and more appreciated.

The literature of Finland was formerly almost entirely devoted to religious subjects. Part of the Old Testament had been translated in the 16th century, but it was not till 1642 that the whole of the Bible was made accessible to those who did not know Swedish or Latin. The credit of rescuing the Finnish language from comparative oblivion belongs to Dr Zacharias Topelius and to Dr Elias Lönnrot of Helsingfors. The former published a collection of scattered songs in 1822, but in 1835 Dr Lönnrot gave to the world his famous epic *Kalevala*, being a systematic collection of popular songs taken down from the lips of the peasantry during years of patient research and wandering. By unwearied diligence he succeeded in collecting 12,000 lines of *runor* and *saga* that for generations had been handed down by the *Runolainen*, or singers, to the sound of the kantela, a sort of primitive harp. Not much notice was paid to this remarkable publication at first, but when in 1849 Dr Lönnrot, who had energetically continued his researches meantime, published a new and extended edition of 22,793 verses in fifty runes, its importance was soon recognised by philologists, and it was translated into Swedish, German, and French. The *Kalevala* is a singular monument of the earlier culture of the people, and has given rise to much critical literature, scholars not agreeing as to the character of the plot, some regarding the incidents as allegorical, others as referring to definite epochs. All, however, are of accord in considering the poem a pure epic with an oriental appreciation of nature, and rich in images, tropes, and synonyms. The poem is written in eight-syllabled trochaic verse, and an idea of its style may be obtained from Longfellow's *Hiawatha*, which is known to be an imitation of the Finnish epic. Professor Max Müller compares the *Kalevala* with the *Iliad* in length and completeness, and adds that 'it will claim its place as the fifth national epic of the world, side by side with the Ionian songs, with the *Mahâbhârata*, the *Shahnameh*, and the *Nibelungen Lied*.' The *Kalevala* has been translated into English by J. Martin Crawford (New York, 1888, and London, 1889). There are translations by Kollan and by Castrén (Swedish), by Barna and by Ujfalvy (Hungarian), by Schiefner (German), and by Le Duc (French). A Finnish-English grammar was published in 1889 at Oxford, by E. J. Eliot, secretary of embassy.

The first Finnish printed book was an *Abecedarium* in 1543; the Bible was not translated till 1642. During the 19th century, and especially within the last twenty years, there has been great literary activity in Finland, and the Russian government encourages in every way the development of the Finnish tongue *versus* the Swedish, which latter language, though still spoken by the higher classes, seems destined to practically disappear in the course of two or three generations. Most of Shakespeare's plays have been translated into Finnish, and the standard works of England, France, Germany, and Russia have long since been rendered into that language. At Helsingfors there is a Finnish theatre, in addition to a Swedish and a Russian theatre, with very good native actors. There are a great many Swedish and Finnish newspapers, and scientific or literary journals, and the publications of the various learned bodies are most valuable; amongst others, those of the Society of Finnish Literature (founded 1831), which has fostered the editing by Lönnrot, Borenius, Krohn, and other scholars, of precious collections of epical songs, ballads, 'songs-of-tears' or metrical laments for the dead, folk-tales, magical formulas, proverbs, riddles, and beast-fables. Porthan and Koskinen are the principal historians of the grand-duchy; Runeberg is undoubtedly the greatest poet and dramatist that Finland has produced, and Professors Krohn and Donner have made themselves most eminent for their works on Finnish. Professor

Donner has published in German a *Comparative Dictionary of the Finno-Ugric Languages* (Helsingfors and Leipzig, 3 vols. 1874–88); and there are several Swedish-Finnish dictionaries, besides Lönnrot's.

See the works of Castrén, Elmgrén, and Weske; on the Kalevala, the works of Krohn, his letter quoted by Max Müller in the *Athenæum*, October 1888, p. 519, his posthumous *Kalevalan Toisinnot*, 'Variants of the Kalevala' (1888), and the 'Kalevala-studien,' trans. by Viktor Hackmann, in Veckenstedt's *Zeitsch. für Volkskunde* for 1889. Kaarle Krohn published at Helsingfors in 1886 a rich collection of beast-fables, &c. (*Suomalaisia Kansansatuja I. Eläinsatuja*).

Finland, GULF OF, the eastern arm of the Baltic Sea, between 22° and 30° E. long., and between 59° and 61° N. lat. It receives the waters of the great lakes Onega and Ladoga. The water of the gulf is not deep, and only very slightly salt. The topography of the Gulf of Finland, which has been thoroughly elucidated by Struve, forms an interesting part of the great work of the Russian survey of the Baltic. The navigation on the northern or Finnish coast is very dangerous, on account of the numerous islands and shoals.

Finlay, GEORGE, the historian of Greece, was born of Scottish parents at Faversham, in Kent, where his father, Major John Finlay, was inspector of the government powder-mills, 21st December 1799. After his studies at Glasgow and Göttingen, Philhellenism carried him to Greece, where he met Lord Byron, and devoted himself with patient enthusiasm to the study of Greek history and antiquities. With the exception of a short period of residence in Rome, and of study at Edinburgh University, the whole of his life was spent in the land of his adoption, which he continued to love, spite of the unworthiness of its leaders and of the miserable failure of his own generous schemes for promoting agricultural progress. For relief he turned to the task of writing its history. 'Had the hopes with which I joined the cause of Greece in 1823 been fulfilled,' he wrote in 1855, 'it is not probable that I should have abandoned the active duties of life, and the noble task of labouring to improve the land, for the sterile task of recording its misfortunes.' The first portion of his great work, *Greece under the Romans*, appeared in 1844, and was followed by the following instalments: *The History of Greece from its Conquest by the Crusaders to its Conquest by the Turks, and of the Empire of Trebizond, 1204–1461* (1851); *History of the Byzantine and Greek Empires from 716–1453* (1854); *History of Greece under Ottoman and Venetian Domination* (1856); and *History of the Greek Revolution* (1861). Finlay devoted the remaining years of his laborious life to revising and partly rewriting his history, but his death at Athens, 26th January 1875, prevented his completing the work, which was issued by the Clarendon Press, under the care of the Rev. H. F. Tozer, with the title, *History of Greece from* B.C. *146 to* A.D. *1864* (7 vols. 1877; vol. i. contains an autobiography). Freeman declares his history the greatest English historical work since Gibbon's *Decline and Fall*.

Finmark, the most northern province of Norway, consists of a narrow strip of rocky coast-land, cleft by numerous bays and fjords. The area is 18,295 sq. m., of which three-fourths belong to the continent, the rest to the numerous islands which skirt its shores. The chief sources of wealth are fishing and reindeer breeding. Only very scanty crops of barley, potatoes, and a few other vegetables are raised. Pop. (1880) 27,000, principally Lapps. Hammerfest, the capital (70° 40′ N. lat.), with (1891) 29,170 inhabitants, is the most northern town of Europe. See Du Chaillu's *Land of the Midnight Sun* (1881).

Fins (allied to Lat. *pinna* or *penna*; see letter F), a term vaguely applied to outgrowths and limbs in aquatic animals. Thus, the paired fins of fishes are true limbs, the unpaired median fins are outgrowths. The term is similarly extended to cetaceans; while a still wider usage includes locomotor expansions in cuttle-fishes and some other molluscs. See FISHES.

Finsbury, a parliamentary borough of Middlesex, forming the north part of London, consists since 1885 of three divisions, Holborn, Central, and East, each returning one member.

Finsteraarhorn, the highest peak (14,026 feet) of the Bernese Alps. See ALPS.

Finsterwalde, an old town of Prussia, 71 miles by rail S. by E. of Berlin. It has manufactures of cloth and machinery, iron-foundries, and coal-mines. Pop. 7566.

Fiord. See FIRTH, NORWAY.

Fiorin Grass. See BENT GRASS.

Fir, a name applied in a comprehensive sense to the true Pines, the Larch, and certain other conifers, but more properly used to denominate the Norway Spruce, the Silver Fir, and their congeners. These two species—now the types respectively of the genera Picea and Abies—were included in the Linnæan genus Pinus; thus, the Norway Spruce was *P. Abies*, and the Silver Fir was *P. Picea*. By these specific names the trees were known to Pliny and other ancient writers, but by inadvertence on the part of Linnæus they were misapplied so that each bore the other's name. This confusion was perpetuated when the species were removed from the genus Pinus, and set up as representatives of distinct genera. As kindred species were discovered and introduced, nomenclature became more confounded. Continental botanists endeavoured for long with only partial success to restore the names Picea and Abies to their ancient use. The point, however, has at length been conceded in the *Genera Plantarum* (1862–76) by Bentham and Hooker; but amateurs and students of coniferæ will still be confronted with the confused nomenclature of the species in works on the subject published prior to the adoption of the recent change of the generic names. Their difficulty will, however, be lessened by their bearing in mind that species hitherto ranged under Abies must now be named Picea; thus, for instance, the Norway Spruce is no longer Abies but *Picea excelsa*, and the Silver Fir is *Abies pectinata*, not Picea of that designation.—It should also be noted that some trees commonly called fir are really pines; thus, the Scotch Fir (*Pinus sylvestris*) is a pine. See PINE.

The genus Abies comprises some twenty-five or thirty species, which are easily distinguished from the Spruce Firs by their erect, cylindrical or but slightly tapering cones, the scales of which are deciduous and fall away in maturity from the axis, which adheres to the branch; and by their flattened leaves being always more or less distinctly arranged in two ranks on each side of the branches, and generally in a horizontal direction. The genus Picea consists of about twelve species, the cones of which are pendulous, and the scales persistent, opening only when mature to shed the seeds. The leaves are arranged spirally, scattered around the branches, needle-like and quadrigonal or almost round. These are the broad essential distinctions of these two genera of firs, but they have some features in common. They are all evergreen-trees, mostly of spiral or pyramidal habit, their branches spring from the stem in whorls—a characteristic of certain other conifers—and the scales of the cones are thin or almost scarious at the apex, a point

which distinguishes them from the true pines. The species of both are widely distributed over the extra-tropical regions of the northern hemisphere, and the Norway Spruce even penetrates within the Arctic circle.

The last-named species, *Picea excelsa*, is one of the noblest and most useful of European firs, attaining the height of from 80 to 150 feet, but with no proportionate diameter of trunk, which is usually rather slender compared with its height. It is a native of the north of Germany, Russia, and Norway, where it forms immense tracts of natural forest. Since its introduction into Britain about 1540, it has been extensively planted, chiefly as a nurse for more tender and slower-growing trees, for which purpose its evergreen character and hardy constitution adapt it well. It does not succeed in windy, exposed situations, nor in thin, dry soil, but in moist, alluvial soil it attains its highest development. It is the *Fichte* of the Germans, called also *Rothtanne* or *Schwarztanne*. It yields the same products as the Scotch Fir (Pine)—resin, turpentine, tar, and lamp-black (see these heads); but more resin than turpentine. The true Spruce Resin flows spontaneously from the bark. The purest pieces are whitish or pale yellow, are sold under the name of Common Frankincense, and used for ointments and plasters, and when melted yield the common Burgundy Pitch (q.v.). The bark of the spruce is a good and cheap non-conductor of heat; the cones are an excellent substitute for tanners' bark. In Sweden and Norway the inner bark is made into baskets; and the long and slender roots, split and boiled with alkali and sea-salt, are dried, and twisted into cordage, which is used both for shipping and by farmers. The wood is used for fuel and for house-building; it also supplies masts and spars for ships. It is the White Christiania deal and Danzig deal of the market, and is very largely imported into Britain from Norway and the Baltic. It is whiter, lighter, less resinous, and more elastic than the timber of Scotch Fir. The sap-wood, whilst still in a gelatinous state, is sweet, and is eaten fresh in Sweden and Lapland; and the inner bark, in times of scarcity, is mixed with a little flour or meal of some kind and baked into bread. The young shoots, still covered with their bud-scales, are in many parts of Europe used for fumigation. The leaf-buds are also employed medicinally in cases of scurvy, rheumatism, and gout. The pollen is often sold by apothecaries instead of the dust of the Clubmoss or Lycopodium.

Fig. 1.
Norway Spruce Fir (*Picea excelsa*):
a, branchlet with male flower; *b*, branchlet with female flower; *c*, mature cone; *d*, one of the scales of cone, outside; *e*, one of the scales of cone, inside, showing seeds; *f*, a leaf with cross section; *g*, gall, caused by punctures of *Cocus abietis* and other insects.

A very superior variety of this fir is known as the Red Norway Spruce. Dwarf varieties are cultivated amongst ornamental shrubs. The Black Spruce (*Picea nigra*), of which the Red Spruce (sometimes called *P. rubra*) is regarded as a mere variety caused by difference of soil, and the White Spruce (*P. alba*) form great woods in North America. The Black Spruce is found as far north as 65° lat. Both these species are now common in plantations in Britain. Both have quadrangular leaves; those of the Black Spruce are of a dark glaucous green, those of the White Spruce are of a lighter colour. The cones of the Black Spruce are short, ovate-oblong, obtuse, and pendulous, with rounded scales ragged at the edge; those of the White Spruce are oval, and tapering to a point, with entire scales. The Black Spruce is a valuable timber-tree, supplying yards of ships, &c.; but its planks are apt to split. The White Spruce is smaller, and the timber inferior. From the Black Spruce the *Essence of Spruce* is obtained, which is so useful as an antiscorbutic in long voyages, and is used for making spruce-beer. Spruce-beer is also made by adding molasses or maple-sugar to a decoction of the young branchlets, and allowing the whole to ferment. From the fibres of the root of the White Spruce, macerated in water, the Canadian Indians prepare the thread with which they sew their birch-bark canoes; and the seams are made watertight with its resin. From the twigs of the Oriental Fir (*P. Orientalis*), a native of the Levant, a very fine clear resin exudes, which is known by the name of Sapindus' Tears. This fir has very short quadrangular leaves, densely crowded and uniformly imbricated. Menzies' Spruce (*P. Menziesi*) and Patton's Spruce (*P. Pattoniana*) are now prized as ornamental trees in pleasure-grounds in Britain: both are natives of California, the former covering wide areas at from 7000 to 9000 feet elevation. It makes rapid growth in Britain, and apart from its ornamental value it has been suggested that it should be planted more extensively for its timber, which is described as very durable, though rather coarse grained. In southern California Patton's Spruce attains the height of from 200 to 300 feet, with a circumference of trunk of from 12 to 14 feet; but in northern California, where it is also found in great abundance at elevations of from 4000 to 6000 feet, it reaches the height of 150 feet as its maximum dimensions, towering above the rest of the forest at the lower levels, but dwindling as it ascends the mountains to the proportions of a shrub a few feet high. It is a slow-growing, but very handsome tree in Britain, with light-green, rigid, thickly set leaves having a glaucous tint below, which enhances its beauty. The Himalayan Spruce (*P. Morinda*) is a remarkably graceful tree found at elevations of from 6000 to 12,000 feet on the Himalayas. Where it succeeds well in Britain, it is one of the most beautiful of pleasure-ground trees, but should not be planted in cold districts. The leaves are longer than those of most other Spruce Firs, and densely clothe the branches, which assume a graceful pendulous outline. The Corean Spruce (*P. polita*) is a comparatively recent introduction to Britain. It forms vast forests on the mountains of Corea, and is indigenous also to Japan. In England it is a slow-growing tree, and should be planted only in sheltered situations.

The Hemlock Spruce of North America (*Abies canadensis*) forms great part of the forests of Canada and of the northern states, extending northwards as far as Hudson's Bay. Its timber is not much esteemed, as it splits very obliquely, and decays rapidly in the atmosphere; but the bark is valued for tanning. The leaves are two-rowed, flat, and obtuse. The cones are scarcely

longer than the leaves. The young trees have a very graceful appearance, but the older ones are generally much disfigured by remaining stumps of their lower branches.—The Douglas Fir (*A. Douglasii*) is a noble tree, attaining a height of 250 feet, which forms immense forests in the north-west of America, from 43° lat. to 52° lat. The bark, when the tree is old, is rugged, and 6–9 inches thick. It abounds in a clear, yellow resin. The timber is heavy, firm, and valuable, the growth very rapid. Experimental plantations of this extremely rapid-growing tree laid down in 1860 by the Earl of Mansfield on his Scone estates, Perthshire, encourage the expectation that it will rival and perhaps surpass the larch in value as a timber tree.—The Mount Enos Fir (*A. cephalonica*), a native of Cephalonia, attaining a height of 60 feet and a diameter of 3 feet, yields durable and very valuable timber.—All these species have been introduced into Britain, and many of them are now common in our plantations, as well as others from the north-west of America and from the mountains of Asia, and are apparently quite suitable to the climate.

Fig. 2.—Cone of Douglas Fir (*Abies Douglasii*).

The Common Silver Fir (*Abies pectinata*, or *Pinus picea*) has erect cylindrical cones, 5–6 inches long, and two-rowed leaves, with two white lines upon the under side. It forms considerable woods upon the mountains of Central Europe and of the north of Asia, and attains a height of 150–180 feet and an age of 300 years. It is not a native of Britain, but large trees are now to be seen in very many places. The wood is white, contains little resin, is very soft and light, and is employed for the ordinary purposes of coopers, turners, and joiners, and in ship and house carpentry, also for making bandboxes and for many fine purposes, especially for the sounding-boards of musical instruments. The same resinous and oily products are obtained from the Silver Fir as from the Spruce and Scotch Fir, but of superior quality. It yields the beautiful clear turpentine known as Strasburg Turpentine. Very similar to the Silver Fir, but generally of much smaller size, and indeed seldom much above 30 feet in height, is the Balm of Gilead Fir (*Abies balsamea*), a native of North America from Virginia to Canada. The wood is of little value, but the tree yields Canada Balsam (q.v.).

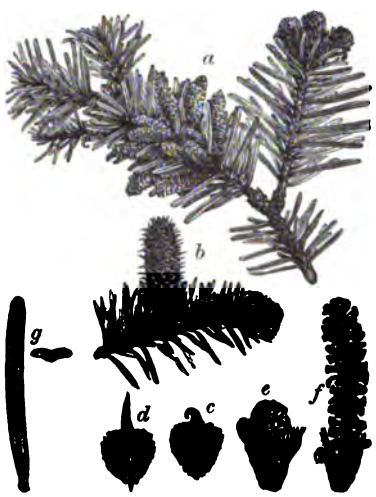


Fig. 3.
Common Silver Fir (*Abies pectinata*):
a, branchlet with male flowers; *b*, branchlet with female flowers; *c*, a scale of cone, outside; *d*, a scale of cone, inside, showing seed; *e*, male flower undeveloped; *f*, male flower fully developed; *g*, leaf with cross section.

Besides these, a number of other species of Abies are found in the western parts of North America and in the Himalayas, some of which are trees of great magnitude, and yield excellent timber, as *A. grandis*, a Californian tree of 170–200 feet in height; *A. amabilis*, a species much resembling it; *A. nobilis*, a majestic tree, which forms vast forests on the mountains of northern California; *A. bracteata*, a Californian species remarkable for its slender stem, which rises to a height of 120 feet, and yet is only about 1 foot in diameter at the base, and likewise for the manner in which the middle lobe of each bractea of its cones is produced so as to resemble a leaf; *A. Webbiana*, the Himalayan Silver Fir, which in its native regions fills the upper parts of mountain-valleys, and crowns summits and ridges at an elevation of upwards of 10,000 feet, a tree of great size, 35 feet in girth, and with a trunk rising 40 feet before it sends out a branch. Most of these have been introduced into Britain with good prospect of their succeeding well in our climate, and other species, as *A. Pichta*, a native of the Altai Mountains, very nearly resembling the Silver Fir, *A. Nordmanniana*, *A. Fraseri*, &c. *P. religiosa* is a tall and elegant tree, a native of the mountains of Mexico, with slender branches, which are very much used by the Mexicans for adorning churches; and its cones are shorter than those of any other Silver Fir.

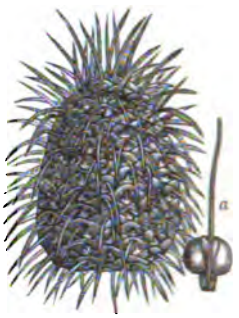


Fig. 4.
Cone of *Abies bracteata*:
a, scale of cone, showing bract.

Fig. 5.—Branchlet with cones of *Abies Nordmanniana*:
At *a* the scales are supposed to have fallen away, showing the axis.

Firbolgs, the name given in the fabulous history of Ireland to one of the races who successively invaded that country in what was probably the bronze age. The various tribes of the Firbolgs seem to have been Britons, and were said to have landed in Ireland under the command of five principal chiefs in three separate divisions, one in the river Slaney, the second in Mayo county, and the third in Ulster. Their chief stronghold, called Dind Rig, was near the Barrow, in Carlow. The Firbolgs were in their turn defeated and almost exterminated by a new race of invaders, the Tuatha Dé Danann, in a battle fought at Moytura, in Mayo. Nevertheless, the race did not wholly perish, for there long continued to be Firbolg kings of Connaught, and in the time of St Patrick it was in all probability the Firbolgs who constituted the bulk of the population of Ireland.

Firdausí, or FIRDUSÍ, the *takhallus* or *nom de plume* (the term signifies both 'garden' and 'paradise') of Abú-'l Kásim Mansúr, the greatest of Persian poets, was born about the year of the Flight 328 (939–940 A.D.), at Shadáb, a dependent township of Tús, in Khurásán, of a stock of *dihkans*, or petty landholders. He spent the greater part of his life on the paternal estate, wedded to his studies. From his grand epic, the *Shah Náma*, or Book of Kings, he has been styled by European *savants* 'the Homer of Persia.' Among the spoils gained by the Arabs at the downfall of ancient Irán was a complete history of Persia, compiled by order of Yazdajird, the last of the Sassanian dynasty, by the most learned historians, which was presented as a valuable gift to the Calif Omar—the reputed destroyer of the famous Alexandrian library. The calif caused this work to be rendered into Arabic, and luckily did not order its destruction, but left it to its chance among the general plunder, when it fell into the hands of a common soldier. The history of this Pahlavi work for some centuries is obscure, but at length it came into the possession of Mahmúd, sultan of Ghazní, whose court was crowded with the most eminent men of learning from all quarters. Mahmúd ordered Dakíkí, the most illustrious poet at his court, to render the work into Persian verse, but he had not proceeded far with his task when he came to a tragic end. In his fifty-eighth year Firdausí resolved to visit the court of Mahmúd, but it was not easy to gain admission to the presence; yet, in spite of the resentment of the sultan's favourites at the intrusion of a stranger, he contrived, by means of a friend with whom he lodged, to convey to the sultan a specimen of his epic (he had been for years engaged upon the work which the death of Dakíkí had left undone), and the result was an invitation to court. Mahmúd ordered his vazír to pay Firdausí a thousand gold dínars (about £500) for every thousand finished couplets; but the poet, having from early youth had the ambition to construct a canal-dam (*bund*) on his patrimonial estate for the benefit of his townsmen, preferred to receive the accumulated amount when he had completed his poem. The vazír of Mahmúd was secretly inimical to Firdausí, and accused him to the sultan of a decided leaning to the doctrines of Zoroaster; but his efforts as well as those of the other courtiers to undermine Mahmúd's confidence were of no avail, and Firdausí continued to enjoy the royal patronage.

Portions of the *Shah Náma* as they were written were often transcribed and circulated and admired far and wide. It is said that he was offered rich presents from the neighbouring princes, which he constantly declined. The later years of Firdausí's life in Ghazní—he seems to have dwelt some twelve years there altogether—were darkened by the death of his son in early manhood, whom he pathetically laments towards the end of his great epic.

At length, after thirty years' toil, the *Shah Náma* was finished in 398 A.H. (1008 A.D.), and the poet presented his monumental work to Sultan Mahmúd, who at once ordered his vazír to pay Firdausí 60,000 gold dínars—but no copy of the epic extant comprises more than 56,600 couplets, and some of these are evidently interpolations. The envious minister, however, despatched the same number of silver dirhams instead (the value of a dirham is about sixpence) in sealed bags. The poet was in the bath when the messenger arrived. 'On opening the bags, his lofty spirit felt all the indignity which he imagined the sultan intended to load him with. He immediately gave 20,000 to the keeper of the baths (*hammámí*), the same sum to the sherbet-seller, and the remainder to the slave who had brought the money. "I wrote for fame," said he to the slave, "not for the attainment of riches."' When the slave told the whole affair to Mahmúd, he was enraged at the insolence of his vazír, and said: 'This action will not only irritate the poet, but mankind will reprobate a sordid parsimony injurious to my fame. I ordered gold dínars to be sent, and you have substituted silver dirhams.' To this the wily vazír rejoined that whatever the sultan gives confers honour on the recipient, and it was insolent in Firdausí to treat any donation of his majesty with contempt. These and other insinuations ultimately aroused Mahmúd's indignation, and the poet, fearing the consequences, fled on foot from Ghazní, but not before he had composed and left behind him a most scathing satire on the sultan. Tidings of Firdausí's flight and the cause soon spread throughout Asia, and the sultan's conduct was severely condemned by the noble and the learned everywhere. For some time the poet was protected by the Nasir Al-Mutasim of Kohistán, but, he being a dependant of Mahmúd, Firdausí was again compelled to flee, first to Mazandarán and then to Baghdád. The sultan, however, hearing where the poet was residing, ordered him to be sent a prisoner to Ghazní; but the calif, unwilling to deliver Firdausí up to the tender mercies of Mahmúd, and being powerless to withstand the sultan, wrote to Mahmúd to the effect that Firdausí had been at his court and was now gone to El-Yaman; and it was with unspeakable grief that he saw the venerable poet once more become a fugitive. But instead of going to Arabia, Firdausí proceeded to Tús, his native place, where he hoped to pass the remaining years of his life in tranquillity.

The wrath of Mahmúd was at length softened into pity, and he ordered the 60,000 gold dínars to be carried to Firdausí at Tús. 'One day, while the poet was walking in the market-place, as a boy was reciting a verse from his satire on the sultan, he fainted, and was carried to his house, where he expired (411 A.H.: 1020 A.D.), without uttering a word. As his remains were being carried to the grave, the present from the sultan arrived at Tús. It was presented to the poet's daughter, who, contrary to the advice of her aunt, declined its acceptance, saying that, as her father did not receive the present in his lifetime, it would ill become her to accept what he declined.'

The *Shah Náma*, while probably based upon actual historical events, is for the most part composed of mythological and purely fanciful incidents, but these are adorned with all the glowing imagery of the Eastern imagination; while true descriptions of human nature and pathetic scenes are of frequent occurrence—such as, for instance, the fine episode of Rustam (the Hercules of Persia, and the chief hero of the epic) and Súhráb, which is unexcelled in its kind in the poetry of any country. We have an admirable example of fairy lore in Rustam's seven labours to slay the White Demon, in which the hero's horse Raksh ('lightning') plays no unimportant part. The following lines, which occur in the *Shah Náma*—

> Choose knowledge,
> If thou desirest a blessing from the universal Provider;
> For the ignorant man cannot raise himself above the earth,
> And it is by knowledge that thou must render thy soul praiseworthy—

find their very echo in Shakespeare's saying, that

> Ignorance is the curse of God;
> Knowledge, the wing wherewith we fly to heaven.

Besides his immortal epic Firdausí wrote a number of shorter pieces, kasídas, ghazals, &c., which are preserved in several Persian anthologies. He was the first, apparently, to compose a poem on the wife of Potiphar and Joseph, under the title

of *Yúsuf ú Zulaykhá*, a subject which has been a great favourite with many later poets, Turkish as well as Persian.

See Atkinson's epitome of the *Shah Náma*, with numerous passages done into English verse; Sir Gore Ouseley's *Biographical Notices of Persian Poets*; Miss Zimmern's *Epic of Kings*; Robinson's *Persian Poetry for English Readers* (1883); the works of Von Hammer, Wahl, Görres; and Dr Ethé, *Sitzungsberichte der bayrischen Akademie* (1872).—There are many beautifully illuminated manuscripts of the *Shah Náma* preserved in the great European libraries, and the complete text was edited by Turner Macan (4 vols. Calcutta, 1829). In 1811 Lumsden, of the college of Fort William, Calcutta, published a portion of the text. There is a complete French translation by Professor Julius Mohl, with the Persian text on the opposite page (7 vols. fol. Paris, 1838–78; in 7 vols. 12mo, 1876–78). Another edition, based upon seven MSS., entitled *Firdusii Liber Regum qui inscribitur Sohahname*, by Joannes Augustus Vullers, was continued after his death by S. Landauer (vols. i.–iii. Paris, 1877–84).

Fire. Countless stories of fireless men have been retailed by credulous travellers, and there is hardly a primitive mythology which has not woven a web of fable round its origin; not seldom it is ascribed to a special theft from the gods by some greatly daring hero, like the Greek Prometheus or the New Zealand Maui. As far as actual knowledge goes we find that the possession of fire and the art of making it by one method or other have belonged to the vast majority of mankind as far back as we can trace. The original method of finding fire was undoubtedly by the simple friction of two pieces of wood, which was developed by progressive art into more complex and convenient methods. One of the simplest methods in use is what Mr Tylor terms the 'stick-and-groove,' in which a blunt-pointed stick is run along a groove of its own making in a piece of wood lying on the ground. By this means a Tahitian can produce fire in a few seconds. Somewhat similar is the Malay process of striking fire by rubbing together two pieces of split bamboo, which has been conveniently fitted by nature with a siliceous coating. Again, the most widespread method is that to which Tylor applies the term 'fire-drill'—a primitive kind of boring instrument, thus described by Captain Cook from his observations of the native Australians: 'They take two pieces of dry soft wood; one is a stick about eight or nine inches long, the other piece is flat: the stick they shape into an obtuse point at one end, and pressing it upon the other, turn it nimbly by holding it between both their hands, as we do a chocolate-mill, often shifting their hands up, and then moving them down upon it, to increase the pressure as much as possible.' Many improvements upon this simple method are found, as that on the principle of the carpenter's brace used by the Gauchos of the South American pampas; the Eskimo method of winding a cord round the drill, so as by pulling the two ends alternately to make it revolve very rapidly; the Sioux bow-drill, in which a bow with a loose cord is substituted for a simple cord; and the pump-drill, familiar in English tool-shops, and used by the Iroquois to generate fire. The Fuegians strike sparks with a flint from a piece of iron pyrites (Gr. *pyr*, 'fire') upon their tinder—a use which the etymology of the word shows to have been known to the ancients. The flint and steel must have come into use soon after the beginning of the iron age, but its origin in the civilised world is wrapped in the mists of antiquity. Among savage peoples it has made its way along with iron, but has often failed to supersede the fire-sticks. The use of the burning-lens to generate fire was known to the Greeks, and we are told by Plutarch was the method of solemnly reviving the sacred fire at Rome. The last phase of fire-making—by lucifer matches—is fast making even the fire-sticks of the South African savage mere curious relics of the past. A strange survival of the ancient methods is the fire-churning still used in India for kindling the sacrificial fire, and the kindling by *wild-fire* alone of the English *need-fire* and German *Nothfeuer*, through which cattle were driven to avert pestilence down to the 19th century, in spite of the constant opposition of the clergy. The Easter and Mid-summer-eve bonfires, so closely connected with ancient sun-worship, were tolerated and even adopted by the church, but the need-fire was disallowed by Rome; while in Russia, on the contrary, it seems to have been practised under the direct sanction of the parish priests.

The religious history of fire is even more obscure than the history of its production, although everywhere we find that a rich mythology has gathered round the subject. Like all the chief manifestations of natural forces, fire was early personified and worshipped, and we see a similar process of personification and divinisation in the names of the first fire-givers—the Greek Prometheus, the *pra-mantha* of the early Aryans, and in his Chinese parallel Suy-jin. The god of fire possesses generally capricious and variable qualities, as in Loki; now severe and cruel like Moloch and Xiuhtecutli; now beneficent like Hestia, Agni, Atar, Ptah, and Baal Hamman. We find among the Greeks, the Phœnicians, the Egyptians, Slavs, and Mexicans the co-existence of several fire-gods who personify respectively the diverse functions of fire; in the Vedas, on the contrary, we have the notion of the identity of Agni alike in the fire, the sun, and the lightning. Again, the essential identity between life, and fire visible in the sky but latent in everything, is an elemental idea among Romans, Hindus, Persians, Slavs, and Red Indians alike. The phenomena of generation are assimilated to the production of fire, whence fire becomes regarded as the author of life, and its worship is appropriately associated with phallic rites. The human soul is of the nature of fire; and fire, the common element of gods and of their creatures, of beings and things, becomes the soul of the universe, and plays a cosmic rôle as universal creator—a conception as akin to the philosophic mind of Zeno as to the primitive worshippers of Ptah and Agni.

Fire has ever been regarded as the great purifying element *par excellence*, not so much from its devouring properties and its incorruptibility as from its power as the dispeller of the demons of darkness. Hence the universality of belief in its power over evil spirits, and the use of lighting fires upon tombs, as well as of ordeals by fire—a pure agent which cannot harm the innocent. Fire puts to flight specially the spirits which cause maladies, whence the philosophy of magical cauterisation, and of the *need-fire* spoken of above. Fire again is considered as the heavenly mediator, which descends in thunder and remounts in flames, devouring the offering and thus answering the prayers of the priest. From this follows naturally *pyromancy*, the interpretation of oracles by fire, and hence the religious character of the cremation of the dead, seen in the outward act of the apotheosis of a Roman emperor. Lastly, fire is considered as the protector of collective existence, whence the perpetual fires kept burning among various peoples, as by the Roman Vestals, the ancient Peruvians, Mexicans, the Damaras, and the like. Fire was carried by ancient Greek colonists from the sacred hearth of the mother-city, and is still the symbol of union among the red-skins of North America. See chap. ix. of E. B. Tylor's *Researches into the Early History of*

Mankind (1865), and Kuhn, *Die Herabkunft des Feuers und des Göttertranks* (2d ed. 1886); Goblet d'Alviella, *Histoire Religieuse du Feu* (1887); also the articles BELTANE (BELTEIN), ORDEAL, PARSEES, ZOROASTER.

The physics and chemistry of fire in various aspects will be found treated at COMBUSTION, FLAME, HEAT, LIGHT; see also ELECTRICITY, FRICTION, FUEL. Forest fires and prairie fires occur in some regions very frequently, and are often rapid in their progress and most destructive. The rest of this article is devoted mainly to an account of the means of preventing or extinguishing conflagrations and minimising the damage done by them.

Fire-engine, a machine employed to throw a jet of water for the purpose of extinguishing fires. Machines for the extinguishing of fires have been used from a very early date. They were employed by the Romans, and are referred to by Pliny; but he gives no account of their construction. Apollodorus, architect to the Emperor Trajan, speaks of leathern bags, with pipes attached, from which water was projected by squeezing the bags. Hero of Alexandria, in his Treatise on Pneumatics—written probably about 150 B.C.—describes a machine which he calls 'the siphon used in conflagrations.' It consisted of two cylinders and pistons connected by a reciprocating beam, which raises and lowers the pistons alternately, and thus, with the aid of valves opening only towards the jet, projects the water from it, but not in a continuous stream, as the pressure ceases at each alternation of stroke. By some it has been contended that he was not ignorant of the value of the air-chamber.

Little or nothing is known as to the extent to which engines of this kind were practically used. We have accounts of 'instruments for fires,' and 'water syringes useful for fires,' in the building accounts of the city of Augsburg, 1518; and, in 1657, Caspar Schott describes a fire-engine used in Nuremberg, which must have been almost identical in construction with that described by Hero. It had a water-cistern, was drawn by two horses, was worked by twenty-eight men, and threw a jet of water, an inch in diameter, to a height of 80 feet. It was not until late in the 17th century that the air-chamber and hose were added; the first being mentioned by Perrault in 1684, and the hose and suction-pipe being invented by Van der Heide in 1670. In England hand-squirts were used up to the close of the 17th century. They were of brass, and contained three or four quarts of water. A man held the handles at the sides, and pressed the button at the end of the piston against his chest; or two men held the handles at the sides, while a third forced up the piston. The nozzle was dipped in a vessel of water after each discharge, then raised, and the water again forced out. So clumsy an apparatus could have been but of little service in the fearful conflagrations to which our old wood-built towns were subject. By 1730 Newsham in London had made successful fire-engines; the first used in the United States were of his make.

With the addition of the air-chamber and hose, and some improvement in the details of construction, the 'siphons' of Hero became the modern fire-engine. The principle of the action of the air-chamber, and of its connection with the pumps, &c., will be easily understood by the aid of fig. 1, where *a* represents in section a piston ascending, *d* the other piston descending, *f* the pipe or hose communicating with the water-supply, *g* the hose that conveys the issuing stream to the fire, *bc* the level of the water in the air-chamber, *e* the space above filled with compressed air. The rising piston raises the water from *f* to fill its cylinder; the descending piston forces the water contained in its cylinder into the bottom of the air-chamber, and thereby compresses the air in *e*. The pistons rise and descend alternately. The compressed air reacts by its elasticity, and pressing upon the surface, *bc*, forces the water through the hose, *g*. The hose, *g*, may have either a direct opening into the bottom of the air-chamber or through the top, as shown in the diagram; in the latter case the connecting pipe must go nearly to the bottom to prevent the chance escape of the air. In the space *e*, above *bc*, the whole of the air that formerly filled the chamber is supposed to be compressed. Assuming this to be one-third of its original bulk, its pressure will be about 45 lb. to the square inch, and this pressure will be continuous and nearly steady, if the pumps act with sufficient force and rapidity to keep the water at that level. As air may be compressed to any extent—and its elasticity is increased in exactly the same proportion—the force that may be stored in the compressed air is only limited by the force put upon the pumps, and the strength of the apparatus.

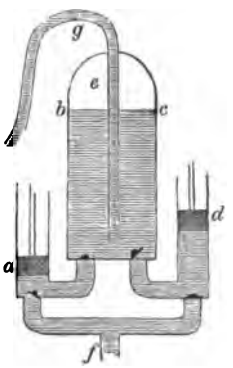


Fig. 1.

There are many kinds of fire-engines, great and small. The simplest consists of a force-pump and a receptacle for water. In the larger engines the cistern is dispensed with, a flexible suction-pipe stiffened with spiral wire being carried directly to the water-supply. The engines used by fire-brigades are usually drawn by two or four horses, though smaller engines are made to be drawn by hand or by one horse. The hose of leather, fastened by metal rivets, has been superseded by rubber-lined canvas, which is strong, light, and flexible.

The 6-inch manual fire-engine of the Metropolitan Fire-brigade consists of a pair of single-acting force-pumps, mounted on a carriage with

Fig. 2.—Messrs Shand, Mason, & Co.'s Railway Platform Fire-engine.

four wheels; at each stroke they discharge 1·63 gallon, whether working at a pressure of 100 lb. to the square inch or of only 2 or 3 lb. They are most effectively worked by about thirty men. Their weight, with implements, firemen, and driver, is about 30 cwt. These are found more convenient

for general purposes than larger engines, as they can be drawn at a gallop by two horses for any distance up to fifteen miles. Four horses are occasionally used for greater distances. The pumps are worked by levers attached to a spindle passing lengthwise through bearings in the carriage frame, and on the spindle is a cross-bar to communicate motion to the pistons of the pumps. The levers are connected lengthwise by long horizontal bars to enable a number of men to work together upon the same pumps. Their principle of action will be understood from fig. 2, which represents a special fire-engine constructed for use in railway stations. It has been selected for illustration as it shows at a glance the arrangement of the pumps, &c., which is alike in all manual engines, except that the air-chamber, *c*, is sometimes differently situated; *a* is the supply or suction pipe, and *b* the discharge or delivery hose.

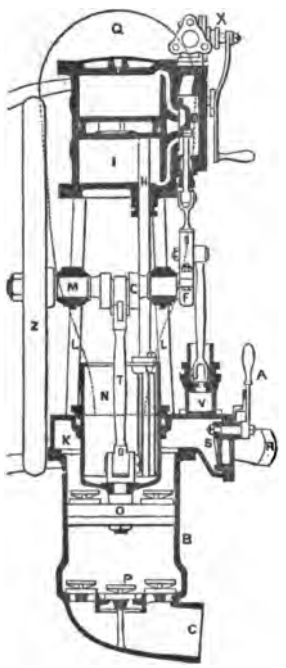


Fig. 3.

I, steam cylinder, the piston of which is connected to the ram or plunger, N, by two rods, one of which is shown at H; the connecting rod, T, transmits motion to the crank, G, producing a rotary motion of the crank shaft, M, on which is fixed the eccentric, F, for working the slide valve, D, and the feed-pump, V; this shaft also carries the fly-wheel, Z. Attached to the ram, N, is bucket, O, in which the india-rubber delivery valves with their guards are shown; P, foot or suction valve; C, inlet to suction chamber; B, pump barrel or water cylinder; K, pump head; L, concentric frame which inflexibly connects the steam and water cylinders; R, two discharge outlets, each of which is commanded by the stop-valve, S, with its lever, A. The starting valve of engine is shown at X, and the copper delivery air-vessel at Q.

The first fire-engine in which steam was used to drive the pumps was that of Braithwaite in 1829; Ericsson made a similar one in New York in 1840. The first application of the steam fire-engine was made when the Argyle Rooms in London were burned in 1830; but it was not till after 1860 that the use of steam fire-engines became effective or common. Floating fire-engines worked by steam came into use on the Thames about the same date.

There is no difference in principle between engines worked by hand and those worked by steam, so far as regards the discharge of water. In ordinary cases hand-wrought engines are the most useful, as they can be set in action immediately. With steam power a certain time is required to get up steam. It is said that steam can be got up in from 6 to 7 minutes; but in practice it is found that, when the boiler is filled with cold water, steam at 100 lb. pressure cannot be obtained in less than 14 minutes. To avoid this delay the water in the boiler may be kept always hot; but if this is done by a constant fire in the fire-box, smoke and soot accumulate to a serious extent. The plan adopted by Captain Shaw, of the Metropolitan Fire-brigade, is to have a removable gas-burner kept burning in the fire-box of the fire-engine. The best fuel is dry shavings, dry firewood, and steam coal. Oil and spirit should not be used, as they leave a deposit of soot on plates and tubes. If the fire is kindled when the alarm is received, the steam may be well up ere the engine reaches the scene of the fire. As a rule, the simplest fire-engine is the best. In the United States steam fire-engines have almost wholly superseded manual engines; and the engines are usually larger and heavier than those used in England. The heaviest American engine, with water in the boiler and men on the engine, weighs over 5 tons, the lightest 2½ tons; those of about 3 tons have of late been preferred. A section of a single cylinder steam fire-engine is shown in fig. 3; the three-cylinder engine is similar in principle, but has no fly-wheel.

Various chemical liquids have been proposed, and to some extent used, as flame-extinguishers. In Germany a cardboard case is used, containing saltpetre, sulphur, &c., which when kindled produce a vapour capable of choking a fire in a closed space. Chemical fire-extinguishers are of various sizes and kinds, but mainly depend on the rapid production of carbonic acid gas, which is an enemy to all kinds of combustion. Water is capable of absorbing large quantities of carbonic acid, which is easily formed by the mixture of acid and alkali. When the gas is generated, its expansion acts as a propelling power, and, the fluid being forced into the flames, the gas in solution is liberated by the evaporation of the water containing it. Glass bottles containing the materials may be hung up in convenient places in factories or dwelling-houses, and these are so arranged that when the bottle is thrown down gas is generated, and tends directly to smother the flame. A portable fire-extinguisher, called the extincteur, is a cylindrical tank made so that it can be carried on the back, containing some 7 or 8 gallons of water. An internal handle is acted on by a lever from the outside, and breaks a bottle of acid when it is required for use. The combining of the elements give off carbonic acid gas sufficient to produce a pressure of from 70 to 100 lb. per square inch on the water, which may be discharged to a distance of 50 feet. Chemical engines on carriages are also in use in the United States and Germany, which carry each two tanks of water (80 gallons), carbonate of soda dissolved in the water, and sulphuric acid in a separate tank, which is mixed with the soda and water, so as to produce carbonic acid in sufficient quantity to give a pressure of 140 lb. In Berlin the steam-engines have tanks filled with liquid carbonic acid, which is liberated so as to expel the water until the steam has been got up. Another chemical contrivance discharges hydrochloric acid and ammoniacal gases. In the early stages of a fire even pails and buckets may be most serviceable; and where the water-supply is very good the hose may be attached directly to the fire-plug or hydrant without any engine.

Fire-brigades.—For working fire-engines a body of firemen are required. The fire-insurance companies formerly had separate establishments of fire-engines and firemen; but in 1825 some of them united, and by 1833 all the important companies combined, and the London Fire-brigade was formed under the management of Mr Braidwood, whose death in the discharge of his duties at the great fire in 1861 was justly deplored as a national loss. In 1865 an act of parliament empowered the Metropolitan Board of Works to take over the engines and appliances of the London Fire-brigade establishment; to secure the services of the brigade men; to construct additional engines and stations; to map out the metropolis into convenient districts; and to cause the firemen to act in harmony with a

salvage corps. The men of the brigade wear a uniform, with strong helmets and metal epaulets to protect them from the blows of falling beams, &c. The courage and skill of the men in making their way through and about burning buildings, for the purpose of directing the stream from the hose, or for saving life and property, and the general efficiency of the whole organisation are worthy of the highest praise. The insufficiency of the London water-supply sometimes frustrates the exertions of the firemen. Most provincial towns now have a fire-brigade upon the London model. The fire-brigade is supplemented to some extent by the police, the water companies, and the insurance companies' salvage corps, as well as by helpful members of the public. For the protection of London, with its area of 121 square miles, its 500,000 houses, and 4,000,000 inhabitants, there was, in 1889, a force of 591 firemen of all ranks, 83 coachmen and pilots, 131 horses, 150 fire-engines (of which 55 are worked by steam), 155 fire-escapes and other long ladders, and 33 miles of hose. The number of calls received during the year 1888 was 4228, of which some proved to be false alarms, some were only alarms for chimneys, and the remainder, 1988, for actual fires. The number of persons endangered by fire was 178, of whom 130 were saved and 48 lost their lives. Of the 48 lost, 28 were taken out alive, but died afterwards. The quantity of water used was 9,000,000 gallons. The cost of the brigade for the same year was £122,000. In 1889 the London County Council resolved at once to augment the fire-brigade by adding 138 firemen, 4 new stations, with steamers and manuals, and 50 fire-escapes; and to increase the electrical alarms to over 600.

The city of Manchester has an area of 5927 acres, with a population of about 400,000. The Manchester Fire-brigade protects besides the districts beyond the city, with an area of 17,000 acres and a population of 185,000. The brigade consists of 51 men permanently employed; and in 1888 it attended 389 fires in the city and 37 beyond it. The Liverpool Fire-brigade protects 5300 acres and 604,465 persons, and comprises 7 officers and 9 firemen wholly employed in fire-brigade duties, besides 204 police-constables drilled as firemen. There are four steam fire-engines and two manual ones. The average number of fires in Liverpool in 1878–88 was 198 per annum. In Glasgow the protected area is 5920 acres, with a population of 551,435; there are 51 permanent firemen, and 20 auxiliaries from the police, 7 steam fire-engines, and 9 manual ones. In 1888 the brigade attended 422 fires.

In America all the fire departments were formerly voluntary; but this plan was gradually abolished in most large cities, and replaced by carefully organised paid departments. Americans are justly proud of their well-equipped firemen, to whom is assigned on public occasions a prominence unknown in Britain. The paid fire-extinguishing corps of the United States are generally organised into companies of from six to twelve officers and men each, equipped with either a steam fire-engine and hose-tender or a chemical fire-engine (called engine companies); or with a hose-carriage only (called hose companies); or with a hook-and-ladder truck (called hook-and-ladder companies). Permanency of position, dependent on good conduct, was first assured to the members of the fire-extinguishing corps in 1867. The fire-extinguishing corps in the United States are usually superior in size, number, and capacity of engines to those of most other countries; though the rapid growth of American cities is apt to produce a lack of organisation and carelessness. The New York fire department has long been regarded as a singularly perfect institution, and has practically a military organisation, under three commissioners appointed by the mayor. The men are constantly on duty, save when on parade or at their meals, and do duty in barracks beside their engine and ladder. The horses stand facing the engine, are loosened by an automatic electric arrangement when the warning is given, the harness ready suspended above them drops on their backs, and in a few seconds they may be harnessed to the engine, which is supplied with water at boiling heat from stationary boilers. The corps of many other cities of the Union are also famous for organisation, discipline, and efficiency.

The hook-and-ladder, or scaling-ladder, which is an important item in the fireman's apparatus in New York and many other cities of the United States, is a pole about 12 feet long, with projections on both sides to serve as steps, and at the end a long hook nearly at right angles to the pole. Fixing one of these in the lowest window of a building, a fireman ascending to the top of it can fix a second ladder in the window of the next story; and so by using alternately the one and then the other scaling-ladder can reach the top of the highest building. Scaling-ladders have been used in connection with fire extinguishing in France for upwards of a century. In the United States these scaling-ladders were first adopted in St Louis; but the example was not lost on New York, which in 1885 had 14 per cent. of its buildings so high that the windows of the top floors could not be reached by the longest 'extension ladders' in use. The 'jumping sheet,' designed to catch persons falling or jumping from a height at fires, is usually made of canvas, with rope handles along the edges for holding it stretched out. The 'water tower' has also come to be in many American towns regarded as a valuable adjunct to the flexible hose, or substitute for it. It is a long length of iron tubing planted vertically on a carriage, and capable of being extended to the height of the topmost window of any house. The tower is connected beneath with the water-supply; and a nozzle at the top, at right angles to the tube, discharges solid water from close quarters with more effect than spray from a distant hose.

The following table, prepared by Captain Shaw for his *Fires and Fire-brigades* (1884), shows comparative data as to ten of the most important cities of the world in 1882:

City.	Area in sq. miles.	Estimated Population.	Cost of Maintenance of Fire-brigade for 1882.	Total Number of Firemen.	Number of Fires, exclusive of False and Chimney Alarms.
Berlin	29	1,123,000	£69,200	765	543
Boston	37	400,000	96,191	668	349
Brooklyn	22	650,000	72,701	256	151
Chicago	36	503,300	109,004	397	919
Cincinnati	25	269,000	41,330	172	280
London	121	3,816,843	103,458	576	1926
Montreal	6	140,747	11,319	68	226
New York	42	1,206,299	335,816	826	1273
Paris	30	2,269,023	80,624	1742	982
Vienna	..	1,103,960	20,000	180	358

It will be noted that London, with a population of near four millions, and property calculated at fourteen hundred millions of pounds, had but 576 firemen, and spent on its brigade only £103,000; while New York, with one-third of the population, spent £335,000.

Fire-alarms, &c.—Throughout many cities and towns are established electric fire-alarms—boxes placed in conspicuous places, at corners of streets, &c., which are connected with the fire-engine stations, and may be made to act by pressing a button or pulling a handle, after the glass covering the apparatus has been broken. There are also alarm boxes which are arranged to act of themselves when the heat of a fire touches them, by means of the expansion of a spiral strip of metal under the influence of the increasing temperature of the room or place where it is fixed.

When a fire is discovered by a policeman or a passer-by, the alarm will in some way be communicated to the fire-engine station as swiftly as possible. The bell is rung, and the men on duty, as soon as they feel sure it is a real appeal for help, immediately harness the horses to the engine and start. The start should, according to circumstances, be made in from one to four minutes after the alarm is received; the pace of the horses should be a mile in four minutes with good horses. On a warning to a fire-escape station at night, the firemen in charge should in less than one minute be moving towards the fire with the escape, at a rate of six miles an hour.

Among appliances that are or may be carried by firemen are axes, mattocks, ladders, canvas buckets, lamps, saws, &c. And the firemen may to a certain extent be helped to breathe in a room full of dense smoke by various devices, such as a breathing-tube, a portable bag of air, a smoke-cap (a kind of respirator or air-filter), a smoke-jacket of cowhide with an air-tube from the engine, or even a complete diver's dress of the Fleuss type (see DIVING).

Fireproof Buildings.—The problem of constructing warehouses, dwelling-houses, &c. that shall be proof against all risk of conflagration has not yet been solved. The liability to conflagration may be greatly diminished by the construction of a building, but cannot be entirely averted; and therefore, in all 'fireproof' buildings containing furniture or other combustible materials of any kind, the ordinary precautions against fire should be strictly observed. Unless this be understood, a so-called fireproof building may be more dangerous than an ordinary one, especially in warehouses, &c. intrusted to the care of watchmen and others, who, relying upon the supposed immunity the name expresses, are liable to neglect many precautions they would not fail to observe in a building believed to be dangerous.

The nearest approximation to fireproof construction may be obtained as follows: The walls should be of stone or brick, and any ties, lintels, &c. required in the construction should be of iron. Wherever wood is inevitably used, it should be prepared with silicate or tungstate of soda, or dissolved alum. Brick arches of small span thrown between iron girders form one of the earliest kinds of fireproof flooring. But experience has shown that, in different ways, both wrought-iron and cast-iron beams are frequently destroyed in the case of a building taking fire. By Whichcord's method the metal girders are incased in fireclay blocks. Measure's patent fireproof flooring consists of iron girders, 3 to 4 feet apart, resting on the lower flanges of which are placed ⊥ iron fillets at intervals of 9 inches. Concrete is then filled in between the girders, and supported by centering until it sets. In Dennett's system concrete arches are thrown between iron girders. Northcroft's flooring is constructed by forming flat arches of specially moulded firebricks. Each arch is double or in two rings, slightly apart, and with the space between them filled up with cement. The arches rest on fireclay skewbacks, which inclose the supporting iron beams. The roof should be constructed in like manner, wooden rafters being entirely excluded. The doors should be of iron, and the security would be much increased if the doors between any two apartments containing combustible materials were double, with a space between them equal to the thickness of the walls. Of course, it is not practicable to carry out all these precautions in a dwelling-house, but the danger from fire may be considerably diminished by attending to some of them. The most important conditions for a warehouse are that each apartment shall be separated from the next by stout walls of non-conducting materials, and more especially that each shall be as nearly as possible air-tight; and whenever, from the nature of the goods, ventilation is required, it should be obtained by periodically opening the doors and windows. If the apartments are air-tight, any fire will extinguish itself, unless there be along with the combustible goods some oxygen-giving substance, such as saltpetre, chlorate of potash, or other nitrates or chlorates.

At first sight it may appear that a warehouse built entirely of iron would be effectually fireproof, but this is far from being the case. In the first place, iron conducts heat more readily than any other material used in building; secondly, cast-iron is liable to crack and split when suddenly heated or cooled. Iron supports may, under some circumstances, be even more objectionable than wood, for if the water from a fire-engine were to play upon a heated cast-iron girder it would probably give way immediately, while a stout wooden beam might have the fire in it extinguished before it was burned through. In great fires the heat is sufficient to fuse iron.

In most civilised countries there are laws regulating the building of houses, so as to render fires less likely and destructive. The theory of all such laws is that the materials and modes of construction should themselves prevent the spread of fire without the presence of firemen; but these laws are very seldom rigorously enforced, and are often defied with impunity.

But even the most perfect fireproof buildings may become dangerous by reason of their contents. Thus, all explosives and combustibles require special care and superintendence. Many manufactures are essentially dangerous, as when oil is largely used. And it is known that spontaneous combustion may positively take place when considerable masses of lampblack, tow, linen, paper, cotton, calico, woollen stuffs, hemp, wood ashes, or ochre are slightly soaked in oil, and packed so that the air has access to them, especially if reached by the moderate warmth of the sun.

Many terribly sudden and fatal conflagrations in theatres have proved that they are, and inevitably it may be, specially exposed to risk from fire. Among valuable precautions are a strong iron screen to let down, so as wholly to separate the stage (where the fire usually begins) from the auditorium; wide passages leading directly to the exit doors; numerous doors easily opened and made to open outwards; illumination not by gas but by electric light; as well as the ordinary rules of safety applicable to all buildings. Fires on shipboard, unless discovered and checked at an early stage, are wont to be specially disastrous.

Sprinklers.—Amongst precautions against fire, attention has been much directed to ***sprinklers*** con-

nected with the water-supply distributed throughout a building. Some of these are turned on by hand, others are automatic. It is claimed for one of these automatic sprinklers that it will discharge water whenever the temperature around it reaches 160° F. When the temperature rises to 160°, the solder joint melts rapidly, the valve seat is withdrawn, and the valve, falling down, makes a deflector for the distribution of water in a spray. Early forms of sprinkler were rose-heads, or hollow perforated bodies; but it was found that the perforations were stopped by dust, or, when in action, by sediment in the pipes. Some sprinklers are arranged to act by means of a thread which burns when the heat becomes sufficient, and so releases the discharge. Lines of horizontal distributing water-pipes (connected with the public water-supply, with a tank on the roof of the building or on a tower) are carried through the building, near the ceilings, from 8 to 10 feet apart, and the sprinklers are attached to these pipes, one to every 10 feet.

Fireproofing.—There are many means by which fabrics may be prevented from flaming, their combustion being reduced to a slow smouldering. By moistening the fabric with a solution of any saline substance, which, upon drying, will leave minute crystals deposited in or between the fibres, its inflammability will be greatly diminished; but the salt imparts a degree of harshness to the fabric. Alum, sulphate of zinc, and sulphate of soda are effectual to prevent flaming, but weaken the fibre. Common salt does the same. Phosphate and sulphate of ammonia are less objectionable on this account, but the former decomposes by contact with the hot iron in ironing. Tungstate of soda is said to have no injurious effect on the fibre. Sulphate of ammonia, chloride of ammonium (sal ammoniac), and borax are among the best fitted for domestic use, though they are not unobjectionable. For made-up clothing, borax is, perhaps, the best, as it is most effectual in its action, and is the least injurious to the appearance of the article, though it is stated to have some weakening effect on the fibre. Wood has been treated in a similar manner. Milk of lime, alum, sal ammoniac, sulphate of ammonia, chloride and sulphate of zinc, sulphuret of lime and baryta, &c. have been used, and its *inflammability*, but not its *combustibility*, is removed. The most efficient protection to wood is silicate of soda. If planks of moderate thickness be brushed three or four times over on each side with a strong solution, they are rendered absolutely uninflammable and almost incombustible; they will only burn when very intensely heated. The silicate fuses and forms a glass which envelops the surface, and even the internal fibres of the wood if it be sufficiently saturated, and thus seals it from the oxygen of the air. But it seems necessary that the saturation should be periodically repeated if the process is to retain its effect. Asbestos paint is serviceable to some extent, but is apt to peel off (see ASBESTOS).

Fire-escapes.—An immense number of contrivances have been at different times proposed for enabling people to escape by windows and house-tops from burning buildings. They are of two distinct kinds—one for affording aid from outside, and the other for enabling those within the house to effect their own escape. Of the latter the simplest is a cord that should be firmly attached to the window-sill of every sleeping-apartment, and coiled up either in a box on the floor or under a dressing-table or other suitable place. A rope one-quarter or three-eighths of an inch thick, and knotted at intervals of about a foot, is well adapted for the purpose. A man with tolerable nerve may let himself down by means of such a cord, either by placing his feet against the wall and working down by holding to the knots, or by clinging with his feet and knees to the rope as well as with his hands. A man may let down a woman or child by means of a sack at the end of the rope, or simply by fastening them to the end, and letting the rope pass through his hands, aided if necessary by the friction of the rope on the window-sill. In American cities large tenement-houses are commonly provided with a permanent fire-escape in the shape of iron ladders running up the back of the building, with light iron balconies at each story.

Fire-escapes to be used from without consist either of simple ladders kept in police-offices or other convenient stations, or a series of ladders that can be jointed together; of poles with baskets attached; of ropes with weights at one end, that they may be thrown or shot into windows; of combinations of ladders, ropes, bags, baskets, nets, &c.

But what is usually known as a fire-escape is a ladder mounted on a carriage with four wheels. Fire-escapes are of various patterns, but the best are very like one another. The fire-escape generally used by the London Fire-brigade (fig. 4) consists of a main ladder, the sides of which are

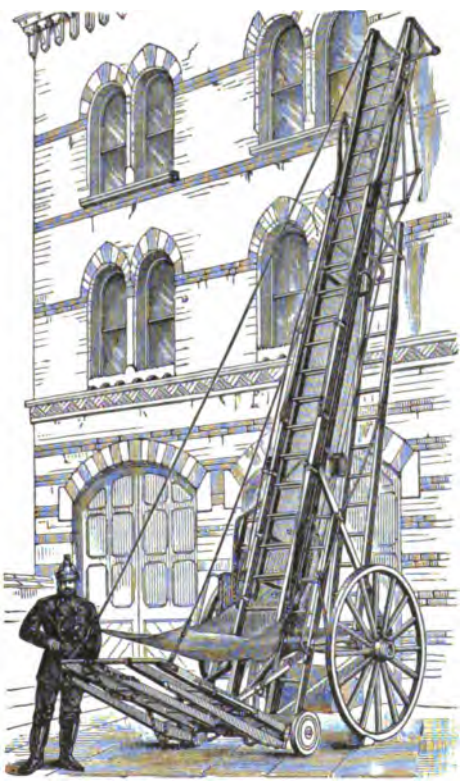


Fig. 4.
Messrs Shand, Mason, & Co.'s London Fire-escape.

strengthened with patent wire-rope, and fitted with an uninflammable trough of copper-wire netting, in which persons may slide with ease and safety from a window to the ground; a fly-ladder, jointed to the main ladder, along which it lies when not in use, and raised when required by ropes and levers; a third or detached piece called the first-floor ladder, which when not in use is carried under the main ladder, but can be jointed to the end of the

fly-ladder; and a fourth piece known as the supplemental length, which can be added when the greatest total height (60 feet) is required. The whole is mounted on a light carriage with springs and high wheels, and can be moved anywhere by two men. The fly-ladder is constructed so as to be immediately detached for use in narrow courts, alleys, &c., or it can be used as an independent means of escape when not required on the main ladder, forming with the detached ladders four distinct means of escape from burning buildings. When required, the fire-escape is run to the burning house, the main ladder standing nearly upright all the while. It is then directed to the required window at a considerable inclination, and the fireman ascends the ladder, and either helps the inmates to descend by it, or, if they are unable to do this, he lets them down by the trough, which forms an inclined plane along which they may easily and safely descend with the aid he is enabled to afford them.

Notable Fires.—The following is a list of notable fires:

A.D.	
64.	Rome burned for eight days; five-sevenths of the city destroyed.
1086.	London.
1212.	London.
1666.	London, the Great Fire, September 2–6; 436 acres swept; loss, £10,750,000.
1794.	London.
1812.	Moscow fired, September 14–20; loss, £30,000,000.
1835.	New York, December 16; loss, £3,000,000.
1842.	Hamburg, May 5–7; loss, £7,000,000.
1845.	New York, July 20; loss, £1,500,000.
1861.	London, Tooley Street, 22d June to 22d July; loss, £2,000,000.
1871.	Paris, Communist outrages in May; loss, £32,000,000.
1871.	Chicago, October 8–10; over an area of 2124 acres; loss, £39,000,000.
1872.	Boston, U.S., November 9–10; loss, £15,000,000.
1882.	London, Wood Street, December 8–10; loss, £1,000,000.

BIBLIOGRAPHY.—See Dana, *The Fire Department in the United States* (Boston, 1858); Young, *Fires, Fire-engines, and Fire-brigades* (1866); Roper, *Handbook of Modern Steam Fire-engines* (1876); Magirus, *Das Feuerlöschwesen* (Ulm, 1877); Capt. Eyre M. Shaw, *Fire Protection: Manual of Organisation, Machinery, Working, &c. of the London Fire-brigade* (new ed. 1889), as also his *Records of the late London Fire Establishment, Fire Surveys, Fires in Theatres*, and *Fires and Fire-brigades*.

Firearms. The generic term 'firearm' includes Cannon, Rifles, Guns, Revolvers (q.v.), and other weapons in which an explosive is used as an agent for the propulsion of projectiles. The history of the invention of Gunpowder (q.v.) is an appropriate prelude to that of firearms, the existence of the latter being wholly dependent upon the discovery of a certain recondite quality in the former.

Inflammable material has been employed in warfare from remotest antiquity; sulphur and resinous gums were the ingredients of some, and naphtha and bituminous substances with nitre of other, of the mixtures known to the ancients as 'Greek fire,' 'wild-fire,' or 'Medea's oil;' but the vessels in which these inflammable compounds were deflagrated cannot properly be termed fire-arms.

A weapon of the pyrotechnical species was developed by some of the eastern nations, and is said to have been used extensively until the 15th century for the frightening of horses and cattle on pillaging expeditions and in warfare. The weapon was in construction similar to a 'Roman candle' of the pyrotechnists, the inflammable filling of Grecian wax and metal filings being alternated with layers of gunpowder and balls of tow mixed with sulphur; the weapon was lighted at the muzzle, and as the 'filling' burned down, the balls were shot out by the gunpowder immediately beneath them.

The knowledge of gunpowder and firearms may be presumed to have extended in a westerly direction through the Arabs, who used them in the 8th century under the name of 'manjaniks,' and introduced them into Spain in the 13th century. Seville was defended in 1247 by cannon throwing stones; Niebla in 1259; and in 1273 Abu Yusuf employed cannon firing stone balls at the siege of Sidi-Moussa, near Algiers. Ghent possessed a small cannon in 1313, and Florence ordered cannon and *iron* balls about 1325. In Germany, Amberg possessed a cannon in 1301, and in 1327 the English employed some Hainaulters, who used cannon for King Edward III. against the Scotch. Cannon were used in 1339 at Cambrai, in 1340 at Mirepoix, in 1345 at Monségur, in 1346 at Crécy. In 1350 some North German knights armed themselves with *iron* guns, and in 1365 Einbeck was very effectually defended with the aid of firearms.

Different countries had different names for these early firearms—in Italy 'bombardo,' in France 'quenon,' in Germany 'buchsen,' in the Netherlands 'vogheleer,' in England 'crackeys' or 'engynnes' of war; but it was not until the 15th century that firearms were classified and named accordingly. *Bombards* were short, capacious vessels, from which stone balls were shot with small charges to a short distance and at considerable elevation; they were essentially the parents of the present bombs or mortars. The *cannon* (*canna*, 'a reed', on the other hand, were, for some time at least, of extremely small bore, scarcely larger than muskets of the 18th century; they discharged leaden bullets, and would have probably been used as hand-weapons but for their cumbrous and heavy workmanship, which necessitated small carriages. Arms of this description are doubtless those referred to as having been brought by Richard II. to the siege of St Malo, to the number of 400 pieces, where they are said to have kept up an incessant fire day and night on the town *without* success.

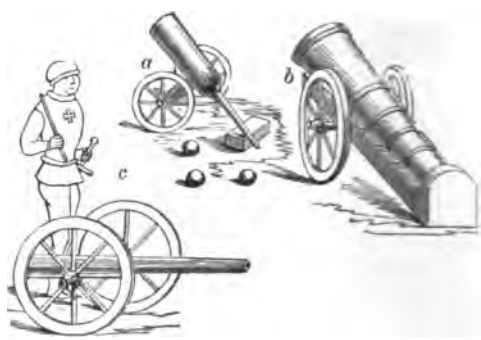


Fig. 1.

a (from the *Chroniques de St Denis*), 14th century; *b*, bombard of the 15th century (from Froissart); *c*, cannon of the 15th century (from *Les Vigiles de Charles VII.*).

All these early firearms were usually loaded to the muzzle, and fired at an extreme angle. Charles V. classed mortars separately, mounted cannon upon carriages, added trunnions, and effected other improvements in his artillery, which consisted of cannon; great, bastard, and small culverins; falcons and falconets. The classification of firearms led to the development of various types to be used for specific purposes, and an invention which effected a great improvement to one type was useless or inapplicable to another. Cannon of 120 tons and pocket-pistols of 4 ounces, although they have a common origin, have not a common history. Cannon were of wrought iron, built up

by the handicraft of the smith, of rods and rings, and were used as they left his forge. Cannon of a copper and tin alloy were cast at Augsburg in 1378; they have since been made of hollowed blocks of stone; or cylindrical holes, bored in the solid cliffs, have been used to fire projectiles, as at Alexandria, Constantinople, and Gibraltar; they have been made of wood, of rope, of leather, and of papier-maché, as well as of almost every pure and alloyed metal it is possible to cast or forge. The early cannon were chiefly used at sieges, as their weight and the badness of the roads, added to the inefficiency of the weapons themselves, precluded their advantageous use as field-pieces, and if utilised in a pitched battle they were fired but once. But on the one hand the development of cannon into small portable weapons produced hand firearms, and on the other the increase of size and weight led to the large weapons so important for the defence of fortifications. Of this type the 'Mons Meg' of Edinburgh Castle is an early specimen; it weighs nearly 4 tons, and fired a stone shot of over 300 lb. The powder-chamber is of a less diameter than the bore of the cannon, in this particular resembling the mortar, and exhibiting the reverse of the principle of enlarged powder-chamber now employed. Such cannon were made at Ghent in the 15th century.

The culverin, a useful size of cannon, was employed generally in England until after the Commonwealth. Culverins fired stone shot, iron balls, leaden bullets, and composite projectiles—a leaden jacketing being cast round uneven stones to make them heavier, and the better to fit the interior of the cannon. Such culverins and projectiles were made by the blacksmiths of Deritend, Birmingham, in the 17th century, and were used at the battle of Worcester.

Fig. 2.—German Breech-loading Cannon of the 16th century.

Field-pieces were not greatly developed until the 18th century, when the improved finish of the interior allowed of long and uniform ranges, and a certain definite accuracy being obtained. The breech-loading field artillery are now of a high degree of excellence; but whether firing shot or shell the limit of power will be found in recoil, as is the limit of accuracy in the correctness of the aim.

For defensive purposes, as well as for certain offensive operations, special arms were required and constructed: of these the long-barrelled wall-pieces for defence; the 'petard,' and *mortars* firing bars, oblong and square bullets, for making a breach; explosive shells and grenades for clearing a trench; grape and chain shot for mowing down compact squares of infantry or destroying the rigging of battle-ships, are the best known. From the 'orgue de bombardes,' another type of early firearm, the quick-firing, many-barrelled machine guns have been developed. The earliest form of this weapon is the 'ribaudequin,' of Italian origin, which consisted of a number of small cannon and pikes arranged upon a portable carriage; it was fired but once during an engagement, and was primarily intended as a defence against a cavalry charge. The 'orgue de bombardes' (fig. 3), with more cannon (fired simultaneously) and fewer pikes, succeeded the ribaudequin.

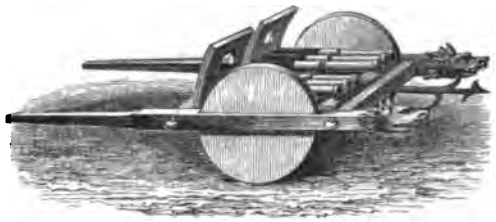


Fig. 3.—French Orgue des Bombardes.

Further developments survived into the era of percussion firearms.

With the cannon and quick-firing machine guns, the improvements have depended less upon the ingenuity of inventors than on the achievements of mechanical science to accomplish accurate workmanship, and work great masses of material as skilled workmen can handle smaller pieces. The improvements in explosives, in the quality of the metal, and in the machinery available, have rendered possible the production of such immense weapons, that the limit of size would appear to be rather in the cost of manufacture and the enormous expenditure risked upon the aim, than in the inability of modern mechanicians to produce still larger and more powerful weapons (see CANNON).

The development of the hand firearm, on the contrary, called for the ingenuity of the handicraftsman, and at first this ingenuity was exercised in the combination of a firearm concealed with some other weapon, so that its firing unexpectedly

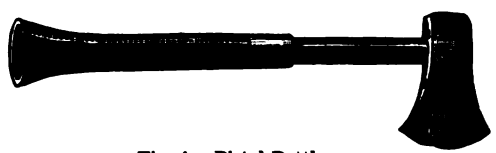


Fig. 4.—Pistol Battle-axe.

should produce a consternation; and for the same reason repeating and double-barrelled weapons were produced. Firearms were incorporated with daggers, swords, pikes, clubs, maces, axes, and shields; and it was the use of these devices by cunning warriors that disgusted the knights and led to their loss of prestige, and hastened the decay of feudalism. The hand firearms owed their success quite as much to the consternation caused by their unexpected discharge as to the execution done by their projectiles: hence Montaigne wrote in 1585, when the muskets in use were much superior to the earlier culverins, that their effect, apart from the shock caused by the report, was so insignificant that he hoped the use of them would be discontinued. It was as a surprise weapon that Neapolitan brigands and French postillions were armed with whips, the handles of which were cunningly devised and well-hidden pistols.

The culverin or hand cannon was a small tube of $\frac{1}{2}$ or $\frac{3}{4}$ inch internal diameter, fixed to a straight piece of wood or welded to an iron handle. At the close of the 15th century they were extensively used. In 1471 culveriners were in the army of Edward IV. after his landing at Ravenspur, Yorkshire; and hand firearms were used at the siege of Berwick in 1521. The smallest hand-culverins—about 4 feet in length and weighing 15 lb.—were used on horseback; heavier weapons up to 60 lb. weight were used

by the foot-soldiers. The culveriner was attended by a 'varlet' to aid in firing the piece, which was always supported upon a forked rest. The arquebus

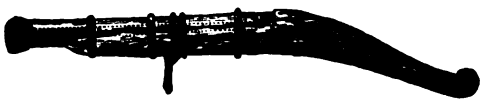


Fig. 5.—Early Hand-culverin.

was a smaller and improved culverin, requiring but one man. Grose writes of the equipment of the culveriner: 'He had, in addition to the unwieldy weapon itself, his coarse powder, for loading, in a flask; his fine powder, for priming, in a touch-box; his bullets in a leathern bag, with strings to draw to get at them; whilst in his hand were his musket-rest and his burning match.'

The touch-hole of the culverin was in late patterns placed in the side, instead of on the top as with cannon, a flash-pan was added, and early in the 16th century the serpentin or lever to hold the burning match was invented, and the match-lock quickly followed. In the best *matchlocks* the flash-pan was covered with a hinged lid, and the serpentin was forcibly thrown upon the touch powder in the flash-pan by a spring; but in the ordinary types the burning slow match was made to descend by pulling the lower end of the serpentin towards the stock. From the matchlock arquebus came the hagbut, hackbutt, hackenbuse, and the musket, which was originally a heavier weapon, and carried a double bullet. These early firearms were loaded with difficulty; at Kissingen in 1636, and at Wittenmergen in 1638, the musketeers fired seven shots in eight hours, which is accounted for by the fact that musketeers were harassed by the opposing cavalry

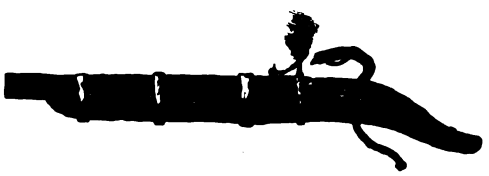


Fig. 6.—Early Matchlock-gun.

and archers, and that the loading had to be effected whilst the forked-rest was attached to the wrist by a short thong, and the soldier 'in skirmish doth charge his musquet afresh, and train his forke or staffe after him.' The matches of slow burning fuse, even when carried in the hat, or in a perforated metal case at the girdle, gave much trouble, especially in wet and foggy weather, and at the battle of Dunbar (1650) the English musketeers were unable to retain their fire on account of the weather. The *wheel-lock* originated from a gun in which pieces of pyrites were placed near the flash-pan, and the igniting spark was produced by the friction of a file rubbed against them. In the wheel-lock the flint is held in the flash-pan by a spring pressing against the opposite extremity of the lever to the one in which the flint is fixed; in the flash-pan is a grooved wheel with serrated edges, which is rapidly rotated by a chain and flat or V spring, or as is the drum of a watch. The wheel was wound up as in a watch, with a movable key, and was released upon the trigger being pulled; its rapid rotation against the flint firmly pressing upon it produced a stream of sparks instantly, and made ignition more certain. The wheel-lock was produced in Germany early in the latter half of the 16th century, and with its introduction the use of firearms for sporting purposes became more general.

The *firelock* or flintlock, more common than the expensive wheel-lock, was produced in Spain about 1625, as a cheap substitute for the wheel-lock. In the flintlock the *hammer* or cover-plate to the flash-pan is knocked backwards by the blow of the flint screwed in the jaws of the *cock*, and, uncovering the priming in the flash-pan, exposes the touch powder to the sparks produced by the flint grating against the steel face of the hammer. The early flintlock was clumsy, simple, and inefficient; it is said to have been produced by marauders, to whom the burning match of the arquebus was dangerous as betraying their presence; and, roughly made, it did not answer as a military weapon so

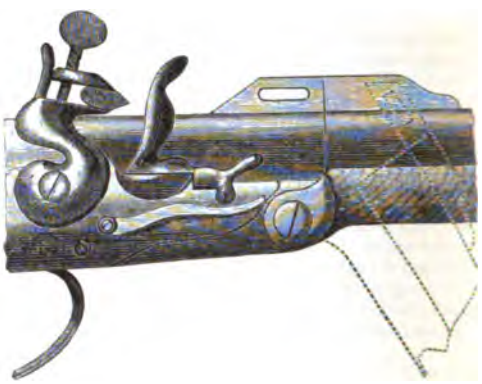


Fig. 7.
French Flintlock Breech-loader, 18th century.

well as the matchlock. Improvements in the latter half of the 17th century caused its more general adoption. It was common in the Netherlands, and was introduced into the English army in the reign of William III., and remained in use until 1840; the last firelocks supplied to the British government were for use abroad, and were made in 1842. The firelock or flintlock musket is still an article of commerce, as it can be used wherever there is a supply of powder and lead. The flint-lock in its highest degree of perfection was manufactured in London as a double sporting weapon at the beginning of the 19th century.

Pistols were developed from the small hand cannon termed 'poitrinal,' and were made in 1540 by Camillio Vettelli at Pistoia. They were used as *concealed* weapons, the German Ritters being the first to adopt them for military purposes. At the battle of Renty in 1554 the Ritters defeated the French through a manœuvre termed 'caracole,' in which the pistols played the most important rôle. The pistols, from having short barrels and heavy, clumsy butts, improved into successful cavalry arms when furnished with wheel-locks, and they were generally adopted as an auxiliary weapon. Double and four-barrelled pistols were common in the 18th century, and the revolving pistol, termed the 'pepper-box,' preceded the introduction of the modern revolver by Colonel Colt (see REVOLVER).

As a triumph of handicraft and exact workmanship the duelling pistol is without a rival, and the twenty-pace pistols firing a large bullet with a small charge of powder, as made in Paris at the present time, are not to be equalled as weapons of precision by any firearm extant. The revolver has superseded the pistol entirely for military and police purposes in civilised countries, but the revolver will in its turn have to make way for a magazine or repeating pistol.

Many of the early cannon hand-forged from rings and bars were breech-loading, the system employed being that of the movable breech-block,

secured in position during the discharge by hammer-driven wedges; or a through pin uniting the block with the breech frame of the cannon. Such weapons date from the 14th century, and similar weapons formed part of the equipment of the *Mary Rose*, which foundered about 1545. Small-arms intended for the use of illustrious persons were occasionally made breech-loading. In the Tower collection is a musket which closely resembles the modern Snider in its breech mechanism, and this remarkable specimen of an efficient breech-loader is said to have belonged to Henry VIII., whilst several other varieties of arms having a movable breech-block were made prior to his reign. Small-arms and cannon with detachable breech-plugs—in which the charge was placed and fired—were made in the 16th century, and before its close breech-loaders with hinged barrels had been introduced. The hinge was usually at the joint, as in the weapon illustrated (fig. 7), and not a couple of inches forward of it, as in the Lefaucheux and other modern developments of the sporting gun. The 17th and 18th centuries were particularly prolific in the production of breech-loading mechanisms, but, owing to the absence of a cartridge containing its own ignition, none were successful until revived after the introduction of the percussion cap.

Amongst the early manufacturers of arms who aided the development by their handicraft or invention the Italian and Spanish smiths deserve mention; the accurately forged barrels of Nicolas Bis, and the fine workmanship on the pistols of the Comminazzo family, cannot be surpassed. Köllner of Vienna, and Kotter of Nuremberg, produced rifling; and Lazarino, Dax, and Nereiter improved the appearance and handiness, and added to the utility of firearms by minor inventions. The wheel-locks were neither manufactured nor used extensively out of Germany and Italy, but the Saxon collection in the Dresden Museum indicates the importance with which the invention was once regarded. The most curious arms were manufactured in Paris, Amsterdam, Hanover, Liége, and Lisbon, and later at the Moscow arsenal.

That necessity is the mother of invention has never been more truthfully demonstrated than by the development of firearms. The wars in Flanders and Germany during the middle ages quickened the genius of their inventors and improved the skill of their armourers; just as the tension in mid-Europe since the war of 1870–71 has given to France and Germany the finest repeating rifles and best artillery; whilst the leisure and taste of the Englishman has called for the finest sporting weapons. The invention of rifling in Germany in the 15th century led to the development of weapons of precision, the highest degree of accuracy being attained by a heavy muzzle-loading small-bore rifle with a high trajectory. The requirements of the military firearm—lightness, ease and quickness of manipulation, extreme range and great velocity, have led to the sacrifice of precision for the advantages possessed by light breech-loading arms (see BREECH-LOADING, and RIFLES).

Of the inventions which have been applicable to all firearms the most important has to do with the *ignition* of the charge of explosive. Fulminating or detonating powders were made by the French chemists of the 18th century; and about 1800 an Englishman, benefiting by their experiments, produced a highly sensitive explosive, composed of fulminate of mercury and saltpetre, which possessed all the requisite qualities of a priming powder for the flintlock firearms. In 1807 Alexander J. Forsyth, a Scottish clergyman, patented the application of the detonating principle for exploding gunpowder in firearms. Many inventors claimed the copper percussion-cap which followed and was first made in England in 1818, its introduction leading to the abandonment of the firelock. The expansive bullet, invented by Greener and improved by Minié, increased the range and accuracy of rifles, and made an accurate breech-loading rifle possible. The cartridge-case containing its own means of ignition, or the percussion-cap, is a French invention improved by Lefaucheux, Lancaster, Needham, Pottet, and others, and to it is due the success of modern breech-loading small-arms, this cartridge-case of solid drawn brass being used for all quick-firing machine guns and some of the smaller cannon. The expansion of the case at the moment of discharge causes it to act as an obturator and block all escape of gas into the breech-loading mechanism, whilst its contraction after firing admits of its being withdrawn with ease.

Sporting firearms consist of the shot-gun and the rifle for large game shooting. The use of hail-shot became general in Germany in the 16th century, and with the introduction of the wheel-lock the use of the arquebus for sporting purposes became more common. The earliest double-barrelled guns were made for military purposes, but sporting guns with two barrels side by side were made in Italy in the 17th century, and the art of shooting on the wing was first practised about 1580. The introduction of better forged barrels in the latter half of the 18th century made a light double-barrelled fowling-piece a possibility, and since then shot-gun barrels made of iron and steel fragments (1798) and twisted scelps (1806) have increased in strength and lightness. Old horseshoe nails and scraps of iron and steel were made into shot-gun barrels; but after 1850 new metal was employed and is now preferred. As the fowling-piece with hand-welded barrels made of twisted rods became more general, the supremacy of continental gun-makers over the English was lessened, and early in the present century the improvements made by Manton, Nock, Cook, Egg, and others placed English guns ahead of all competitors. The French invention of composite cartridge-case and breech-loading was turned to practical account by the English, who have unceasingly improved upon the original idea. In addition to the breech-loading mechanism, the shot-gun has been improved in range by the use of choke-boring—i.e. the constriction of the barrel at the muzzle; in safety, by the rebounding lock, which again has been superseded by various hammerless locks, or arrangement of the firing mechanism within the head of the gun; and in self-ejecting mechanism. See BREECH-LOADING; also GUN (Sporting).

The sporting rifle is a type of firearm evolved from the wheel-lock hunting weapons of Germany. Its production is proof of the adaptability of fire-arms to special needs; the desiderata of a weapon for large game hunting include the quick firing of a second shot, and a paralysing effect from the penetration of the bullet. The repeating rifle cannot be twice fired as quickly as the double rifle, and length of range with a light ammunition and continuous quick firing are points sought in a military weapon. Precision is dependent upon the weight of the projectile being sufficient to maintain the direction imparted to it during its passage through the barrel. The bullet is helped to do this by the rifling giving the projectile a rotary motion, which equalises irregularities in the bullet, and lessens its tendency to deflect. The greater the velocity, the less quickly must the rifling turn; but with improved solid bullets, covered with nickel or steel, it is possible to get the bullet to grip the rifling at a velocity of 2000 feet per second, and a complete turn is made in ten inches, in which case the bullet has a double

rotary motion and takes a corkscrew flight. The modern sporting or express rifle, as it is termed, fires a hollow expansive bullet at a high velocity for a few hundred yards, accuracy and range being sacrificed to force at impact. The average muzzle velocity of the military rifle is 1500 feet per second, of the express 2000 feet per second; and although with new ammunition and improved explosives the latest military rifle attains this initial velocity, the force of the bullet on impact does not approach that of the sporting rifle projectile. The smallest sporting rifle fires a bullet of about 120 grains, and the largest a bullet of 1600 grains (see RIFLES). Firearms are also used for a variety of secondary purposes: for the firing of signal shells at sea (in lieu of rockets), shooting oil-filled vessels from ships to prevent the breaking of the waves in stormy weather, for firing harpoons with a line attached, as used in whale and narwhal fishing, &c.

In the manufacture of early firearms the smith was the first and last workman. The Italians were amongst the first to ornament firearms, and finish them by chiselling, chasing, and engraving, as the Spaniards were amongst the first to supplement the work of the smith by filing and smoothing the exterior of the weapons, and polishing the interior of the barrels. For the last three centuries the most skilled handicraftsmen of Europe have been employed in the making or beautifying of firearms, and at the present day the manufacture of sporting guns remains essentially a handicraft, the mechanical processes having but lightened the labour of the workman, not superseded him. Some 20,000 workmen are now employed in Europe in the manufacture of sporting guns, the chief centres being Birmingham, Liége, and Prague, whilst the machine factories of Europe, together with the government arsenals engaged in making small-arms, employ a much larger number. In addition to the places mentioned, at Suhl, St Etienne, Steyr, and Tula, and at Springfield, Hartford, and elsewhere in the United States, large numbers of firearms are made yearly. The idea of making army muskets with interchangeable parts originated with the French about a century ago, but the only successful result was the 'drop forging' or stamping out of the various limbs, and about 1797 Whitney made some 10,000 muskets in America from stampings, and used improved machinery in finishing the parts.

The perfecting of the machinery for the manufacture of interchangeable arms is the work of Hall, of Harper's Ferry, U.S., whose system was adopted in government workshops in 1818; and of Blanchard, whose improved lathes produced interchangeable stocks. The system of making firearms by machinery was introduced into England in 1856, since which date many futile attempts have been made in various countries to produce fine sporting arms wholly by machinery.

The improvements immediately sought in firearms are such as will tend to simplify or strengthen the breech-loading mechanism (see BREECH-LOADING), and to strengthen and at the same time lighten the barrel; the discovery of a material stronger than steel; and such inventions as will increase the range or precision of the weapon or lessen its recoil. For the capabilities of various weapons, see CANNON, RIFLES, REVOLVERS, &c.

The best military small-arms—rifles—are available to a range of 2000 yards, and the best express to 300 yards. A match-rifle will fire with a mean deviation of 1·75 feet or less at 1000 yards range, and a shot-gun will put upwards of two-thirds of its charge of shot into a circle thirty inches in diameter at 40 yards range, and the last shot of the charge will not be more than ten feet behind the first one that reaches the target at that distance. The killing range of the average shot-gun is about 45 yards, of wild-fowling guns with swan shot 140 yards. After the pulling of the trigger, until the charge of shot reaches the muzzle, ·007 of a second elapses, and ·13 before the shot, having passed the muzzle, strikes the target 120 feet distant.

For the early history of firearms, see Grose's *Military Antiquities;* Wilkinson, *Engines of War* (1841); Greener, *The Gun and its Development* (1881). For modern arms, J. H. Walsh ('Stonehenge'), *Modern Sportsman's Gun and Rifle* (1882–84), and *Weapons of War* (1885); Greener, *The Gun* (1889 edition), and *Shot-guns* (1888). For firearms manufacture, Brandeis, *Moderne Gewehr-Fabrikation;* and Greener, *The Gun.*

PROVING OF FIREARMS, in Law. All weapons manufactured or offered for sale in England must be proved either at one of the government proof-houses in England or at the Banc d'Épreuve at Liége. A royal charter granted in 1637 to the London gunmakers gave them powers to search for and prove and mark all manner of hand-guns, great and small daggs, and pistols. The several statutes of 1813, 1819, and 1855 rendering the proving of firearms compulsory have been superseded by the Gun-barrel Proof Act, 1868 (31 and 32 Vict.), regulating the duties and powers of the proof-houses in London and Birmingham (the only two in England). By this statute the forging or counterfeiting of the proof-marks or stamps is treated as a misdemeanour punishable by imprisonment for not more than two years; and a fine of £20 is imposed on any person selling or exposing for sale barrels not duly proved, or exporting or importing barrels with forged proof-marks. These penalties are to be levied on conviction before two justices or a metropolitan or stipendiary magistrate. The statute does not extend to Scotland or to Ireland, and arms manufactured for Her Majesty are exempted from its operation.

The introduction of new and more powerful explosives and guns of improved types has necessitated changes in the proof-house tests. The most important provides that weapons shall be tested with such explosives and projectiles as those with which they will be charged in actual use. Until April 1888, both shot-guns and rifles were tested with fixed charges of common gunpowder and leaden bullets.

Fireball is the popular name of projectiles, other than rockets, which are used for incendiary or illuminating purposes. They are more properly called *carcasses*, or *ground* and *parachute light-balls*. The carcass is a thick shell filled with fiercely burning composition, and having large holes, or vents, out of which this streams. The ground light-ball is filled with brightly burning composition, and burns on the ground. The parachute shell is fired from a mortar, and fuzed so as to open in the air and support, by means of a parachute packed inside it, a pan of brightly burning composition. The electric light has superseded these last two, and the rocket the first.—For another kind of fireball, see LIGHTNING.

Firebote, the right of a tenant, according to English law, to cut wood on the estate for the purpose of fuel. See ESTOVER.

Fireclay is the variety of clay which is used for the manufacture of firebricks, gas-retorts, crucibles, glass pots, chimney-pipes, and other articles, most of which require to resist the action of high and long-continued heat. Ordinary fireclay is chiefly found in beds not usually much exceeding two feet in thickness, in the coal-measures, interstratified with seams of coal and other rocks. In the British Islands it is most largely worked about Glasgow, Newcastle-on-Tyne, and Stourbridge in Worcestershire, at which last

place it is said to have been discovered about 1555 by some wandering glassmakers from Lorraine. But it occurs, more or less, in most places where true coal is found. It is mined in Germany, Belgium, France, the United States, and other countries. Stourbridge fireclay, owing to its excellent quality, is largely exported to foreign countries, as well as bricks and other objects made of it. Refractory clays are found, though more rarely, in other formations besides the coal-measures. For example, some of Tertiary age found in Dorsetshire and Devonshire are made into firebricks. The following table shows the principal constituents of fireclay:

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Silica	65·10	51·10	59·49	53·52	54·20
Alumina	22·22	31·35	28·95	33·68	33·80
Potash	·18	..	..	trace	trace
Lime	·14	1·46	trace	·76	trace
Magnesia	·18	1·54	..	·14	·02
Oxide of Iron	1·92	4·68	1·05	·52	·01
Water	9·28	10·47	11·05	11·34	10·86
Organic Matter	·58		..	..	·15

No. 1, Stourbridge; No. 2, Newcastle-on-Tyne; No. 3, Gartsherrie, Scotland; No. 4, Poole, Dorsetshire; No. 5, Morgantown, West Virginia, United States. See CLAY.

Fireclays from the same locality often differ considerably in their composition and quality. Some of the Newcastle clays, for example, contain from 70 to 80 per cent. of silica with from 9 to 18 per cent. of alumina. A high percentage of silica and alumina together (their relative proportions being comparatively immaterial) and small quantities of alkaline substances and oxide of iron constitute a refractory fireclay. If not small in amount, alkaline bodies in the clay tend to make it easily fusible, so that bricks formed of it are apt to soften and yield in a furnace. Fireclays are generally yellow in colour after being fired in the kiln. No very sharp line of distinction can be drawn between hard infusible clays and softer marly clays used for terra-cotta, garden vases, and some kinds of house bricks. In districts where fireclay is abundant composition bricks for ordinary building purposes are partly made of it. For furnace-building materials which resist the action of a very intense heat, such as dinas and bauxite bricks, see under Brick, Vol. II., page 434. Powdered flint, as well as chrome iron ore, is likewise used for furnace bricks.

Firedamp is the miners' term applied to light carburetted hydrogen or coal-gas when it issues from crevices in coal-mines (see GAS). These crevices are named 'blowers' by the miners, and are evidently the outlets of gas that exists in a compressed state in pores and cavities in the coal. The issue of the gas is in some cases audible, and on applying a light it burns as a jet of flame. When mixed with air in proportions between $\frac{1}{7}$ to $\frac{1}{13}$ of its volume the mixture is explosive, producing disasters that are too well known. The researches of Mr Galloway and others have shown that the gas is only one of the factors producing the worst catastrophes. A comparatively small explosion of gas stirs up any coal-dust that may be lying on ledges, or on the floor of roads and workings, each particle of dust is fired, and the combined result is like the firing of grains of gunpowder.

Fire-engine, Fire-escape. See FIRE.

Firefly, a name applied to many 'phosphorescent' insects, which are all included within the order Coleoptera, or beetles. Some of them (among the Elaters) give forth a steady light, and these may be distinguished as fireflies proper from the Glow-worms (q.v.) and 'lightning-bugs' (among the Lampyrids), which flash light intermittently. In the phosphorescent Elateridæ, furthermore, the production of light has its seat more anteriorly than in the Lampyridæ, where it is abdominal. As the Lampyrides are discussed under GLOW-WORM, only the Elaterid fireflies need be noticed here.

The most brilliant fireflies are species of Pyrophorus, most at home in tropical America. One form—*Pyrophorus noctilucus*—common in the West Indies and Brazil, attains a length of about an inch and a half, and has a dark rusty-brown colour. On the upper surface of the first ring of the thorax are two yellowish oval spots, which are brilliantly luminous during the nocturnal activity of the beetle, while on the first ring of the abdomen a still brighter organ is situated. Even the eggs are luminous, and excised portions placed in a damp chamber remain functional for two or three days. The pounded debris of the insect is also luminous. The luminous organs are special modifications of the epidermic (*hypodermis*) cells, which are disposed in two layers, of which the outer alone is luminous, while the inner contains masses of waste products, and is riddled by air-tubes. The luminosity depends on a process of oxidation; the oxygen is supplied by the tracheæ, and the brilliancy varies with the respiratory activity, being (according to Heinemann) only indirectly affected by the nervous system. What the substance oxidised really is remains undiscovered. On the sleeping or entirely passive insect a soft light may be observed; the real blaze is only exhibited during active respiration, and may be exaggerated experimentally by blowing in an extra supply of oxygen. Dubois's experiments seem to show that the fireflies utilise their phosphorescence to guide their steps.

Common Firefly (*Pyrophorus noctilucus*) in burrow of mole-cricket, showing the two oval phosphorescent organs on the thorax.

The light of these living lamps, or *cucujos*, as the Mexicans call them, has frequently saved a traveller's life; the Indians 'travel in the night with fireflies fastened to their hands and feet, and spin, weave, paint, and dance by their light,' and they are often used for decorative purposes. A few of them in a glass vessel give light enough to read by, and when not wanted for any such purpose they may be set to catch mosquitoes in the house. In Vera Cruz, according to C. F. Holder, the Pyrophori are so commonly used as toilet ornaments that they form an important article of trade. The natives lure them by means of lights waved on the end of sticks, and catch them in nets. 'They are then placed in a box covered with a wire netting, bathed twice a day in tepid water, and at night fed with sugar-cane.'

See GLOW-WORM, PHOSPHORESCENCE; C. F. Holder, *Living Lights* (Lond. 1887); R. Dubois, *Les Élatérides lumineux* (Meulan, 1886); F. F. Moore, *Fireflies and Mosquitoes* (Lond. 1888); and numerous papers quoted by Holder. For a detailed account of the anatomy and physiology of Pyrophori, see C. Heinemann, *Archiv. f. mikr. Anat. XXVII.* (1886), pp. 296–382.

Fire-insurance. See INSURANCE.

Firelock. See FIREARMS.

Firenzuola, AGNOLO, Italian writer, was born at Florence, 28th September 1493. Having studied law at Siena and Perugia, he began to practise as an advocate in Rome. But in a few years he enrolled himself in the monastic order of Vallombrosa.

On the death of Clement VII. he left Rome, and finally became abbot of Prato, where, or at Rome, he died before 1548. His chief works are a spirited paraphrase of the *Golden Ass* of Apuleius, a work in close imitation of the *Decameron*, a eulogistic discussion concerning the charms of the fair sex, a couple of comedies, and some poems. Firenzuola's works are distinguished for the classic elegance of their style, as well as notorious for their licentiousness. The best collected edition is one published at Florence (2 vols. 1848).

Fire-raising, in the law of Scotland, is the equivalent term for Arson (q.v.) in England.

Fire-ship, a vessel, usually an old one, filled with combustibles, sent in among a hostile squadron, and there fired, in the hope of destroying some of the ships, or at least of producing great confusion. Livy mentions the use of such by the Rhodians, 190 B.C. Earliest in modern times, so far as known, they were employed by the Dutch in the Scheldt during the war of independence in the Netherlands, and shortly after by the English, in 1588, against the Spanish Armada. Lord Dundonald (q.v.) employed them against the French in 1809; and the Chinese tried them against the British fleet before Canton in 1857, but unsuccessfully. The service of navigating one of these ships into the midst of an enemy, there firing it, and then attempting to escape, is always fraught with great risk of failure and disaster.

Fireworks. See PYROTECHNY.

Firishta. See FERISHTAH.

Firkin (dim. from *four*), an old measure of capacity containing 9 gallons (old ale and beer measure). But previous to the year 1803 it had two values, being estimated at 8 gallons in old ale measure, and at 9 in old beer measure. The firkin is equivalent to 9½ imperial gallons. The name is also applied to a small wooden cask, as for butter. This contains 56 lb.

Firlot (from *four*), an old Scottish dry measure, of which there were four in a Boll (q.v.). Though differing in value for different substances and places, its relation to the boll remained invariable. See PECK.

Firm. See PARTNERSHIP.

Firmament, a word formerly used to signify the vault of heaven. The term found its way into English from the Vulgate, which renders the Septuagint *stereōma*, and the Hebrew *rakia*, by the Latin *firmamentum* (Gen. i. 6). Rakia (from the verb *raka*, 'to beat or strike out') signifies whatever is expanded or stretched out, and was specially employed by the Hebrews to denote the hemisphere above the earth, compared (Exod. xxiv. 10) to a splendid and pellucid sapphire. Elsewhere (Ezek. i. 22–26) it is spoken of figuratively as that on which the throne of the Most High is placed. Hence it follows that the notions of solidity and expansion were both contained in the Hebrew conception of the firmament. The blue ethereal sky was regarded as a solid crystal sphere, to which the stars were fixed (compare the *cælo affixa sidera* of Pliny, ii. 39 and xviii. 57), and which was constantly revolving, carrying them with it. This sphere or firmament divided 'the waters which were under the firmament from the waters which were above the firmament;' and the theory of the phenomena of rain, &c. was that there were 'windows in heaven'—i.e. in the firmament, through which, when opened, the waters that were above the firmament descended. 'The same day were all the fountains of the great deep broken up, and the windows of heaven were opened' (Gen. vii. 11). The view entertained by the Greeks and other early nations was essentially the same. In the progress of astronomical observations it was found that many of the heavenly bodies had independent motions, inconsistent with the notion of their being fixed to one sphere or firmament. Then the number of crystalline spheres was indefinitely increased, each body that was clearly independent of the rest having one assigned to it, till a complex system was introduced, capable of being fully understood only by the philosophers who formed it. See (under Ptolemy) PTOLEMAIC SYSTEM. It was long before men conceived the idea of the possibility of a body being maintained in motion in space without a fixed support, and, considering the number of phenomena of which the hypothesis of a crystalline firmament offered an apparent explanation, we must regard it as having been in its day a curious and ingenious speculation.

Firmân, a word of Persian origin, signifying an order, and used by the Turks to denote any official decree emanating from the Ottoman Porte. The right of signing any firman relating to affairs connected with his special department is exercised by every minister and member of the divan, but the office of placing at the head of the firman the *tughra*—a cipher, or monogram, containing the names of the sultan and of his father in interlaced letters, and which alone gives effect to the decree—is committed to the hands of a special minister, who is called *nishânji-bashi* (see S. Lane-Poole, *Turkey*, in the 'Story of the Nations' series). The name applied to such decrees as have been signed by the sultan himself is *hatti-sherîf* (properly *Khatt-i sherîf*). The name firman may also signify a more formal kind of Turkish passport, which can only be granted by the sultan or by a pasha.—A written permission to trade is called in India a firman.

Firminy, a town in the French department of Loire, 9 miles SW. of St Etienne by rail. Near it are rich coal-mines; and nails and other iron goods, ribbons, and buttons are manufactured in large quantities. Pop. (1886) 12,415; (1891) 14,502.

Firola, a genus of free-swimming marine gasteropods, in the division known as Heteropoda (q.v.).

Firozabad, a town of India, North-west Provinces, 24 miles E. of Agra, with numerous ruined buildings. Pop. 16,023, two-thirds Hindus, who carry on a little trade.

Firozpur, or FEROZEPORE, a town in the Punjab, 3½ miles from the left or south-east bank of the Sutlej. Founded, it is said, by Firoz Shah (1351–87), and at one time a large and important town, it had sunk into poverty and insignificance before it actually came, in 1835, into the possession of the English. Since then the place has regained much of its former consequence, and it possesses the largest arsenal in the Punjab. It contains a church built in memory of those who fell in the Sikh wars (1845–46). Pop. (1891, including cantonment 2 miles south, 20,000), 50,437.—Firozpur district has an area of 2752 sq. m., and a pop. of about 750,000 (549,253 in 1868). Much has been done, since British occupation, to increase the value of this once dreary and desert plain, by tree planting and otherwise, and now 76 per cent. of the district is under cultivation.

Firozshah, a battlefield in the district of Firozpur, 12 miles from the left bank of the Sutlej, the scene of the attack of the British forces, led by Sir Hugh Gough and Sir Henry Hardinge, on the Sikh camp, December 21, 1845. The entrenchments were carried and the natives routed after two days' fighting.

First-born (Heb. *bekor*, Gr. *prōtotokos*, Lat. *primogenitus*), in scriptural use, signifies the first

male offspring, whether of man or of other animals, due to the Creator by the Mosaic law as a recognition of his supreme dominion. The first-born male, whether of men or of animals, was devoted from the time of birth to God, and the first-born male child had to be redeemed one month after birth by an offering not exceeding in value five shekels of silver (Exod. xiii. 13), provided the child lived longer than that period. The first-born male of animals also, whether clean or unclean, was equally regarded as devoted to God; that of clean animals, if free from blemish, was to be delivered to the priests within twelve months after birth, to be sacrificed to the Lord; nor was it permitted to any but the priests to partake of the flesh of such victims. If the animal were blemished, it was not to be sacrificed, but to be eaten at home. The first-born of unclean animals, again, was either to be put to death or to be redeemed with the addition of one-fifth of its value; if not redeemed, to be sold, and the price given to the priests. By the Mosaic law primogeniture had certain privileges attached to it, the chief of which were the headship of the family and a double portion of the inheritance. Among other nations considerable variety existed as to the succession of children to the inheritance of their parent, for the discussion of which see the articles ENTAIL, FAMILY, FEUDALISM, LAND-LAWS, and SUCCESSION.

First-fruits (Heb. *reshith;* Gr. *prōtogennēmata*, and *aparchai;* Lat. *primitiæ*), that portion of the fruits of the earth and other natural produce which, by the usage of the Jews and other ancient nations, was offered to God as an acknowledgment of his supreme dominion, and as a thanksgiving for his bounty. Among the Jews the institution of first-fruits comprised both public and private offerings. Of the former the three principal were made at the opening of the corn-harvest, at the Feast of Pentecost, and at the Feast of Tabernacles. The private offerings made by individual Jews were a cake of the first dough of the year and the 'first of all the fruits.' All these offerings were divided into two classes: *Bicurim*, comprising the various kinds of raw produce, of which, although the law seems to contemplate all fruits, seven sorts only were considered by the Jewish doctors to fall under the obligation of first-fruit offering—viz. wheat, barley, grapes, figs, pomegranates, olives, and dates; and *Terumoth*, or the produce of the year in the various forms in which it is prepared for human use, as wine, wool, bread, oil, date-honey, dried onions, and cucumbers.

Offerings analogous to the Jewish first-fruits became usual very early in the Christian church, as is clear from a passage in Irenæus, but appear to have been merged in the legal provision established by the emperors. The medieval ecclesiastical impost known under the name of *primitiæ* or first-fruits, and sometimes of *annates* or *annalia*, was entirely different. See ANNATES.

Firth, or FRITH, an estuary, from the same root as *ferry;* Dan. *fiord;* akin to Lat. *portus*, and Gr. *porthmos*. For the Norwegian fiords, see NORWAY.

Firth, MARK, born in 1819 at Sheffield, in 1849 with his father and brother established there the great Norfolk steel-works, whose specialty soon became the manufacture of steel ordnance. He was a munificent benefactor to his native town, his gifts including almshouses (1869), a public park (1875), and the Firth College (1879) in connection with university extension (see SHEFFIELD). He died 28th November 1880.

Fisc (Lat. *fiscus*, 'a wicker-basket'), an old term for a prince's treasury. The word 'fiscal' is a derivative; as also Procurator-fiscal (q.v.).

Fischart, JOHANN, one of the most original German satirists, known also under the name of Huldrich Elloposkleros, was born either at Mainz or Strasburg, about the middle of the 16th century. He was brought up at Worms, studied law at Strasburg, became in 1581 advocate to the Imperial Chamber at Spires, and in 1585 bailiff of Forbach near Saarbrücken, where he died in the autumn of 1589. Of the very numerous writings which appeared from 1570 to 1590, partly under his own and partly under fictitious names, about fifty have been proved to be on the whole genuine, though disfigured by interpolations. In respect to others, however, the authorship is doubtful. His most celebrated works are based on foreign models, particularly Rabelais, but manifest no servile imitation: a free creative genius everywhere works plastically on the materials. To this class belong his *Aller Practick Grossmutter* (1572); *Affentheurliche Geschichtschrift vom Leben der Helden Grandgusier, Gargantoa und Pantagruel* (1575); *Podagrammisch Trostbüchlein* (1577); and *Bienenkorb des Heyligen Römischen Imenschwarms* (1579). These writings are wholly satirical. With the most inexhaustible humour he lashes, now the corruptions of the clergy, now the astrological fancies, the dull pedantry, or other follies, public and private, of the time. Next to these stands the outrageously comic work of Fischart's—quite original in its conception—entitled *Flöhhatz, Weibertratz* (1573). Essentially different in its homely and simple tone is *Das glückhafft Schiff von Zürich*, written in verse, and published in 1576. Similar in point of style are his *Psalmen und Geistliche Lieder* (1576). The rest of Fischart's numerous writings, partly in prose, partly in verse, are of unequal merit, singularly varied in style and contents; but throughout all we find the same rich satirical humour, the same warm and genuine feeling for the moral foundations of all public and private life—religion, fatherland, and the family. His works are, moreover, one of the richest sources for the manners of his time. In his treatment of the language no German author can be compared with Fischart, not even Jean Paul Richter himself. He coins new words and turns of expression without any regard to analogy, but nevertheless displays the greatest fancy, wit, and erudition in his most arbitrary formations.

See Vilmar, *Zur Litteratur J. Fischarts* (2d ed. 1865); Von Meusebach's *Fischart-studien* (edited by Wendeler, 1879); and Ganghofer, *Johann Fischart und seine Verdeutschung des Rabelais* (1881).

Fischer, ERNST KUNO BERTHOLD, the son of a country pastor, was born in the Silesian village of Sandewalde, July 23, 1824. From the Posen gymnasium he passed to the university of Leipzig, where he attended lectures on philology and theology; but after his first session he went to Halle, and here, under the influence of Erdmann and Schaller, becoming interested in philosophy, he resolved to devote himself to this as his life-study. He took his Ph.D. degree in 1847, and in 1850 established himself at Heidelberg as a *privatdocent* of philosophy. His eloquence and his poetical sympathies, in addition to his actual knowledge of philosophy, now stood him in good stead. Students came in flocks to hear him, and his enormous popularity, resulting from his enthusiasm, deep insight, and clearness of exposition, increased steadily. Suddenly, however, in July 1853, presumably because of private charges of pantheism made against the first volume of his *History of Modern Philosophy*, the Baden government without any explanation deprived him of his position as privatdocent. During three years of academic exile that followed, Fischer lived quietly with kindred spirits

amid the beautiful surroundings of Heidelberg, and continued meantime to work at his History, publishing between 1853 and 1856 the volumes on Spinoza, Leibnitz, and Bacon. In 1856 he received a call to Fichte's old chair of philosophy at Jena; and in Jena he laboured for sixteen years. At last, in 1872, when Edward Zeller succeeded Trendelenburg at Berlin, Fischer—all practical difficulties in connection with the freedom of lecturing having now disappeared—obtained Zeller's post at Heidelberg.

Fischer's chief work is his great history of modern philosophy, *Geschichte der Neuern Philosophie* (1852–77). It consists of six parts, several of which are subdivided into various volumes. The parts treat respectively of (1) the Cartesians and Spinoza, (2) Leibnitz, (3) Bacon and his successors, (4) Kant, (5) Fichte, (6) Schelling. Fischer's historical books are for modern philosophy what Zeller's are for old-world systems. His other great philosophical achievement is his *System der Logik und Metaphysik* (1852; new ed. 1865), in which, while he adheres in the main to Hegel's position, he yet criticises Hegel severely on many important points. Of his numerous smaller literary and philosophical writings the most noteworthy is a *Critique of Kant*, which, like *Descartes and his School*, has been translated into English. Other works deal with Goethe's *Faust*, Goethe's *Iphigenia*, and Lessing. Fischer is recognised as one of the leaders of speculative thought in Germany.

Fish, HAMILTON, American diplomatist, was born in New York city, August 3, 1808, graduated at Columbia College, and was admitted to the bar in 1830. A Whig in politics, he was elected a congressman in 1842, and governor in 1848. In 1851 he was returned to the United States senate, where he opposed the repeal of the Missouri Compromise and joined the Republican party on its formation. He was secretary of state under Grant from 1869 to 1877, signing, as one of the commissioners, the Washington Treaty of 1871, and carrying through the settlement of the Alabama Question (q.v.). Died September 7, 1893.

Fish-culture. See PISCICULTURE.

Fisher, an American carnivore. See PEKAN.

Fisher, JOHN, Bishop of Rochester, was born about 1469 at Beverley, Yorkshire, and in 1483 entered Michael-house, Cambridge, of which he became a fellow in 1491, and master in 1497. In 1502 Margaret, Countess of Richmond (1443–1509), Henry VII.'s mother, was led by his virtues and learning to make him her chaplain and confessor; and in 1503 he was appointed first Lady Margaret professor of Divinity. Next year he was elected chancellor of the university, and consecrated to the see of Rochester. Thirty years he laboured diligently for the welfare of his diocese and university. A friend of More and Erasmus, a man who at forty-six began Greek, at fifty Hebrew, he zealously promoted the New Learning, and advocated reformation from within; as zealously both by voice and by pen he resisted the Lutheran schism. So early as June 1527 he pronounced firmly against the divorce of Henry VIII.; and having lent too ready an ear to the 'revelations' of the Holy Maid of Kent, Elizabeth Barton (q.v.), in March 1534 he was attainted of misprision of treason, and next month, for refusing the oath of succession, was sent with More to the Tower. In May 1535 the new pope, Paul III., made him a cardinal; Cromwell told it to Henry. 'Yea,' said the king, 'is he yet so lusty? Well, let the pope send him a hat, but I will so provide that he shall wear it on his shoulders, for head he shall have none to set it on.' He kept his word. On 17th June the old man, worn by sickness and ill-usage, was tried for denial of the king's supremacy; on the 22d, still cheerful and courageous, he was beheaded on Tower Hill. His head was set high on a pole upon London Bridge; his body, after lying stripped naked till nightfall, was buried first in a neighbouring graveyard, and later in the chapel, within the Tower, of St Peter ad Vincula. In 1886 he was beatified. See MORE (SIR THOMAS); and the Rev. T. E. Bridgett's *Life of Blessed John Fisher* (1888).

Fisheries. In almost every part of the world fishes form some portion of the food of mankind, but they form a much more important part of the food-supply in the northern temperate regions than in the tropics or the southern hemisphere, and they are obtained in enormously greater abundance from the sea than from inland fresh waters. Hence it has become customary by a metaphor to speak of the 'harvest of the sea.' It is only within the last century, if we except the fish-ponds of the medieval monasteries and the culture of fresh-water fishes in China, that attempts have been made to control the conditions under which valuable fishes live and multiply. It is impossible in most cases to feed and protect aquatic animals with the same completeness as domesticated land animals. The cultivation of the former consists chiefly in artificially securing the production of large numbers of young, then setting them at liberty, and endeavouring to promote an abundant supply of their natural food, to destroy their enemies, and remove all unfavourable conditions. In this way the supply of salmon and some other fish and of oysters has been in some places largely increased—oysters especially in France and Holland, salmon and other fish chiefly in the United States. But no exclusively marine species has yet been successfully cultivated on a scale large enough to be of practical importance, and it is still an open question whether scientific methods can be applied to increase the supply of valuable marine fish diminished by excessive fishing. See PISCICULTURE.

But although marine fishes are produced in enormous abundance without human aid or foresight, the amount of labour and capital required to capture them is very large. Sea-going vessels and boats are themselves costly machines, and other elaborate and expensive machinery has to be carried and worked on board of them; the vessels and gear have to sustain very hard wear; both are frequently damaged, the gear being often, and the vessels sometimes, lost altogether. The capture of fish and their consumption have enormously increased in Europe and North America since the beginning of the age of steam. This increase is due to the great increase of population, and the consequently increased demand for cheap and palatable food, and to the facility afforded by the railways for conveying fresh fish to the large inland towns.

Nearly all the most abundant marine fish on the coasts of Europe and North America are valuable as food, some being held in great estimation as delicacies by the rich, others forming a staple food of the poor. The chief exceptions are the dog-fishes, which are extremely abundant and at the same time of no value as food, although they are occasionally eaten in some places on the coast. The other most valuable marine animals on the European coasts are the lobster, crab, crayfish, shrimps, and prawns among Crustacea, and certain molluscs, chiefly the oyster, though mussels, clams or scallops, and whelks are of some value. Except in extensive fresh-water lakes, true fresh-water fishes are of minor importance, but there are several valuable 'anadromous' fish which ascend rivers to a greater or less distance. The most important of

these are the salmon and sea-trout, but the smelt and shad are abundant in some estuaries of Europe, and another species of shad (*Clupea sapidissima*) is abundant and highly valued in America. Eels also are largely eaten in Europe, and the sturgeon, though rare in Britain, is abundant in some large rivers of the Continent.

The following are the principal different kinds of sea-fishing carried on in the United Kingdom: (1) trawling, (2) line fishing, (3) drift-net fishing, (4) seine-net fishing, (5) moored-net fishing, (6) crab and lobster fishing, (7) oyster-dredging.

(1) *Trawling* here means fishing with the beam-trawl, which is a triangular bag-like net towed along the sea-bottom. The mouth of the trawl-net is attached to a frame, consisting of a long wooden beam supported by a triangular hoop of iron at each end. These trawl-heads, or runners, glide along the ground, and raise the beam three to four feet above it. The upper side of the net is attached to the beam, the sides to the trawl-heads, while the lower edge of the mouth of the net is formed by a thick and heavy rope which is a great deal longer than the beam, and thus lies on the bottom between the irons in a deep curve or bight. As the net is towed along, the ground-fish are disturbed, and rise above the foot-rope, and, being prevented from escaping by the upper side of the net, they are swept into its narrow end, where their escape is made still more difficult by a constriction of the cavity of the net somewhat in front of its closed end. The size of the trawl varies according to the size of the vessel working it, but for deep-sea fishing the beam is 36 to 50 feet long, and the mesh of the net is always about 4 inches at the mouth to 1½ inch at the 'cod' end. The trawl is towed by means of two 'bridles,' which are long ropes of equal length attached one to each trawl-head, and a very strong, thick rope, the 'warp' or 'rode,' the end of which is fastened by a shackle to the two bridles.

The majority of trawling vessels are sailing boats, but recently steamers have been used in several places, especially in Scotland. The sailing boats range from 30 to 80 or even 100 tons register. Both on the east and south coast they were formerly all cutter-rigged; but this was when the maximum size did not exceed 50 tons. The larger vessels on the east coast are now ketch-rigged, carrying two masts each with gaff sails. On the south-west coast there are very few vessels over 50 tons. Most are cutter-rigged; though some have been converted to the other rig, which is much more economical in working, and safer in bad weather. The trawl is always carried along the rail or bulwarks on the port quarter, extending from the main rigging or a little behind it to the taffrail. When the trawl is 'shot,' it is towed from either the port or starboard quarter, according to the wind and tide. On the south coast the trawling rope is usually hauled in over the bows by a hand-winch, the after-bridle being finally wound in by a smaller winch aft. But on the east coast the boats are fitted with patent capstans by which the rope can be hauled in amidships, and these capstans are now almost always worked by steam.

On the east coast the greater number of trawlers belong to Hull, Grimsby, Yarmouth, Lowestoft, and Ramsgate. The grounds fished by these are chiefly the Dogger Bank in winter, and the banks off the Danish, German, and Dutch coasts in summer. In winter each smack usually carries ice and takes home her own fish; but in summer the vessels fish in fleets, and steam-carriers are employed which collect the fish and take it to London or the east coast ports. The principal trawling ports in the south-west are Brixham and Plymouth. The trawlers here fish not in a fleet, but independently of one another. The autumn and winter fishing is carried on off the respective ports, but in spring and early summer nearly all the boats fish south of the Wolf Rock off Mount's Bay, or off the north coast of Cornwall, which grounds have also been visited in spring by a large number of North Sea boats. In many places steam-tugs combine trawling with their ordinary work, shooting their trawls when on the lookout for ships. This is the custom with the steam-tugs of Falmouth and Cardiff, the boats from the latter place fishing west of Lundy Island. There are a few trawlers at Tenby, and this kind of fishing is also carried on from Whitehaven, Fleetwood, Blackpool, Southport, and Liverpool, the trawling grounds on the north-west coast lying between the Isle of Man and the mainland, and off the Welsh coast.

There are no sailing trawlers of large size at any of the Scottish fishing ports; but some smaller boats with smaller trawls fish from St Andrews and one or two other places. Steam-trawling, however, is carried on both by tugs and by screw-steamers entirely devoted to the industry at Granton and Leith, and at Aberdeen. The grounds fished by the Firth of Forth boats extend from the outer part of the Firth to 30 or 40 miles east of the Isle of May, while the Aberdeen boats fish off the coast of Aberdeenshire and in the Moray Firth. The Firth of Forth, St Andrews Bay, and the territorial water from Kinnaird Head to the Ord of Caithness were in 1887 closed against trawling by the Scottish Fishery Board. In Ireland, Dublin is the centre of a large and important trawling fishery, and possesses a fleet of about 50 smacks, which are from 30 to 50 tons measurement, and cutter-rigged. These boats work between the Isle of Man and the Irish coast. Trawling is also carried on to some extent in Dingle and Galway bays, but not on an extensive scale. Most of the grounds mentioned as fished by trawlers are between 30 and 40 fathoms in depth. Occasionally trawling is carried on in deeper water, even up to 70 fathoms, but the labour of hauling in is then considerably increased. Trawling can only be carried on over ground which is fairly level and free from obstructions; over a rough, rocky bottom it is, of course, impossible to work a trawl. In fact, one of the principal expenses in this kind of fishing is the cost of new trawl-nets, beams, irons, and rope to replace those worn out or lost. Even without accidents the net soon wears out, and on the most favourable ground the trawl not uncommonly catches fast in a sunken wreck, an isolated rock, or a lost anchor, and is either lost or considerably damaged.

The principal fish caught in the trawl are all kinds of flat-fishes—viz. halibut, turbot, brill, soles, plaice, flounders, dabs, and other less familiar forms called by different names in different places, such as lemon soles or merry soles, megrims, witches; also skates and rays, which are bottom-fish of a flattened shape but of a different class; and all kinds of round-fish, or, as they are sometimes called, white fish, which feed to a great extent on the sea-bottom, such as cod, haddock, whiting, pouting, pollack, coal-fish, hake, ling; and also other miscellaneous species, as gurnards, red mullet, bass, sea-breams, dorys, and conger.

(2) *Hook and line fishing* is of two kinds—that carried on by hand-lines, and that by long lines. Long lines, again, vary in length and the size of the hooks, according to the fish sought. Thus, off the east coast of Scotland large-sized boats go long distances from land to 'shoot' lines of very great length with hooks of large size, and catch cod, ling, halibut, skates and rays, turbot and coal-fish (*Gadus carbonarius*). Smaller boats fish at shorter distances, with similar lines and smaller hooks, for

haddock. This latter fishery is regularly carried on all along the east coast of Scotland, and forms the principal occupation of the smaller boats. The lines are always baited with mussel, and the hooks are always baited on shore by the wives and children of the fishermen. The baiting is done in a very careful and skilful manner. Each man of a crew contributes a certain number of lines of his own; each line when ready to go to sea is coiled up in a separate basket, made of wickerwork and very shallow—a creel. All the hooks are laid in the centre of the coil, and as they are baited and placed in position fresh grass is scattered over them and among them, so that the bait remains moist until the line is shot. When the ground is reached the boat is allowed to sail (or in some cases steam) steadily and gently along. A heavy stone attached to one end of a line is thrown overboard first, and attached to this stone is another line, long enough to reach to the surface, and fastened at its upper end to a flagstaff, buoyed and weighted so as to float upright in the water. The line is then taken overboard from the boat as she moves along. To prevent the hooks catching in the rail of the boat the line is made to pass over a thick metal cylinder which one of the crew holds in his hand. Before the whole of a line is run out another is fastened (bent on) to its end, so that all the lines are joined together, and stretch for two miles or so along the bottom of the sea. The line is always shot across the tide—i.e. transverse to the direction in which the tide is flowing, so that the short lines which fasten the hooks to the main line, at intervals of one fathom, are kept extended perpendicular to the main line. When the last line is shot another buoyed flagstaff is attached to the end of it, and the whole is left at the bottom for half an hour to an hour. Then the flagstaff last thrown overboard is picked up again, and the line is hauled in in the opposite direction to that in which it was shot. An occasional plaice or gurnard is caught on these lines, but the majority of the fish taken are haddocks. Many of the baits are taken by starfishes, whelks, crabs, &c., and a large number of the hooks in certain localities bring up specimens of the hag-fish, or borer, which has no jaws, but takes the hook down into its stomach.

On the east coast of England the largest kinds of long lines are extensively used. They are worked by vessels of about the same size as deep-sea trawlers, but having a compartment of the hold to which the sea-water has access, and in which the cod, the principal fish caught, are kept alive. These lines are each usually about 7000 fathoms long altogether when shot, or about 8 ordinary miles, and carry 4680 hooks. The bait most used consists of whelks. The fishing is principally carried on in winter over the Dogger Bank and Cromer Knoll. The long lines used on the south coast, locally called 'bulters,' are not so long, and are worked usually from smaller, generally open, boats. The bait mostly used is squid (*Loligo vulgaris*), which is obtained from the trawlers, and the principal fish caught are conger, cod, ling, hake, skates, and rays. Hand-lines are single lines with one or more hooks, of which one end is kept in the hand, the hooks being drawn up and re-baited whenever a fish is caught. This kind of fishing is largely carried on on the east coast for cod, and on the south coast with smaller hooks for whiting. It is carried on always at a short distance from the land.

Thus a great many fish are caught in almost equal numbers by hook and by the trawl; but each kind of instrument has its limitations. Soles, for instance, are scarcely ever caught by the hook, though turbot, brill, and halibut are; the conger, on the other hand, is only occasionally taken in the trawl. Long lines can be shot on any kind of ground, and rough, rocky ground, where the trawl cannot be worked, is usually the most productive for long-line fishing. All the fishes caught by these methods are predaceous forms, with large mouths, which feed either on the invertebrata of the sea-bottom, or on the migratory fish which swim in shoals, such as the herring and pilchard. The trawl can only catch those which are feeding on smooth ground, while the baited hook secures them on rough ground and in mid-water.

(3) *Drift-nets* are oblong nets fastened together in a long series, buoyed above so as to float vertically in the sea. The series of nets, or 'fleet,' as it is called, is fastened at one end by a rope to the boat from which it is worked, and nets and boat 'drift' or 'drive' with the tide. The nets are shot at right angles to the current of the tide, and those fish which swim in shoals in the upper waters of the sea strike against them in their course, or when carried along by the tide; and, their heads passing through the meshes, the fish can neither swim forwards, because their bodies are too large to pass through the meshes, nor backwards, because their gill-covers are then caught by the string of the net. These nets are used to capture herring, mackerel, and pilchard. The herring-fishery is principally pursued on the east coast of Great Britain, especially on the east coast of Scotland; the mackerel is most abundant on the south coast of England and Ireland, while the pilchard is almost entirely confined to the south-west coast of England. The nets as used for herrings and pilchards only differ in the size of the mesh. For herrings the mesh is about 1¼ inch square, or 30 to 32 meshes to the yard. The nets are supported by a rope along the upper edge, and when shot are connected by tying the ends of these ropes together, and along this rope pieces of cork are attached to keep it uppermost. To the same rope, at each end of each net, are attached bladders of considerable size by means of a few fathoms of strong line. As these buoys float on the surface of the water, the nets are suspended below at a distance depending on the length of the buoy-lines, and varying according to the depth at which the fish are expected to occur. For pilchards the nets have a mesh of 36 to 38 to the yard.

Mackerel-nets have a larger mesh—viz. only 25 or 26 meshes to the yard, and also are worked differently. The 'back' of the nets is kept at the surface of the sea, floats being fastened directly on to it, and a separate rope, called the 'foot-line,' is connected to the 'back' of each net by a long connecting-line. The foot-line therefore sinks to some distance below the bottom of the nets. The reason for this is that mackerel usually swim quite near to the surface of the water, and, as the line running along the 'back' of the nets, being kept at the surface, is liable to be broken by passing vessels, it is necessary that the nets should be attached to the foot-rope, which sinks to a safe distance, and by which the nets are hauled in.

Drift-nets in Scotland and in the south-west of England are worked from lugger-rigged boats, fitted with foremast and mizzen. The foremast is the larger, and is lowered when the nets are all shot. The mast is stepped in a kind of socket, to admit of its being lowered. When a boat is 'riding to her nets,' if there is any wind, even when the sails are lowered, a considerable strain is put upon the rope by which she is fastened to the nets. The latter, being in the water, are not affected by the wind. It is to reduce this strain and obviate the danger of breaking the rope that it is necessary to lower the mast. On the east coast of England luggers are chiefly used for the herring-fishery; but for mackerel-fishing large boats, often clinker-built,

fitted with two masts, fore and aft rigged, are mostly employed.

(4) The *seine* is a single, continuous net, attached to a cork-line above and a leaded line below, and attached at each end by means of these lines to a long rope. In Britain the seine is always worked from the shore. It is shot from a rowing-boat in a large semicircle, and then by means of the two end ropes is hauled on shore, or the ends are brought together so as to inclose the fish. For catching pilchards on the coast of Cornwall very large seines are used, about 200 fathoms long and 10 fathoms deep at the deepest part. These nets are too large to be drawn on to the shore when they inclose a large number of fish; the ends are therefore brought together close to the shore and moored, and smaller seines are shot within the larger net to take out the fish as they are required. This kind of fishing is principally pursued at St Ives. Smaller seines, called ground-seines, are used on the south coast for catching sprats and gray mullet, and are mostly worked in estuaries. The net used in England, Wales, and Ireland for catching salmon and sea-trout in public waters is a kind of seine, and is worked by a boat called a coble.

(5) *Moored-nets* are of various kinds. Herring-nets, similar to those used in drifting, are moored in some places across the tide, the fish caught being taken out by means of boats every morning. A kind of moored beam-trawl, called a stow-net or bag-net, is used in estuaries—e.g. in the upper parts of the Firth of Forth; the flowing or ebbing tide carries fish of various kinds into its mouth. The mouth of the net is attached by means of bridles to the same anchor which moors the boat from which the net is worked.

(6) *Crabs* and *lobsters* are taken in traps, which are usually dome-shaped cages made of wickerwork or netting stretched on a frame. Openings, in the form of funnels projecting into the interior of the trap, are situated either at its top or sides. The trap is baited with pieces of fish, and sunk by means of heavy stones attached to its bottom. These traps are called crab or lobster pots, and usually several of them are put down in a series attached to one another. Their position is marked by cork floats connected to the pots by a line long enough to reach to the surface, and by this line the pots are recovered.

(7) The *oyster-dredge* is like a small trawl, but the mouth is made by a rectangle of iron bands, and the net is usually made of iron rings linked together.

Next in importance after the sea-fisheries in the United Kingdom is the salmon-fishery, which is subject to a number of legal restrictions; for, while the fish in the sea are not private property until captured, the salmon in fresh water is nowhere in the United Kingdom considered as public property. In England and in Ireland, in common law, the salmon in rivers which are not navigable belong to the riparian owner, while every one has a right to fish in the tidal part of navigable rivers and in the sea. But in Scotland all the salmon-fishings in the country, not only in rivers but also in estuaries and on the sea-shore, to one mile beyond low-water mark, belong to the crown, or the grantees of the crown. It is an historical consequence of this difference that salmon and sea-trout are taken in English and Irish public waters—i.e. on the coast and in estuaries—by net and coble, while in private waters they are usually taken by rod and line. There are some 'fixed engines,' which, having been in existence for some time, have not been made illegal, but no new cruives or stake-nets are allowed by law. In Scotland stake-nets are the usual means of capture on the coast and in estuaries, and there are several cruives on the unnavigable rivers.

The whale-fisheries of the Arctic Ocean are not so important as they were at one time, the invention of gas and the discovery of other lubricants having rendered us independent of whale-oil. The success of the whale-fisheries has also fluctuated so much as to prevent modern capitalists from embarking very largely in the trade. The only novelties that distinguish the whale-fishery of the present day are the introduction of steam-whalers, and, in some instances, the practice of vessels wintering in Greenland; but, even with these advantages, British whalers barely pay their expenses, and the fishery, as compared with former years, exhibits a considerable falling-off. The total whaling fleet numbered at one time 159 ships, but to-day it barely amounts to a tenth of that number. The seal is now largely captured for the purpose of obtaining its oil; many thousands annually are killed by British sealers, as many as 15,000 being taken by the men of a single ship. Norway also fits out a number of steamers for the Arctic seal and whale fisheries. See WHALE, SEAL, GREENLAND, &c. The South Sea or sperm-whale fishery is principally in the hands of the Americans, who pursue this branch of commerce most successfully.

The other European countries bordering the North Sea and the Channel practise all the various methods of fishing pursued by British boats, and occasionally a certain amount of jealousy and friction arises between the men of different nationalities. Of extensive fisheries off the coast of Norway the most important are the cod-fishery of the Loffoden Islands (which is carried on both by hand-lines and by gill-nets like our drift-nets), and the herring drift-net fishery. Lobsters and mackerel are also taken by the Norwegians in considerable numbers, but their coasts are not adapted for trawling. The sardine-fishery, carried on by seines, occupies a large number of people on the south and west coasts of France, as well as on the west coast of Italy. See also TUNNY.

France and Holland both possess oyster-fisheries which are far more productive than those of Great Britain, and this is due in great measure to the science and care with which the oysters are cultivated. The principal seats of this industry in France are at the bays of Arcachon and Concarneau; in Holland, at the mouth of the Scheldt. See OYSTER.

In other parts of the world the largest fisheries are those of Canada and the United States. In the latter there are very important seine-fisheries for shad (a species different from the European shad), which ascend the Hudson, Delaware, and Susquehanna in order to spawn. Soles and turbot do not exist on the American side of the Atlantic; but black-fish, weak-fish, blue-fish, porgies, the herring, the common mackerel, and another species, the Spanish mackerel, are very largely fished. There is also another valuable clupeoid, called the menhaden, much larger than the herring. The mackerel is captured by means of large seines worked out at sea from a large boat. The vessels engaged in this fishery are schooners of 60 to 80 tons, and the seine boat is launched from the vessel when a school of fish is sighted. A large number of mackerel are also taken in drift-nets, similar to those of Europe. The Newfoundland cod-fishery is extremely productive, and is prosecuted both by hook and line, and by seines worked at sea; on the Grand Banks the fishermen are mostly French, the inhabitants of Newfoundland, as of Canada generally, carrying on the more convenient and less risky inshore fishery. Both Canada and the United States possess valuable oyster-fisheries, and the oyster 'farms' of New York state—notably, since 1888, along the floor of Long Island Sound—are especially extensive; but

the European oyster does not occur in America. See OYSTER.

The most important fishery on the Pacific coast is that for the Pacific salmon, large quantities of which are preserved in tins for export to Europe. On the Atlantic side, also, the rivers of Maine and farther north abound in salmon. For the American seal-fishery, see ALASKA.

The Canadian fisheries dispute dates from the close of the war of 1812. Under the treaty of 1783, at the close of the war of independence, the fishing-banks, coasts, bays, and creeks of Canada had been thrown open to United States fishermen; but the British commissioners in 1814 held that the second war had destroyed the earlier treaty, whereas the American representatives claimed that the rights guaranteed by the treaty were inalienable and irrevocable. The matter was left open, no reference to the fisheries appearing in the treaty of Ghent. An attempt to settle the dispute in 1818, by granting to Americans the right to fish outside the limit of three marine miles from the Canadian coast, failed to allay the controversy, which was now embittered by the 'headland question' and others, involving the right of Americans to fish in the Gulf of St Lawrence, the Bay of Fundy, and the Bay of Chaleurs. Following on the seizure of the *Washington*, this dispute, so far as it related to the Bay of Fundy, was submitted to arbitration, and decided in favour of the United States. Except during the years 1854–66, when a reciprocity treaty was in vogue, matters remained unsettled until 1871, when by the treaty of Washington the fisheries of both countries were thrown open reciprocally. Britain, however, asserted that, the privilege of fishing in American waters being practically worthless, she accorded more than she received; and from a commission organised nearly six years later she claimed an award of $14,280,000 for the use of the Newfoundland and inshore fisheries for twelve years—the period of treaty. The sum awarded was $5,500,000. For the further history of the dispute, see CANADA.

Within the last century a great many legislative enactments concerning the fisheries have been passed in the United Kingdom. Legislation concerning the salmon-fisheries has a different character from that applied to the sea-fisheries. The former consists in restrictions upon the rights of private property in salmon, or upon the public right of fishing, enforced for the sake of preventing the diminution of the natural supply of the fish. The latter, up to the present time, consists chiefly in regulations of navigation and marine police, the object of which is to maintain order and justice among different classes of fishermen, and to prevent fishing-vessels endangering the safety of one another, or of other vessels, at sea. For the laws in force for salmon-fisheries, see SALMON.

By the Sea-fisheries Acts of 1868 and 1883, and the conventions between Britain and other European countries, the right of fishing within three miles of the coast of any country is exclusively reserved to the subjects of that country. All regulations concerning the size of the mesh of net or the character of fishing apparatus are now abolished. All British sea-fishing boats must be numbered and registered, and the enforcement of this regulation is intrusted to the customs officers, who are assisted by the coastguard, each boat carrying letters showing the customs district to which it belongs. Stringent regulations are enforced as to the lights to be carried by fishing-boats, and the protection of drift-nets and lines from injury by trawlers. No trawler is allowed to shoot his trawl within three miles of any boat which has drift-nets in the water.

It is only within the last few years that steps have been taken to organise the administration of the powers of the government over the fisheries of the United Kingdom in such a way as to provide the public annually with statistical and comparative information of a complete and systematic kind upon these industries. This is especially true with respect to England and Wales. Up till the year 1886 jurisdiction over the fisheries of these countries was vested partly in the Home Office and partly in the Board of Trade. The former department included two fishery inspectors, who made an annual report on the salmon and fresh-water fisheries, but did not regularly report on the marine fisheries. In 1886 this jurisdiction was transferred to the Board of Trade, a sub-department being organised under that board to transact fisheries business. Since then there have been three inspectors—two for fresh-water, and one for marine fisheries. These issue two separate annual reports, addressed to the secretary of the Board of Trade; and in the year 1888 the Twenty-seventh Annual Report on Salmon and Fresh-water Fisheries and the Second Annual Report on Sea-fisheries were published. The Board of Trade also publishes monthly returns, and an annual abstract of the quantity and value of fish landed on all the coasts of the United Kingdom. These statistics are collected in England and Wales by the officers of the coastguard, by direction of the Fisheries Sub-department, while the statistics of Scotland and Ireland are furnished to the Board of Trade by the Scottish Fishery Board and the inspectors of Irish Fisheries respectively. Complete returns were obtained for the first time for England and Wales at the end of 1886; for Scotland at the end of 1887; for Ireland at the end of 1888. In Ireland the returns are collected, as in England, by the coastguard; in Scotland by the local officers of the Fishery Board.

Jurisdiction over the Scottish fisheries is vested in the Fishery Board for Scotland, whose offices are in Edinburgh. This board makes an annual report to the government of the United Kingdom, addressed to Her Majesty's Secretary for Scotland for the time being. The board, as at present constituted, was established by act of parliament in 1882; before that time a board existed which regulated the inspection and branding of cured herrings, but the present board was instituted with revised and extended powers. For the purposes of administration the coasts of Scotland are divided into districts, each of which has one or more fishery officers. The number of these districts is twenty-six—seventeen on the east coast, and nine on the west. It must be borne in mind that the elaborate and thorough character of this administrative organisation in Scotland has been developed in consequence of the peculiarities of the Scottish herring trade. The supply of herrings on the coasts of Scotland, especially on the east coast, is enormous, and the demand for these herrings as food has always been very large, and has increased with the increase of population in Europe. Fresh herrings, of course, cannot be exported abroad in very large quantities, but they are acceptable and cheap food when salted, and great quantities are annually exported in this condition to Denmark, Germany, Russia, and Scandinavia, where they form a regular part of the diet of the mass of the people, especially in winter.

To encourage the industry of herring-curing the British government from 1809 to 1826 paid a bounty of 4s. on each barrel properly cured. The original Scottish Fishery Board was instituted principally to organise the official inspection of the cured herrings, and its officers branded every barrel whose contents came up to the required standard, and

on which therefore the bounty could be claimed. Between 1826 and 1830 the bounty was gradually reduced, and finally abolished. But the brand still continued in demand among the foreign buyers, and the Scottish curers therefore continued to apply for it. Thus it came about that in 1859 a fee was demanded by the Fishery Board for the same brand which originally conveyed the right to a bounty. The branding is not in the least compulsory, and some curers rely on their own trade-mark as a sufficient guarantee of quality. But a large proportion of the curers are willing to pay the fee charged for the official brand, which is now 4d. a barrel. In 1886 the income received from these fees by the board was £8649; in 1887, £8166. Thus the board is provided at once with an income and an organisation which naturally come to be employed in collecting information of all kinds concerning all the sea-fisheries, and in fostering and developing the whole industry.

The board also exercises a superintendence of the fisheries, and maintains order at sea by means of a number of vessels which are now manned and managed by the admiral-superintendent of Naval Reserves, but whose movements are directed by the board. Two of these vessels, a screw-steamer and a sailing schooner, are permanently in the service of the board, but in the herring season additional tenders and cutters are commissioned to assist in the work.

In Ireland the superintendence of the fisheries is entrusted to three inspectors, who constitute the Fisheries Department of the government offices at Dublin Castle. These officials act together as a body, and have jurisdiction over both sea and inland fisheries, upon which they make a single joint report annually to the lord-lieutenant of Ireland.

According to the annual returns of the Board of Trade, published under the title 'Statistical Tables and Memorandum relating to the Sea-fisheries of the United Kingdom,' &c., the total value of the fish landed on the coasts of the United Kingdom in 1888 was £6,418,000, made up as follows:

England and Wales	£4,213,000
Scotland (excluding salmon)	1,411,000
Ireland (excluding salmon)	191,000

The value of the salmon of Scotland and Ireland for 1888 was still uncalculated, but in 1887 was:

Scotland	£283,000
Ireland	320,000

and it is assumed that the totals for 1888 did not very greatly differ from these. The total weight of the fish thus valued, exclusive of shell-fish, was:

England and Wales	317,000 tons.
Scotland (excluding salmon)	238,000 "
Ireland (excluding salmon)	20,000 "

The returns give no statistics of the number of men or vessels employed in the fisheries of the United Kingdom, though they furnish these particulars concerning those of some other countries. But we find in the Scottish Fishery Board Report for 1887 that the number of persons employed in fishing that year in Scotland was 50,023. The number of fishermen and boys in 1887 in England is given in the Report of the Inspector of Sea-fisheries as 47,341. The Irish report for the same year states the number of persons totally or partially engaged in fishing at 21,750, of whom only 6387 were exclusively occupied in the fisheries. If we take the larger number for Ireland and add the totals of the three countries together, the total number of fishermen and boys for the United Kingdom amounts to 119,114. The total number of boats employed in England and Wales is not given. The Scottish Fishery Board gives the number of boats and trawlers belonging to Scotland in 1887 as 15,135, to which are to be added 102 vessels fitted out for long fishing voyages. The total tonnage was 132,837. According to the Irish report, the total number of boats employed in Ireland in the same year was 5865.

The herring-fishery is by far the most productive and valuable of all the sea-fisheries of Scotland. The largest herring-fishing on the Scottish coasts ever known was in 1884, when 1,697,077 barrels were cured. The number cured in 1887 was 1,303,424, valued at £1,042,739. This is, of course, very different from the value on landing.

In the statistical tables of the Board of Trade the following statistics of foreign countries are given:

	Vessels.	Men.	Value of Fisheries.
Norway (1887)	31,630	123,843	£820,000*
France (1886)	23,880	135,178	3,361,000
Canada (1887)	29,260†	59,933	3,830,438

The United States do not publish an annual estimate, but the figures for 1880 given in the compendium of the tenth census are: Fishermen, 131,426; vessels, 6605; boats, 44,804; value of products, £8,609,210.

In the Board of Trade returns it is stated that the sea-fisheries of the United Kingdom appear to be of greater value than those of any other country which publishes tolerably complete records, and probably are of greater value than those of any other country in the world. And this in spite of the fact that the yield of the sea-fisheries of the United States in 1880 is stated to be worth more than eight million pounds. The explanation of this is that the United States figures include more than the mere landing values, and that an exact comparison of British with American fisheries cannot yet be made. If we compare the number of fishermen to the total population, we find that the proportion in Scotland is about one in 76; in England and Wales, one in 612; in Ireland, one in 216; in the United States, one in 381; in Norway, one in 16; in France, one in 278.

Fisheries exhibitions like that at London in 1883 have been held in various places with much success. On fisheries, see articles PISCICULTURE, ANGLING, COD, HERRING, &c.; also E. W. H. Holdsworth, *Deep-sea Fishing and Fishing Boats* (1874); the English, Scottish, and Irish Reports; the *Journal of the Marine Biological Association* (begun in 1887); and the Annual Bulletin of the United States Fish Commission. These last contain comprehensive articles on the fisheries of all parts of the world.

Fisher's Hill, in the Shenandoah valley, Virginia, 30 miles S. of Winchester, memorable for Sheridan's victory over the Confederate General Early, on 21st September 1864.

Fishes, a great class of backboned animals, rising above the lowly vertebrates—Ascidians, lancelet, and round mouths—on the one hand, and leading on to the Amphibians on the other. The Tunicates or Ascidians (q.v.) are indeed numerous, but they are mostly degenerate; the level attained by the lancelet (Amphioxus, q.v.) is represented only by a single genus; the round mouths or Cyclostomata (q.v.) are few in number and partially retrogressive, but the fishes have been and are successful. In the possession of the characteristic vertebrate axis and central nervous system, in general compactness and co-ordination of structure, in their external armature of scales, and in their great fecundity, fishes have an easy pre-eminence over their invertebrate inferiors, while as successfully adapted forms they hold as firm possession of their own special medium as birds do of theirs. Their success may be read in the immense number of individuals, species, and

* The value, however, for each year from 1874 to 1886 is given as over £1,000,000.

† Of which only 1168 were vessels, the rest boats.

genera, not only now, but in the great æons of the past; in the geological record which shows how the Cartilaginous Fishes (q.v.) or shark tribe have persisted strongly from Silurian times, or how the decadent Ganoid (e.g. sturgeon) order is followed by a yet richer predominance of the modern Bony Fishes (q.v.); and, furthermore, in the wealth of adaptive specialisation which distingnishes so many, and which in the case of the 'double-breathers' or Dipnoi prophesies, in the evolution of lungs, the important transition from water to *terra firma*.

Literary History.—The history of the study of fishes finds its beginning as usual in the work of Aristotle (384–322 B.C.), who distinguished over a hundred Ægean species, is perfectly clear in discriminating them from cetaceans and invertebrates, and records a surprising amount of information in regard to both their structure and habits. As with other departments of natural history, so ichthyology, in spite of its stable foundation, remained virtually unprogressive for eighteen centuries. In the 16th century at length Belon began to collect both specimens and information; Salviani, the physician of three popes, published an illustrated work characterised rather by artistic merit and popular interest than by scientific value; while Rondelet, as a medical anatomist, ventured further into structural details than either of his contemporaries. In the next century the classifying genius of Ray and Willughby achieved great progress, and the establishment of order was continued by Artedi, whose results were edited by his fellow-student Linnæus. The labours of the Linnæan school were ably continued by Bloch and Lacépède, both working during the critical period of the French Revolution. The anatomical investigations of Alexander Monro, embodied in a classical folio, led on to the great *Histoire Naturelle des Poissons* begun by Cuvier, continued by his pupil and collaborateur Valenciennes, and finally left unfinished in 1845 at the twenty-second volume. The virtual discovery of the Ganoids by Agassiz, their investigation by Johannes Müller, the separation of the Dipnoi, the Cyclostomata, and Amphioxus by the same anatomist, and the discovery of Ceratodus, described in 1871 by Günther, were ichthyological events of great importance. Within late years, apart from the vigorous prosecution of anatomical investigation, the study of the development of fishes has yielded to such workers as Balfour, Parker, and Semper results of fundamental import; our knowledge of fossil forms is being continually enriched by the researches of Traquair and others; the theoretical aspects of structure have been especially investigated by Dohrn; while the high-water mark of general ichthyology is represented in the British Museum Catalogue of Fishes and other works by Günther.

General Survey.—After excluding the lancelet and the round mouths as survivors of far-removed ancestral forms, there remain four great orders of fishes properly so called—the Cartilaginous Fishes, the Ganoids, the Dipnoi, and the Bony Fishes or Teleosteans. The first three orders, of more ancient origin, are distinguished as Palæichthyes from the modern fishes or Teleostei which now form the vast majority. The cartilaginous fishes include the Elasmobranchs—skates and rays, sharks and dog-fish, with the addition of an unimportant sub-order, Holocephali, for the king of the herrings (Chimæra) and the genus Callorhynchus. The Ganoids or heavily-armoured fishes had their golden age in Devonian and Carboniferous times, and are represented nowadays only by a few genera—e.g. sturgeon (Acipenser), bony pike (Lepidosteus), Polypterus, and Amia; while the Dipnoi or double-breathers have only three representative genera, widely separated in geographical distribution—Ceratodus from Queensland, Protopterus from West and tropical Africa, and Lepidosiren from the Amazon. The Teleostean fishes include all the most familiar fresh-water and marine forms.

General Characters.—Like other vertebrates, fishes possess a segmented body, well indicated by the disposition of the muscles; a dorsal nerve cord, swollen anteriorly into a brain; a dorsal axis or notochord, more or less completely replaced by a genuine backbone; a set of respiratory clefts on the pharynx, which here persist and are associated with gills; a ventral heart; and eyes which arise for the most part as outgrowths of the brain. But their prominent peculiarities are associated with the three sets of structures—scales, fins, and gills. The scales are products of both outer and inner skin—i.e. of both epidermis and dermis; the unpaired median fins are always supported by skeletal rays, and the paired lateral fins or limbs are never in any definite sense fingered; the gills are retained throughout life, and except in the Dipnoi there are only the beginnings of pulmonary respiration. Technical negative characters are the absence of an allantoic bladder and of a true inferior vena cava.

Structure and Functions.—The most characteristic *form* is that of herring, haddock, salmon, and the like, an elongated, laterally-compressed spindle, thinning off like a wedge posteriorly, and obviously the result of, or an adaptation to, the mode of aquatic progression. But the skates are flattened from above downwards, and the bony flat-fish, such as plaice, are compressed laterally; the eels, the ribbon-fish (e.g. Regalecus), the band-fish (Cepola), the pipe-fish (Syngnathus), are much elongated; while the globe-fish (Tetrodon, Diodon), coffer-fish (Ostracion), and sun-fish (Orthagoriscus) are more or less globular. The flat-fish live at the bottom; the elongated forms have a serpentine habit of creeping through crevices; the globular forms are sluggish, and may float apparently passive in the water. Prominent external characters, to be presently noticed in order, are the nostrils and eyes, the openings of the gill-cavities, the various kinds of scales, the paired and the median fins, the lateral sensory lines, the openings of the gut and urinogenital organs, the symmetrical or asymmetrical shape of the tail.

The *skin* has no true glands; the under stratum or cutis is without muscular elements; both layers take part in forming the exoskeleton of scales. In some bony fishes, in the Dipnoi, and in the sturgeon, goblet-like mucous cells burst and produce a slimy surface, but the usual slime so noticeable in skates and many other fishes exudes from special sensory tubes. Pigment cells under nervous control are common in the skin—e.g. in plaice, which thereby more or less rapidly alter their colour to suit their surroundings. The colours of fishes are often resplendent, and usually depend on the presence of lipochrome or fatty pigments, greatly enhanced by structural peculiarities and by the presence of a silvery foreground of guanin in the epidermic cells (see PIGMENTS). As in the 'gemmeous dragonet,' the males are at the breeding season often transfigured in brilliant 'wedding' robes. The exoskeleton varies very widely, and so inconstantly that Agassiz' attempt to base a classification on the nature of the scales has been universally abandoned. Cartilaginous fishes are characterised by large or small skin-teeth, 'dermal denticles' or 'placoid scales,' forming the spines of a thornback or the shagreen of a shark. They are based in bone, cored with dentine, tipped with enamel, and are similar in structure and development to the true teeth of the mouth. The bone and dentine are formed from the cutis or dermis, the enamel from the epidermis. Skin-teeth occur here and there in other fishes, but

flat scales predominate. These lie in sacks of the under skin, sometimes fuse together into plates, are covered with enamel in the bony pike and some other Ganoids, but are best known as soft overlapping plates in the common Teleosteans, where they are called cycloid or ctenoid, according as the free margin is entire or toothed.

Skeleton.—The oldest vertebrate skeletons were cartilaginous, and the greater part of every individual framework has to recapitulate this stage. Very early, however, and at first in scales and teeth, bone was developed; but many of the older types of fishes are only slightly or very partially beyond the cartilaginous level. This is true of Elasmobranchs, Dipnoi, and some Ganoids, while other Ganoids and the bony fishes *par excellence*—the Teleosteans—have ossified skeletons. As in all other vertebrates,

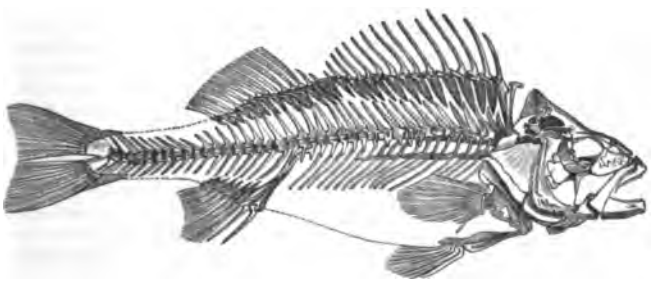


Fig. 1.—Skeleton of the Perch (after Günther).

the longitudinal axis begins as a rod of cells on the dorsal wall of the gut. This notochord, itself of endodermic origin, becomes surrounded by a mesodermic sheath, and when a genuine vertebral column is established it is always by the predominance of the sheath over the enclosed rod. In some Elasmobranchs, in gristly Ganoids, such as the sturgeon, and in Dipnoi, the notochord with its sheath persists undivided; while in other fishes vertebral bodies, bony or otherwise, are established. The typical fish vertebra is concave at both ends, and every two adjacent vertebræ thus enclose a wide space in which the remains of the notochord persist. The bony pike (Lepidosteus), one of the bony Ganoids, stands alone in having vertebræ hollow behind but convex in front. The dorsal axis protects the spinal cord, which lies above, by forming a continuous tunnel, or by a succession of 'neural arches.' In the tail region 'hæmal processes' similarly surround the blood-vessels, and the external ends of neural and hæmal arches may come to be associated with dorsal and anal unpaired fins. The tail-end of the axis is usually bent upwards, but is straight in Dipnoi and a few others, and is surrounded by a special bony sheath in many Teleosteans. Thus, we have an asymmetrical tail in Elasmobranchs and some Ganoids, a perfectly symmetrical tail in Dipnoi, and a superficially symmetrical tail in most Teleosteans, and in some Ganoids, where the way in which the rays are disposed disguises the real upturning of the axis. When the notochord remains undivided the ribs are cartilaginous, and in all fishes they are very simple.

To understand the skull it is necessary to recognise its triple origin: (1) The brain is at first enclosed in a cartilaginous box, with which the gristly capsules surrounding nose and ear become at an early stage intimately associated. This chondrocranium or gristly brain-box is a truly axial portion of the skull, corresponding to a comparatively large number of segments (see SKULL). It is always well developed, and remains entirely unossified in Elasmobranchs alone, being in other fishes more or less modified into bones. (2) But, in the second place, what are called skin bones have to be taken into account. These dermal ossifications, 'membrane,' or better 'investing-bones,' probably had their historic origin in the fusion of bony scales. They are greatly developed in bony Ganoids and in Teleosteans, and more or less cover the chondrocranium on its roof, floor, and sides. (3) Lastly, there depend from the skull a series of arches, of which the posterior form supports for the gills, while the anterior form at least the groundwork of the jaws, and may enter into yet more intimate union with the main body of the skull.

Limbs.—The paired fins of fishes are in origin strictly comparable with the arms and legs of higher vertebrates, but their component parts are too simple to be very definitely compared with those of fingered or toed appendages, such as occur for the first time in amphibians. A typical fin consists of a basal piece, or of several, associated internally with a pectoral, and less constantly with a pelvic girdle. From the base a large number of rays radiate outwards. A most interesting type, from which some have attempted directly to derive the 'dactyls' of higher forms, is exhibited by the Dipnoi, in which a main axis runs down the limb (see CERATODUS). It seems most probable that the paired fins are concentrations or remnants of a continuous lateral fin extending along each side of the body, or of a series of limbs, one for each segment. Among the modifications worth noting are the enormous pectoral fins of skates, the anterior position of the pelvic fins in many bony fishes, and the entire absence of limbs in eels, pipe-fish, and a few other Teleosteans. As to their use, it must be remembered that the chief organ of locomotion is the tail, and that the paired fins serve to raise and depress the fish in the water, or to some extent as rudders. In a few cases, as in the climbing perch, they are utilised as scrambling appendages. The pectoral girdle which supports the fore-limb is cartilaginous in Elasmobranchs, Dipnoi, and some Ganoids, but is elsewhere ossified. Coracoid and scapular portions are distinguishable, while in Ganoids and Teleosteans there is a special development of investing bones. The pelvic girdle is a well-developed hoop in Elasmobranchs, while in Ganoids and Teleosteans, with one or two trifling exceptions, it is absent. The unpaired fins are derived from a continuous fringe seen in

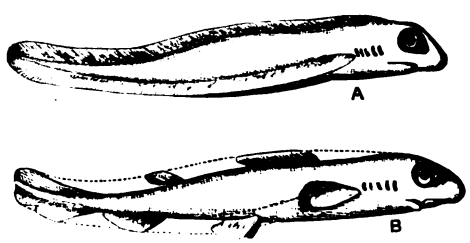


Fig. 2.—The Origin of Fins:

A, showing the undifferentiated embryonic and probably primitive state, with continuous median and lateral fins. B, showing the two dorsals, the caudal and anal unpaired fins, and the pectoral and pelvic paired fins. (After Wiedersheim and Parker.)

the embryo (see fig. 2), and this state occasionally persists. Usually, however, there are several dorsals and anals, and the great locomotor fin of the tail. The rays are horny, cartilaginous, or bony, and vary enormously in size, form, and number. Sometimes spine-like and all of one

piece, sometimes soft and jointed, they afford valuable aids in classification.

Muscular System.—The great muscles of the trunk and tail, which do the work of locomotion, retain a segmented arrangement (as can be very plainly seen even on a boiled fish); and the segments or myotomes are separated by septa of fibrous connective tissue. Very remarkable modifications of muscular tissue form the various electric organs. See ELECTRIC FISHES.

Nervous System.—The brain and spinal cord are smaller in relation to the body than in other vertebrates. The growing skull outruns what it encloses, and the adult brain thus lies in a relatively large cranial cavity. All the usual divisions of the brain are developed, and in adult life lie virtually in one plane. Ten nerves from the brain, a large number from the spinal cord, and a sympathetic system exhibit their usual relations. See the articles BRAIN and NERVOUS SYSTEM.

Sense Organs.—In most fishes a diffuse sensory system is located in the skin. Nerve endings of various kinds occur here and there over the surface, projecting superficially, arranged in definite lines, lodged in pits, or associated with a peculiar system of canals filled with mucus. The sensory structures thus variously arranged are distinguished as 'nerve eminences' and as 'end buds.' The former are very familiar in the lateral lines, one of which runs down each side of most bony fishes, and in the mucous canals which branch so abundantly on skates. The 'end buds' hardly occur in Elasmobranchs, but are abundant in Teleosteans, especially about the head. Near the mouth of the sturgeon, the cod, and other forms are tactile 'barbules.' Important too, though unfamiliar, are the 'eye-like,' 'pearl-like,' and 'phosphorescent' organs on the skin of deep-sea fishes.

The nose sacs lie ventrally in Elasmobranchs, in some of which—e.g. skates—they are connected with the corners of the mouth in a sort of hare-lip fashion. In Ganoids and Teleosteans the nasal sacs lie dorsally in front of the eyes, while the Dipnoi are alone among fishes in having posterior nasal apertures opening within the mouth, as in higher vertebrates.

The eyes (see EYE) are usually large, but are destitute of glands, and have but a slight development of lids. In fishes living in darkness, whether in caves, mud, or the deep sea, the eyes may be rudimentary (see BLIND FISH). The final position of both eyes on one side is a remarkable peculiarity of bony Flat-fish (q.v.).

The ear, which is not very deeply buried, is surrounded by a cartilaginous capsule in Elasmobranchs and Dipnoi; but in other cases, whether the surroundings be gristly or bony, the wall next the skull is membranous. As in higher forms, the ear begins as an inturning of the skin, and a canal opening to the exterior in many Elasmobranchs persists as a remnant of this. From the comparatively superficial position of the ear, the waves of sound have not to penetrate so deeply as in higher vertebrates, and 'are conducted partly through the gill-cover (when present), and partly through the gill-slits or spiracle;' while in the skate there is what physiologically corresponds to a kind of drum. Inside the ear are the usual otolithic accumulations, sometimes soft, sometimes stone-like. In many Teleosteans, as may be conveniently seen in cod or haddock, one of the otoliths is strikingly large.

Intelligence and Emotions.—Fishes are not usually credited with many emotions or with much intelligence, but their natural life has not yet been sufficiently studied to admit of a fair verdict. As it is, anglers know how they become wary and cunning, and keepers of aquaria have recorded many instances of the commoner emotions and of fair intelligence. According to Romanes their emotions approach those of ants or of children four months old, except that no evidence of genuine sympathy is forthcoming. 'Fear and pugnacity are too apparent in fish to require special proof. The social or gregarious feelings are strongly shown by the numberless species which swim in shoals, the sexual feelings are proved by courtships, and the parental by those species which build nests and guard their young.' The stickleback woos his mate with undisguised passion and amusing coquetry, and guards the nest and eggs with jealous care. The Chinese butterfly-fish or Macropod, besides making an ingenious frothy nest of air and mucus, lifts the eggs into it by enveloping them in a cloud of bubbles. Tamed fishes have been known to become familiar with their keepers, and to answer to certain sounds. In natural life, the angling of the fishing-frog, the spitting of the archer-fish, the leaping of salmon and their careful selection of spawning grounds, the memory for localities which some are said to exhibit, all indicate that intelligence is not asleep in the fish's brain.

Alimentary System and Food.—The gut of fishes exhibits the usual vertebrate characteristics; but the distinctions of the several regions are often less marked than in higher forms. The mouth has no salivary glands, but, except in sturgeons, some Lophobranchs, and a few more, it has well-developed teeth on various bones. These mainly consist of ivory or dentine, tipped with enamel, and vary greatly in size, form, and mode of attachment. In cartilaginous fishes they rise out of a fibrous membrane which grows over the jaw as the outer teeth are worn away; in the angler (Lophius) and some other Teleosteans they bend backwards, and oppose the egress of struggling prey; in bony Ganoids and in Teleostei they occur on branchial arches (pharyngeal teeth), as well as on the usual bones of the skull. The mouth is ventral in Elasmobranchs, but in other cases is terminal, or occasionally upturned. The pharynx opens to the exterior by the respiratory gill-slits; gullet, stomach, intestine, liver, and gall-bladder have

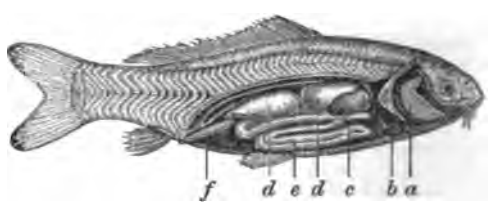


Fig. 3.—Internal Anatomy of the Carp, showing the muscle segments where the skin has been removed:
a, gills; *b*, heart; *c*, liver; *d*, swim-bladder; *e*, intestine; *f*, ureters.

their usual relations; in Ganoids and most Teleosteans a large number of 'pyloric cæca' are given off at the beginning of the intestine; the pancreas is often diffuse or absent in Teleosteans; except in the last-named order, but especially in Elasmobranchs, there is a spiral ridge running down the large intestine, greatly increasing its internal surface. In Elasmobranchs and Dipnoi the gut ends in a cloaca or common chamber, into which the urinogenital ducts also open. In other fishes the anus lies in front of and separate from the other aperture or apertures.

The food of fishes is very diverse, from minute Protozoa to whales; they are carnivorous, vegetarian, or virtually omnivorous. Worms, crustaceans, insects, and molluscs and other fishes are important items in the carnivorous diet, in which they are

usually voracious and often anything but discriminating. Some swallow mud for its living or decomposing contents; others, again, feed on sea and fresh-water weeds. The food is usually swallowed whole, though some sharks tear their prey into available pieces. Not a few forms manage to swallow other fishes out of all proportion to their own size, and in museums may be seen specimens which have managed to get outside victims even larger than themselves! Besides the formidable teeth of sharks and the like, the modifications of the jaws in sword- and saw-fish are conspicuous adaptations to a highly-evolved carnivorous habit.

Circulation.—In all fishes, except the Dipnoi, the heart receives impure blood only. This is driven by the muscular chamber or ventricle to the gills, whence being purified it is collected into the dorsal aorta which gives off arteries to all parts of the body except the head, which receives a direct supply from the most anterior of the vessels returning from the gills. From the body anterior and posterior veins convey the impure blood into the heart, into the so-called senus-venosus, or porch to the auricle. Though the direct work of the heart is solely to drive impure blood to the gills, it need hardly be pointed out that, as the chief origin of the alterations of pressure which determine the circulation, the heart has its usual, though obviously indirect, systemic significance. Except in the bony fishes, the ventricle is prolonged into a contractile tube known as the *conus arteriosus;* but, except in the Dipnoi, the heart is accurately described as two-chambered. Venous blood from the posterior region passes through the kidneys, forming a renal-portal system, as in amphibians and most reptiles, and there is the usual hepatic-portal system wherein vessels from the intestine pass into the liver. The hepatic veins leading from the liver enter the heart independently of the other posterior veins, and thus there is no strict *inferior vena cava.* In the Dipnoi the circulation has been modified with the acquisition of lungs. The heart receives pure as well as impure blood, and the auricle is divided by a septum. Fishes have the usual lymph system, and the ordinary blood-glands—spleen, thyroid, and thymus.

Respiratory System.—From the pharynx the characteristic vertebrate clefts open to the exterior, and admit of a water current in by the mouth, down the pharynx, out by the clefts. Between the clefts extend the supporting (branchial) arches, and these bear the folds or filaments on which the blood is exposed—in other words, the gills. In the cartilaginous fishes the separate gill-clefts are obvious enough externally; in other fishes the apertures are protected by a fold or operculum, and the partitions which form a series of chambers in skate or shark become more or less reduced. Thus, in the haddock there is one external opening on each side, and the gill-filaments are borne upon arches which are only attached at their extremities. The number of gills or clefts varies considerably; there are usually five in Elasmobranchs, four in Teleosteans. The primitive fish doubtless had a large number of gill-slits, and Heptanchus still survives with seven. In Elasmobranchs and some Ganoids the most anterior of the distinct gill-slits forms what is known as the 'spiracle,' opening on the top of the head, sometimes bearing a rudimentary gill, and lying in the position of the Eustachian tube in higher animals. In young Elasmobranchs, sturgeons, and many bony fishes there are to start with *external* gill-filaments, somewhat like those of a tadpole, while in Protopterus, one of the Dipnoi, there are three pairs of external gills in adult life. In the majority of fishes, but not in Elasmobranchs, nor in bony flat-fish such as plaice, there is an Air-bladder (q.v.) or swim-bladder, which arises almost always as a *dorsal* outgrowth from the gut, and prophesies the lung of higher vertebrates. As the name suggests, its function is in most cases hydrostatic, raising or lowering the fish according to its state of expansion or contraction, and it always receives a supply of arterial blood. In the 'double-breathing' Dipnoi, which gulp air at the surface, the swim-bladder functions as a genuine lung, and the same is true to a less marked extent of a few other fishes. In all Ganoids and in the Physostomi section of bony fishes the connection between air-bladder and gullet remains throughout life an open passage; in the other bony fishes (Physoclisti) the connection is a solid cord or is altogether obliterated. The sac extends along the back under the vertebral column, and is exceptionally (e.g. Polypterus) double like lungs; in four families of Teleostei it is connected anteriorly with the ear by a chain of bones, 'by means of which its relative fullness can be appreciated by the fish.' Some bony fishes—e.g. climbing perch and certain Siluroids—have curious accessory respiratory organs, and are able to remain for some time out of the water; and here also may be noted the dilatable sac which opens into the ventral side of the pharynx in some box or globe fishes—e.g. Diodon.

Excretory System.—To the zoologist the kidneys of fishes are of great interest, because it has been possible through the study of their development to reach an approximate elucidation of the 'homologies' or real resemblances in the different parts of the urinogenital system throughout the vertebrate series. Only two general sentences are here permissible. At an early stage a segmentally arranged series of ciliated excretory tubules, or nephridia, make their appearance; they are strictly comparable to the excretory tubes of invertebrates, and a certain unity is thus demonstrable between earthworm and dog-fish. Of these little tubes some form the adult kidney, others the 'Wolffian body' or 'parovarium,' while others disappear. But, besides the tubules which lie transversely, there is on each side a longitudinal duct with which some at least of the nephridia become connected; this so-called 'segmental duct' is either derived, as the insinking of a skin (ectodermic) groove, or else from the external portion of the middle (mesodermic) layer; on each side it typically becomes double, and forms the reproductive ducts for either sex, but the half which is important in the male is rudimentary or unimportant in the female, and *vice versâ.*

Reproduction.—The sexes are almost always separate, but a male organ or testis 'is constantly found imbedded in the wall of the ovary in Chrysophrys and Serranus (two bony fishes), and the last-named fish is said to be self-impregnating.' As in most other vertebrates, occasional hermaphroditism occurs as an abnormality—e.g. in mackerel and herring. The males of bony fishes are usually smaller than their mates, and sometimes very markedly so; in many cases, especially at the breeding season, they are further distinguished from the females by bright colouring. Thus, the male 'gemmeous dragonet' (*Callionymus lyra*) is so flushed with brilliant colour that it was regarded by Linnæus as quite distinct from the 'sordid,' dingy female. The male sea-scorpion (*Cottus scorpius*), usually ill-favoured, becomes gorgeously adorned during the spawning season, and the same is true of a great many forms. In Elasmobranchs the males are distinguished by the possession of copulatory organs or 'claspers.' As the males often fight with their rivals, special adaptations have come to be associated with this habit; of these the hooked

lower jaw of the male salmon, so suitable for butting, is perhaps the most familiar instance. In many marine fishes the females appear to be in a very large majority. There are frequently other differences between the sexes, especially as regards the unpaired fins, and Darwin also quotes some cases (especially Ophidium) where it seems that the males, and the males only, have the power of producing sounds. See SEX, SEXUAL SELECTION. The ovaries and testes are almost always paired organs, which become large and conspicuous in the reproductive season. In all Teleosteans save one, and in the bony pike (Lepidosteus), there are ducts continuous with the ovaries; in other fishes the eggs burst into the body-cavity, and are subsequently pressed into the ducts. The male elements are likewise occasionally set free in the body-cavity (Dipnoi and Murænidæ), but usually pass more or less directly into ducts. In most Elasmobranchs, in Ganoids, Dipnoi, and a few Teleosteans, there are two openings or 'abdominal pores' from the body-cavity to the exterior, which perhaps represent a primitive exit for the reproductive elements, and in a few cases still serve for that purpose. In the great majority, however, the reproductive ducts fulfil their usual functions, and open either into a cloaca in Elasmobranchs and Dipnoi, or behind the anus in Ganoids and Teleosteans.

Most fishes are oviparous, laying the eggs as such, and that usually in great numbers. They are extruded on the bottom—e.g. among gravel—or in many cases are discharged broadcast in the water. A few fishes, such as sturgeon and salmon, ascend rivers for spawning purposes; while others, like the eel, descend to the sea. The female salmon is careful in the choice of a spawning ground, and in ploughing a groove for the eggs among the gravel is said to avoid areas which have been already occupied by her forerunners. In regard to trout, it has been observed that the absence of a suitable bottom may lead to retention of the ova, to consequent disease in the organ, and to an inferior brood the next season. The eggs of oviparous Elasmobranchs are surrounded by a chitinoid case, the so-called mermaid's purse, so often found empty on the beach. This sheath is a product of the lower portion of the oviduct, and often has tendril-like prolongations at the corners, which twine themselves automatically round seaweed, where the embryos are rocked till the time of hatching. Most sharks and a few Teleosteans bring forth their young alive. In the viviparous Teleosteans the eggs develop in the ovary; in the sharks, in the lower portion of the oviduct. Two of the viviparous sharks (*Mustelus lævis* and *Carcharias glaucus*) are of peculiar interest in the establishment of a vascular placenta-like union between the yolk-sac and the wall of the oviduct, an arrangement which has also been noticed in a couple of lizards. In the Teleostean Anableps the yolk-sac has villi which protrude into a dilated ovarian chamber and absorb nutritive material. As to fertilisation, the usual process is that the male deposits the spermatozoa or the milt upon the laid eggs or spawn, but it is evident that fertilisation must be internal when the forms are viviparous or when the eggs are enveloped in a firm sheath.

Parental Care is but rarely exhibited by fishes, and then usually on the part of the males. Love for offspring usually varies inversely with their number, and those of fishes are legion; nor would young fish benefit much by any care, except an impossible providence which would prevent their being swallowed. Apart from numerous viviparous forms, the female of a Siluroid genus (Aspredo) carries the ova on her belly till they are hatched, just as the Surinam toad bears her progeny on her back; and in Solenostoma a pouch for the eggs is formed by the ventral fins and skin. The male stickleback (Gastrosteus) makes a nest of grass stems and water weeds, weaves it round with

Fig. 4.
The male of a Pipe-fish (*Syngnathus acus*), with pouch beneath the tail for carrying the eggs (after Günther).

mucous threads (which seem to be almost pathological products of the kidneys compressed by the enlarged male organs), and jealously guards the eggs laid by his mate. The same is said to be true of a species of Chromis from the Sea of Galilee; and more or less elaborate nests are formed by the males in the genera Cottus, Cyclopterus, Antennarius, Ophiocephalus, and Callichthys. 'The male of some species of Arius carries the ova about with him in his capacious pharynx,' while in the pipe-fishes and sea-horses various abdominal brood-pouches are developed.

Development.—The fish egg is a small thing, except in the cartilaginous fishes, where it is very large, and enclosed in the characteristic chitinoid case. In other fishes there are only the usual egg-sheaths, such as the *zona radiata*, with one aperture or more for the entrance of the spermatozoon. Fertilisation usually takes place in the water, much less frequently within the female. Since the old experiments of Jacobi (1757–63), artificial mingling of the sperms and eggs has often been resorted to, both in the embryological laboratory and in the practical work of stocking rivers (see PISCICULTURE). In the egg the yolk usually bears a large proportion to the strictly formative material, and the division with which development begins is partial in all known cases except the sturgeon and the bony pike. Development is, in most cases, a

Fig. 5.—Young bony Fish, with dependent yolk-sac still unabsorbed.

rapid process, and the newly-hatched forms bear the still incompletely absorbed yolk-sac dependent from their ventral surface. The larval forms are often unlike the parents, for instance, in the possession of external gill-filaments in Elasmobranchs, &c., or in minor features connected with mouth, fins, and armature. The most striking change is that which happens to young, bony Flat-fish (q.v.). See EMBRYOLOGY, and such articles as SALMON.

Relation to Environment.—In many fishes the limit of growth is less definite and less rapidly attained than is usual among higher vertebrates. In favourable circumstances individuals will go on growing, and may far outstrip the average of the species, while, on the other hand, a confined habitat and restricted food-supply may reduce the size. 'The young of coast-fishes, when driven out to sea, where they find a much smaller supply of food, remain in an undeveloped condition, assuming a hydropic appearance.' Such, probably, are the

enigmatical Leptocephalidæ. Besides affecting the size, the nature of the surroundings and the nutritive supply influence both form and colour. It is a well-known fact that the same species of trout presents a variable appearance, according to the habitat of the individual. It rarely happens among fishes that the pigment wholly disappears, but it is not uncommon for an 'incipient albinism' to be produced by a change of the contents of the pigment-cells into yellow, a variation most familiar in the gold-fish, but occurring in not a few. Very different, and of more importance in the life of the fish, is the power which some possess of sympathetic change of colour. Thus, in the plaice the colour of the environment influences the eye, a nervous impulse determining the contraction or expansion of the pigment-cells passes to the skin, and the animal is adapted to the colour of the ground on which it rests. Few general statements can be made as to the sensitiveness of fishes to changes in the medium. Pelagic fish are very susceptible; but other marine forms—e.g. flounders—thrive well in fresh water. 'A shark lives in Lake Nicaragua; a goby, blenny, and Atherina in the lakes of North Italy.' The passage of a fresh-water fish to the sea is very rare. Many fishes can endure prolonged fasting and also lowered temperature, but in both these respects marine forms are far excelled by those inhabiting fresh water. Low temperature causes some fishes to pass into a torpid state of 'Latent Life' (q.v.), or Hibernation (q.v.), while in the dry season of tropical countries other forms (e.g. Siluroids and Protopterus) encyst themselves in the mud, where they may remain like living mummies for prolonged periods. See also BLIND FISH.

Some small fishes live in amicable partnership with other animals—e.g. inside large sea-anemones (see COMMENSALISM). The genus Fierasfer seems in a fair way to become parasitic, since the members find more or less permanent lodging within

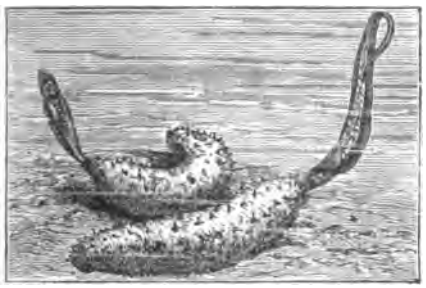


Fig. 6.—Fierasfers entering and leaving Holothurians. (From the atlas of the Naples Aquarium.)

sea-cucumbers, medusæ, and other animals, feeding, however, not upon their hosts, but upon the minute animals which they contain. Fishes themselves are infested by numerous internal and external parasites. Crustaceans, or Fish-lice (q.v.), occur in great abundance on skin and gills, especially on sluggish or on sickly forms. Various flukes are also found externally, and a large number of Cestodes in tapeworm or bladderworm stages live in the viscera. The pike and burbot are hosts of the immature stages of the formidable Bothriocephalus; the stickleback often bears the young of the fresh-water mussel; the hydroid Polypodium is parasitic on the eggs of the sturgeon; and so on through a long series (see PARASITIC ANIMALS).

Distribution in Space.—Most fishes live either exclusively in the sea or exclusively in fresh water, but some pass for spawning purposes from the one to the other, and not a few thrive with apparent indifference in either or in a brackish medium. The marine forms enjoy a wider distribution over the globe, but the inhabitants of fresh water also spread by circuitous swimming, by changes in the river systems, and even by short overland marches, or by having their ova carried on the feet of water-birds. Both marine and fresh-water forms occur in Polar regions. Günther describes about forty species from the icy waters at or beyond the 1500 fathom line; and fishes are still present in Alpine lakes about the level of perpetual snow, up, indeed, to a level of 15,000 feet or more. Of genuine fresh-water fishes about 2300 species are recorded, of which four are Dipnoi, thirty-two Ganoids, and the rest Teleosteans, with a marked predominance of carps or Cyprinidæ, and Siluroids or cat-fishes. The marine forms are usually distinguished as shore, pelagic, and deep-sea fishes. The shore fishes, including about 3500 species, frequent the coasts, and rarely descend below 300 fathoms. The pelagic fishes swim and usually spawn in the open sea, are less numerous than the shore forms, and thrive especially in the equatorial waters: the cartilaginous fishes form a large percentage of the pelagic fauna. The deep-sea fishes include over a hundred genera, most of which are Teleosteans. Of these forms, monographed by Günther in his *Challenger* Report, a little more must be said.

Deep-sea Fishes were not known with any definiteness till the *Challenger* expedition virtually discovered the new zoological world which they inhabit. The explorations of the *Talisman* and the *Travailleur* have also contributed important results to our knowledge of these usually strange-looking forms. To understand their peculiarities it is necessary to recall the principal factors in their environment. (*a*) Sunlight is absent, and so often are eyes, which, in the absence of stimulus, remain undeveloped. It is interesting to notice Günther's results. From a depth of from 80 to 200 fathoms the eyes are larger than usual, to make the most of the scanty sun-rays which fade away at those depths. Beyond the 200 fathom line 'small-eyed fishes as well as large-eyed occur, the former having their want of vision compensated for by tentacular organs of touch, whilst the latter have no such accessory organs, and evidently see only by the aid of phosphorescence. In the greatest depths blind fishes occur, with rudimentary eyes, and without special organs of touch.' The Phosphorescence (q.v.) is produced by numerous marine animals and by the fishes themselves. Many of the latter exhibit round, shining, mother-of-pearl-coloured bodies, imbedded in the skin, in part sensory, in part phosphorescent. (*b*) The temperature of the bottom is low and equable, and a wide range of distribution is thus unimpeded. (*c*) The pressure is, of course, enormous at those great depths, and, though the fishes feel it as little as we do that of the air, it has doubtless been an

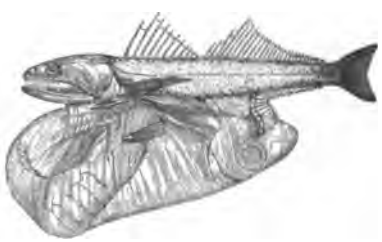


Fig. 7.—A deep-sea fish (*Chiasmodus niger*) which has swallowed another fish (seen beneath) bigger than itself (after Günther).

important factor in determining their structure. Bones and muscles are less developed; the former

are very light and brittle, the latter are thin. The forcible ascent to diminished pressure, of course, produces rupture and other changes, so that it is sometimes difficult to infer the natural form of the body and texture of the tissues. (*d*) As sunlight is absent, so also are plants. The abyssal fish are therefore carnivorous, 'the most voracious feeding frequently on their own offspring, and the toothless kinds being nourished by the animalcules which live on the bottom, or which "like a constant rain" settle down from the upper strata.' Some of the carnivorous forms show evidence of great rapacity, and not a few are characterised by wide gape and dilatable stomach, able to 'receive a fish twice or thrice the bulk of the destroyer.' The skin in many deep-sea fishes is marked by an extraordinary development of the mucus-secreting system, and this exuded layer has been observed to be phosphorescent in some fresh specimens. The colouring is simple, most of the forms being either black or silvery. The absence of light and the sluggish habit may have something to do with this peculiarity. (*e*) Lastly, the perfect calm of the abyssal water must be remembered, and associated with the tendency many of the fishes have to develop long, delicate filaments on fins or tail. As to the maximum depth at which fishes certainly occur, *Bathyophis ferox* was dredged from 2750 fathoms.

Classification.—The chief technical characteristics of the four orders, Elasmobranchii, Ganoidei, Dipnoi, and Teleostei, may be summed up in the following table; but the articles BONY FISHES, CARTILAGINOUS FISHES, DIPNOI, and GANOIDS should also be consulted at this stage, as well as special articles on distinctive types.

	Elasmobranchs.	Ganoids.	Dipnoi.	Teleosteans.
SKIN	With skin-teeth.	Large hard scales.	Large soft scales.	Usually soft scales.
LIMBS	Large; hind pair abdominal.	Hind-limbs abdominal.	With a median axis.	Hind-limbs often far forward.
TAIL	Asymmetrical.	Asymmetrical, or the same disguised.	Symmetrical.	Apparently, not really, symmetrical.
SKELETON	No investing bones; almost wholly cartilaginous.	Investing bones on skull and pectoral girdle; otherwise cartilaginous or bony.	Persistent undivided notochord; largely cartilaginous.	Well ossified, with completely formed vertebræ, and well-developed investing bones.
OPTIC NERVES	Fuse with a crossing of fibres near the brain.	The same.	The same.	Cross without fusing.
GILL-APERTURES	5–7 opening externally, usually + a spiracle.	A cover or operculum; sometimes a spiracle.	Covered internal gills, in one case + external.	An operculum.
SWIM-BLADDER	None.	Present with persistent duct.	Functional as a true single or double lung.	Present, with or without persistent duct.
INTESTINE	Cloaca; spiral fold in intestine.	Anus separate from urinogenital aperture; a spiral fold.	As Elasmobranchs.	No spiral fold; separate anus, and often separate urinary and genital apertures.
HEART	Contractile conus arteriosus.	The same.	The same and a septum between auricles.	No contractile conus.
OVA	Few, large, internally fertilised eggs; many forms viviparous.	Small, externally fertilised; oviparous.	Numerous small eggs; oviparous, but little known.	Numerous small eggs, externally fertilised, except in a few viviparous forms.
ALIA	Males with copulatory organs on hind-limb.	A decadent order with seven or so living genera.	Nostrils communicating with mouth. Three living genera transitional to amphibians.	The vast majority of living fishes.

In addition to the four orders above contrasted, it is usual to distinguish a fifth—Holocephali—for the reception of Chimæra (q.v.) and Callorhynchus. These two forms, of which no notice has been taken in the above general sketch, agree in most of their features with the Elasmobranchs, but differ, for instance, in the development of an operculum, in the distinctness of the anus from the urinary and genital apertures, and in the nakedness of the skin.

History of Fishes.—The earliest fish remains occur in the Upper Silurian strata, mostly in the form of spines, scales, shields, and mere fragments.

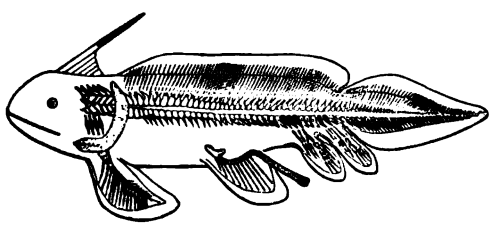


Fig. 8.—Restoration of *Pleuracanthus gaudryi* (Brogniart).

Some of these belonged to true sharks, but the armoured Ganoids (Pteraspis) were also alive in that ancient time. In the Devonian period both orders were represented, but the Ganoids greatly predominated, if the remains may be trusted as affording a true index. In the Carboniferous the Ganoids continued their long golden age, and the Elasmobranchs were also abundant. We figure a remarkable form (Pleuracanthus) recently described from the French coal-measures, which the discoverer, M. Brogniart, regards as representing at least a distinct order, perhaps a sub-class, the 'Pleuracanthides'—'a group ancestral to and connecting the Dog-fishes, Cestracionts, Rays, Chimæras, Sturgeons, and Ceratodus.' Very singular and novel are the two small anal fins, which are 'placed one behind the other, and have the appearance of true limbs.' In the Jurassic strata the modern types of shark and dog-fish become numerous, and have so remained ever since. Far otherwise the Ganoids; relatively few survived the Jurassic epoch, and the few genera now living form but a paltry remnant of a vast and heterogeneous host. Some of the ancient Ganoids exhibit characteristics which link them to the Dipnoi, and it is generally admitted that it was from Ganoid ancestry that the Dipnoi (which appear in the Permian) had their origin. The occurrence of the modern genus Ceratodus in strata so far back as the Permian 'presents the most remarkable instance of persistence in the whole range of vertebrate animals.' The Dipnoi form a transitional order, leading on to amphibians, and probably never included more than a progressive few. In another direction, but probably also from Ganoid ancestry, the modern bony fishes or Teleostei evolved. They appear for the first time in Creta-

ceous strata, 'being immediately preceded by the Teleostoid group of Ganoid fishes of the family Leptolepidæ, which effects a passage to them' (Heilprin). Forms with open swim-bladders, and forms in which the connection with the gut is closed, both appear early, but there is no doubt that the former (Physostomi) are the more primitive. Herring, smelt, pike, and other bony fishes of to-day occurred in the chalk period, but it was only in the Eocene or early Tertiary times that the modern fauna became established. Fresh-water forms must be regarded as derived from marine forms, and the change of habitat probably began in very early times.

To sum up—the first fishes were probably somewhat after the shark pattern; these were soon followed and outnumbered by Ganoid forms; in successive æons the Elasmobranchs increased and remained firmly established if not markedly progressive; the Ganoids on the other hand waned most markedly, but according to many they gave rise to the highly successful Teleostean type, and to the progressive transitional Dipnoi. At present the Teleosteans are, of course, in an overwhelming majority; next come the persistent Elasmobranchs, including *Chlamydoselachus*, a Japanese shark which is said to be the oldest living type of fishes, with

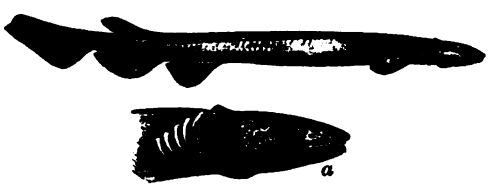


Fig. 9.—*Chlamydoselachus anguineus* (Garman), the oldest living type of Fishes:
a, head on larger scale.

direct ancestors of Devonian antiquity; the eight or so living genera of Ganoids are a mere handful compared with the extinct forms; while the Dipnoi are only represented by three genera. As to the relations of fishes to the round mouths or Cyclostomata, to the lancelet or Amphioxus, to the Ascidians or Tunicata, and to still more remote worm-like forms such as Balanoglossus, it is only possible at present to say that all are offshoots from primitive vertebrate types.

Economic Interest.—Apart from the import of fishes in the general economy of nature, their practical interest for mankind is centred in the fact that so many form part of our food-supply. Their importance in this respect is especially great in Polar regions, where other sources of nutrition are scanty. It may be here noticed that many are temporarily or constantly poisonous. The poison is in the blood and is destroyed by heat in the eels; it is constant and in the flesh in *Clupea venenosa*, various globe-fish, and many others; it is temporary and in the roe of spawning pike, burbot, &c.; while in many cases it is not intrinsic, but due to the food on which the fish lives, or to decomposition products formed after death. Gills and other parts which quickly decompose should always be avoided. Some fishes, such as stingrays and weavers, readily give wounds with their spines, and the mucus of the body thus inoculated produces symptoms of poisoning. In Synanceia, Thalassophryne, and other forms there are true poison organs associated with spines, and the results of a wound are sometimes fatal. Besides the great nutritive utility of fishes, there are a few minor products of some importance, such as cod-liver oil from the liver of Gadoids, isinglass from the swim-bladder of sturgeons, &c., and shagreen from the skin of sharks and rays (see PISCICULTURE).

From their position near the base of the vertebrate series fishes are the most hopeful subjects for the solution of many of the fundamental problems of zoology; in their endless variety of habit they afford wide scope to the observant naturalist; while for their grace of movement, beauty or quaintness of form, and splendour of colouring they merit a larger share than they have hitherto received of artistic attention.

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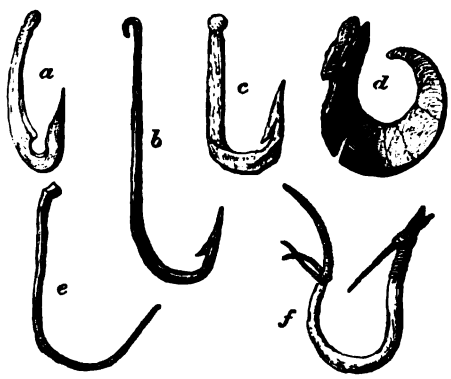
Fishes, ROYAL—those which at common law are the property of the crown—are the Whale (q.v.) and the Sturgeon (q.v.), when either thrown on shore, or caught near the coast.

Fish-guano. See GUANO.

Fish-hawk, or FISHING EAGLE. See OSPREY.

Fish-hooks. Both in Europe and in America fish-hooks have been found, belonging to prehistoric times, which are made of flint, bone, shell, copper, bronze, and, on the latter continent, even of gold. The oldest apparatus for catching fish was not a hook, but a crossbar of flint sharpened at both ends and attached to a thong. Some of the oldest prehistoric fish-hooks, including a few of bone, bear



Early Fish-hooks (from Rau's *Prehistoric Fishing*):
a, lacustrine fish-hook, made of a boar's tusk, found at Moossee-dorf, Switzerland; b, bronze lacustrine fish-hook, found at Romanshorn, Lake Constance; c, deer-horn fish-hook, found in Madison county, New York; d, shell fish-hook from Santa Cruz Island; e, cactus-spine Indian fish-hook from Arizona; f, halibut hook, made by the Makah Indians, Cape Flattery, from the knots of the hemlock spruce.

a considerable resemblance to modern English hooks in shape and in the form of the barb. Many of the rude-looking fish-hooks made by savage races are strong, well made, and ingeniously contrived. The

shell and bone hooks of the Maoris of New Zealand and the natives of the Solomon Islands, as well as the bone and iron hooks of the Eskimos, are examples of these. Curious fish-hooks of cactus spines, made by Indians, have been found in Arizona. Ancient Roman fish-hooks discovered at Pompeii exactly resemble those in use at the present day, only they are of bronze instead of steel. But almost as much may be said of the prehistoric bronze fish-hooks discovered in Scotland, Ireland, and at several places on the continent of Europe. Illustrations of a large number of ancient fish-hooks are given in a volume on *Prehistoric Fishing in Europe and North America*, by C. Rau, published by the Smithsonian Institution.

In England fish-hooks are chiefly manufactured at Redditch in Worcestershire. The best of these are still made by hand, and the following is an outline of the stages in the process. (1) Soft cast-steel wire is cut by shears into lengths required for a given size of hook. (2) A number of these cut wires are placed on a plain surface against an upright, and then by means of a strong knife the beards or barbs are formed. (3) The points are next put on by carefully filing the wires, each being pointed almost in an instant. (4) By means of a mould mounted in a wooden handle the wires are bent or turned to the proper shape. (5) The ends of the shanks are now ringed, flatted, or marked by an ingenious machine or hammer. (6) At this stage the hooks are hardened — i.e. they are placed in a furnace and brought to a certain heat, which varies with the kind of hook, and then plunged into a vat of oil. (7) They are next tempered by placing them, mixed with emery sand, in a pot over a charcoal fire. There they are kept in constant motion till they are sufficiently tempered. (8) Scouring is effected by placing the hooks with water in barrels and keeping these in motion for one or two days, to remove all scale. (9) Polishing is done by placing the hooks in an oblong bag with emery and rapidly shaking them. Sometimes the polishing is done in barrels moving round at an angle of 45°. Fish-hooks are now, however, chiefly made by machinery which performs most of the above operations automatically.

A large firm who manufacture fish-hooks at Redditch, and who have published an account of the process, from which the above outline has been prepared, state that there are fifty-three different sorts of hooks. Among these there are the kinds known as Kirkby, Limerick, Dublin, Carlisle, Kendal, sneck, round bent, crystal, roach hooks, live-bait snap-hooks, lip-hooks, &c. See ANGLING.

Fishing-frog. See ANGLER.

Fish-louse, a name widely applied to any of the Copepod crustaceans which occur as external parasites both on fresh-water and marine fishes. Some have also been found on amphibians. As they live on the juices of their hosts, they undoubtedly do damage, and the fishes on which they are abundant are often sickly. They may occur on the skin itself, but are even more common about the gills. To the zoologist they have a special interest on account of the degeneration which they often exhibit, when contrasted with their free-living relatives or even with their own young stages. They are often curiously misshapen, and swollen out with abundant feeding; the males are sometimes free and the females alone parasitic, or the males may be pigmies borne on their mates. In other cases the females become truly parasitic only after sexual union, when about to bear eggs, and the habit of parasitism has doubtless been acquired in some instances for the safety and convenience of the mothers. Some (e.g. Penella) pass from being external hangers-on to become true internal parasites. The following are examples of common 'fish-lice' and of the hosts which they infest: *Chondracanthus cornutus*, on flat-fish (frequent); *Caligus rapax*, dog-fish, gurnard, lumpsucker, dab, whiting, &c. (frequent); *Ergasilus sieboldii*, carp, pike, &c. (frequent); *Dichelestium sturionis*, sturgeon (on gills); *Lernæocera cyprinacea*, carp, &c. (boring in flesh); *Lernæa branchialis*, flounder, &c. (on gills); *Penella sagitta*, fishing-frog (in flesh); *Achtheres percarum*, perch, &c. (on gills); *Lernæopoda elongata*, dog-fish (on eyes); *Anchorella uncinata*, cod species (on fins and gills); *Argulus foliaceus*, carp, perch, pike, stickleback, trout, &c. (frequent). The above are all Copepods—i.e. low down in the crustacean series; but parasitic Cirripedes (q.v.) occur in the skin of whales and fishes, and on other crustaceans; a little family of Amphipods (Cyamidæ) also infest cetaceans; among Isopods, many Cymothoidæ live on the skin and gills of fishes, while a still larger number of the related Bopyridæ and Entoniscidæ frequent other crustaceans. See CRUSTACEA, PARASITIC ANIMALS.

Fish-louse (*Achtheres percarum*), magnified.

Fish River Caves. See BLUE MOUNTAINS.

Fisk University. See NASHVILLE.

Fissirostres (Lat., 'split-beaked'), one of the tribes into which the great order Passeres or Insessores used to be divided. The name refers to the width of gape, associated with the habit of catching insects on the wing. Swallows, swifts, and goat-suckers were included in this old-fashioned title.

Fissurellidæ. See LIMPET.

Fistula, in former times, was applied, in its etymological meaning of *pipe*, to such an Abscess (q.v.) as had contracted to a narrow, hard, open passage in the soft tissues of the body, lined by a kind of false membrane, giving rise to a thin discharge. At the present time, however, the term fistula is generally limited to such a passage when in communication with, or in the immediate neighbourhood of, one of the mucous canals; elsewhere it is called a Sinus (q.v.). Thus, it is common to speak of salivary fistula, urinary fistula, &c.; but the most common and troublesome kind of all is the *fistula in ano*, in connection with the lower bowel, or Rectum (q.v.; and see ANUS). The term is also applied to unnatural communications between two adjacent mucous canals (e.g. vesico-vaginal fistula), or between one of these and the external surface (e.g. gastric fistula, fœcal fistula), independently of their size and shape. The treatment of fistula should only be entrusted to experienced surgeons; but there are always quacks in abundance willing to undertake it, and hold out flattering hopes of an early cure without proper surgical procedure.

For the cure of salivary or urinary fistula all that is generally necessary is to restore the patency of the natural ducts, which is done by passing instruments along them. Should a fistula, however, be situated where it is surrounded by muscular fibres, as at the orifice of the lower bowel, it is necessary to divide these, so as to leave the part at rest while nature repairs it. During the process of healing care must be taken that the wound closes from the bottom, otherwise the cut surfaces are apt to reunite, leaving the fistula unimproved. This may be secured either by stuffing the wound with lint, or by daily passing a probe or a finger along it to break down any adhesions that may have formed. Stimulant applications are also

sometimes necessary to promote the healing process.

At times, however, fistulæ require more elaborate treatment, and are extremely difficult to close, especially those which result from loss of tissue between two adjacent mucous canals; fortunately, however, modern surgery is able to remedy these also. It is necessary to make the edges of the orifice once more raw, and to bring them in contact, but formerly the wound used rarely to unite, as the stitches produced such an amount of irritation. Now, however, by the use of silver-wire, or catgut, and by scrupulous attention to cleanliness, the parts can be kept together long enough to insure union; and thus, by the ingenuity of American surgeons, especially the late Marion Sims of New York, and others in Britain, certain diseases of women, arising from protracted labours, and formerly rendering the unfortunate subjects of them miserable and unfitted for any of the duties of life, may be now remedied by a skilfully performed operation. See E. and E. W. Andrews, *Rectal and Anal Surgery* (2d ed. Chicago, 1889).

Fistularidæ. See FLUTE-MOUTHS.

Fistulina, a genus of Hymenomycete fungi allied to Boletus (q.v.), family *Polyporei;* the under surface (*hymenium*) at first covered with minute warts, which ultimately form separate tubes. *F. hepatica* is common in Britain and throughout Europe on old oak, walnut, and chestnut trees; it occurs also on ash and beech. It is semicircular, of very regular outline, with a lateral stem, or none; its colour red; its substance fibrous and fleshy, much resembling beet-root. When old and beginning to decay, it looks like a mass of liver. It sometimes attains a great size. Mr Berkeley mentions one which grew on an ash pollard, and weighed nearly thirty pounds. This fungus, while young, is much esteemed in some parts of Europe as an esculent; whilst there is almost no possibility of confounding it with any dangerous fungus. Its taste resembles that of the common mushroom, but is rather more acid. 'When grilled, it is scarcely to be distinguished from broiled meat.' It furnishes itself with abundance of sauce.

Fistulina hepatica.

Fitch, JOHN, inventor, was born in what is now South Windsor, Connecticut, in 1743, and after a short, unhappy, married life, and a period of wandering, settled at Trenton, New Jersey. At the outbreak of the revolution he became a gunsmith for the American troops, with whom he wintered at Valley Forge. He next made surveying and trading tours in the West, and after escaping from captivity among the Indians returned to Pennsylvania, where in 1785 he completed his first model of a steamboat; this had wheels at the sides, which were replaced in the following year with paddles or oars. In the face of discouragement and neglect he succeeded in constructing a vessel, 45 feet long and 12 feet beam, with an engine of 12-inch cylinder, which made a successful trial-trip on the Delaware, at Philadelphia, 22d August 1787. Larger vessels were built in 1788 and 1790, the latter being run as a passenger-boat, at eight miles an hour, to Burlington (20 miles) throughout the summer. Misfortune, however, dogged 'poor John Fitch's' steps; his supporters fell away; and in 1793 he went to France to construct a steamboat, only to find his project frustrated by the Revolution there. It is said that his plans and specifications were deposited with the American consul at L'Orient, who for several months entrusted them to Robert Fulton (q.v.); and the latter's steamboat certainly was in 1817 declared by a committee of the New York legislature to be 'in substance the invention patented by John Fitch in 1791.' Penniless and dejected, Fitch worked his passage back to America, where in the summer of 1798 he is said to have committed suicide in a tavern at Bardstown, Kentucky.

Fitchburg, a city of Massachusetts, on the Nashua River, at the junction of three railroads, 50 miles WNW. of Boston. It has numerous paper-mills, and manufactures of machinery, chairs, pianos, and tools. Pop. (1880) 12,429; (1885) 15,375; (1890) 22,037.

Fitches. See VETCHES.

Fitchy, or FITCHÉ, in Heraldry. See CROSS.

Fits, a name popularly applied to any sudden seizure of disease implying loss of consciousness, or any considerable change in the condition of the mind, but particularly to attacks of Epilepsy (q.v.), and other forms of Convulsion (q.v.).

Fitz is an old Norman-French word signifying 'son,' from the Lat. *filius* (Fr. *fils*); the old spelling is usually *fiz*, another later form being *filtz*. Like the Scotch *Mac*, the Irish *O'*, and the oriental *Ben*, it is prefixed to proper names to signify descent, as in the Norman names Fitzwilliam, Fitzwalter, Fitzgerald. A later application of it has been to denote the natural sons of royalty, as in Fitzroy, Fitzjames (see BERWICK, DUKE OF), and Fitzclarence.

Fitzgerald, LORD EDWARD, a prominent member of the society of United Irishmen, was a younger son of the Duke of Leinster, and was born at Carton Castle, near Dublin, October 15, 1763. After his father's death he was brought up in France, but returned to England in 1779 to enter the army. He served with distinction in the American war, next sat for Athy in the Irish parliament, and was drawn to Paris by the resistless spell of the great Revolution. Here he renounced his title of nobility, and married Pamela, daughter of Madame de Genlis by *Égalité* Orleans, next returning to Ireland in 1793, to plunge ere long into the troubled sea of political conspiracy. He joined the United Irishmen in 1796, and went to France to arrange for a French invasion of Ireland. Soon after his return the plot was betrayed to the government, and Fitzgerald, after a few days of hiding in Dublin, was seized, not without a desperate scuffle, in which he received wounds of which he died, sixteen days later, 4th June 1798. See the Life by Moore (2 vols. 1831).

Fitzgerald, EDWARD, was born March 31, 1809, at Bredfield House, near Woodbridge, in Suffolk. His father, John Purcell, took his wife's family name on her father's death in 1818. In 1816 the family went to France, and lived for a time at St Germains, and afterwards at Paris. In 1821 he was sent to King Edward VI.'s School at Bury St Edmunds, where James Spedding, W. B. Donne, and J. M. Kemble were among his schoolfellows. He went up to Trinity College, Cambridge, in October 1826, where Spedding joined him the next year, and where he formed fast friendships with Thackeray, W. H. Thompson, afterwards Master of Trinity, and John Allen, afterwards Archdeacon of Salop. He took his degree in January 1830.

His father's family resided at Wherstead Lodge, near Ipswich, from 1825 to 1835, and subsequently at Boulge Hall, near Woodbridge; there he lived with them until 1838, when he took up his separate residence in a cottage near the gate of Boulge Hall. His life at this time was a quiet round of reading and gardening, occasionally broken by visits from or to friends; his chief friends in the neighbourhood were the Rev. G. Crabbe, the son of the poet, and vicar of Bredfield, Archdeacon Groome, and Bernard Barton, the Quaker-poet of Woodbridge, whose daughter he afterwards married. Every spring he used to make a long visit to London to see his friends. There he constantly met Donne, Spedding, and Thackeray, and was a frequent visitor at Carlyle's house. Lord Tennyson and his brother Frederic had been his contemporaries at college; but it was in London that they became intimate; how fast the friendship was is best shown by Lord Tennyson's dedication of *Tiresias*. In 1853 he left the cottage and settled near Woodbridge, and afterwards in the town itself; but in 1874 he removed to Little Grange, a house which he had built for himself in the neighbourhood. His great outdoor amusement in these years was yachting; and every summer was spent cruising about the Suffolk coast, especially near Lowestoft and Aldborough, the latter locality being of great interest to him as associated with the poems of his favourite, Crabbe. He thoroughly enjoyed the life on his yacht, carrying his books with him, and delighting to take his friends for short trips, when they might read and talk over well-known passages together. He also enjoyed the rough, honest ways of the sailors and fishermen; and he liked to collect their peculiar words and phrases. But he could not escape 'the browner shade' which Gibbon ascribes to the evening of life, and the sea gradually lost its charm; one old sailor died, and another grievously disappointed him; and he at last gave up the yacht for his garden, where his favourite walk was called the 'Quarter-deck.' He died suddenly, June 14, 1883, while paying his annual visit to his friend the Rev. G. Crabbe, the poet's grandson, at Merton Rectory, Norfolk. One of his great characteristics was steadfastness in friendship; he was slow to form intimacies, but, once riveted, the link lasted till death. His outward manner was reserved, and he might sometimes seem a little wayward or petulant; but under all this cold exterior there lay a tenderness like Johnson's, and a fine stroke of imagination or a noble deed would make his voice falter and his eyes fill with tears.

The first forty-two years of his life passed in quiet reading and thinking, and it was not till 1851 that he published anonymously his dialogue on youth, *Euphranor*, which was followed by *Polonius* in 1852. In the meantime a friend had persuaded him to begin Spanish, and this not only opened a new world of interest, but revealed to him his own powers. He at once took to Calderon's plays, and afterwards to *Don Quixote*, and in 1853 he published a translation of six dramas of the former with his name attached; but he soon withdrew it from circulation, and two more were afterwards printed privately. About 1853 the same friend interested him in Persian. Sa'di's *Gulistán* early attracted him by its quaint stories, and in 1856 he published an anonymous version of Jámí's *Salámán and Absál*; and he also wrote, but never printed, an abridgment in verse of 'Attár's *Mantik ut tair*. But the Persian poet who most interested him, from the time of his first seeing his works in 1856 in a MS. in the Bodleian Library, was 'Omar Khayyám, the astronomer-poet of the 11th century. These poems were then known only by a few current quotations, as they were first printed at Paris in 1857 by M. Nicolas; but Fitzgerald at once recognised their beauty, and his name and the poet's will probably remain indissolubly linked together. Here his genius as a translator appears at its height. He possessed to an extraordinary degree the power of reproducing on his reader the effect of the original; and, though the original ideas are often altered, condensed, and transposed in an apparently reckless way, these lawless alterations and substitutions are like those in Dryden, and they all tell; the translator becomes the 'alter' and not the 'dimidiatus Menander.' His letters and collected works have been edited by Mr W. Aldis Wright (3 vols. 1889).

Fitzherbert, MRS, a Roman Catholic lady, born Maria Anne Smythe in 1756, to whom, after she had been a second time left a widow, the Prince of Wales, afterwards George IV., was secretly married in 1785 by an Anglican clergyman. This marriage, contracted without the king's consent, was of course invalidate under the Royal Marriage Act of 1772; but the prince carried his meanness so far as to persuade Fox to deny that there had been a marriage at all, and afterwards denied that he had done so. On his marriage to the Princess Caroline in 1795 the connection was broken off for a time, to be resumed with the pope's consent, and finally broken off in 1806. Mrs Fitzherbert, whose conduct in trying circumstances has been warmly praised, died at Brighton, 29th March 1837. See her Memoirs, by Langdale (1856).

Fitzroy, the largest river of Western Australia, has its sources in the King Leopold Range, and, after describing a wide curve to the south, reaches the sea at the southern end of King Sound. Its total length is about 300 miles, the lower 100 of which are navigable for small boats. Its valley is a well-grassed country. The river was discovered by Stokes in 1838, and explored for about 250 miles by Alexander Forrest in 1879.

Fitzroy, ROBERT, admiral and meteorologist, a grandson of the third Duke of Grafton, was born at Ampton Hall, near Bury St Edmunds, July 5, 1805, and entered the navy in 1819. His first important work was that of surveying the coasts of Patagonia and Tierra del Fuego, 1828–30; and this work he was charged to continue on his reappointment to the command of the *Beagle* in 1831. On this voyage he was accompanied by Darwin, the two together publishing in 1839, three years after their return to England, a *Narrative of the Surveying Voyages of H.M.S. 'Adventure' and 'Beagle,'* vols. i. and ii. by Fitzroy, and vol. iii. by Darwin. For two years (1843–45) he was governor of New Zealand, then a newly-constituted colony. Although placed on half-pay in 1850, he was promoted in due course to be rear-admiral (1857) and vice-admiral (1863) on the retired lists. In 1854 he received an appointment in the meteorological department of the Board of Trade, his attention being principally given in his later years to meteorology and the lifeboat service. The cheap and serviceable 'Fitzroy barometer' was made on a plan suggested by him; and it was he who instituted the system of storm warnings that has grown into the daily weather forecasts. Among his works are *Meteorological Observations* (1859), and *Weather-book* (1863), as well as *Remarks on New Zealand* (1846). He put an end to his own life, in a fit of mental aberration, 30th April 1865, at Norwood in Surrey.

Fitzwilliam, WILLIAM, Earl Fitzwilliam, was born in 1748, and, succeeding his father in 1756, took his seat in the House of Lords in 1769. He at first opposed Pitt, to whom he afterwards went over, with a considerable portion of the Whig party, owing

to the excesses of the French Revolution. As lord-lieutenant for three months of Ireland (1794–95), where his warm support of Catholic emancipation aroused enthusiastic hopes, he was considered by Pitt too liberal; and his recall was followed by the rebellion of 1798. He was president of the council in the Grenville ministry, in 1806, and took some part in the Reform Bill agitation. He died 8th February 1833.

Fiume (Illyr. *Rika*, Lat. *Fanum St Viti ad flumen*), an important seaport of Hungary, at the mouth of the Fiumara, 142 miles WSW. of Agram by rail, and 35 miles ESE. of Trieste across the Istrian peninsula, stands at the head of the beautiful Gulf of Quarnero, in the Adriatic, where the Julian Alps end. It consists of an old and new town, the latter, on the sea, being well built and laid out with many handsome streets and squares. Its extensive industries include manufactures of paper, torpedoes, tobacco (government factory, with over 2000 hands), sails, ropes, chemicals, starch, liqueurs, &c., besides a large petroleum-refinery, American flour-mills, and a rice-shelling factory. The tunny-fisheries of the Gulf also are valuable. Fiume's chief importance, however, is as the entrepôt of a great and steadily increasing commerce. A free port from 1717 till 1891, it has a harbour with a lighthouse and several breakwaters, which was greatly improved by the Hungarian government in the years following 1872, when new moles and quays with warehouses, and petroleum and other docks, were added, at a cost of nearly a million sterling, with the immediate effect of increasing the trade fivefold within the next twelve years. Moreover, further works were projected in 1888, to cost nearly half a million. In 1887 the exports amounted to £4,288,163, chiefly flour and grain, oak staves and timber, prunes, wine, mineral waters, sugar, and torpedoes; the imports reached £1,631,546, rice, crude petroleum, tobacco, wine, coffee, and cotton goods being the principal items. The trade is almost entirely a transit trade, even the petroleum and rice going forward into the interior after manipulation. Nearly half of the entire foreign trade is carried under the British flag; the aggregate direct trade in British vessels has increased, almost without a check, from £300 in 1876 to £1,638,872 in 1887; and the indirect or carrying trade from £27,700 to £1,067,524 within the same years. The chief imports from Britain are cotton goods and yarn, American tobacco, machinery, and coal; a large quantity of paddy rice and jute are imported from British India. Area of town and territory, over 12 sq. m.; pop. (1889) 22,029.—The *county* of Fiume, belonging to Croatia, lies to the east, between Carniola and the sea, and is almost entirely filled by the Karst range. In the relatively small valley area, and along the coast, olives, figs, pomegranates, and citrons flourish. Area, 1000 sq. m.; pop. (1881) 81,070. See Litrow, *Fiume und seine Umgebungen* (Fiume, 1884).

Five Members, The, were those members of parliament—John Pym, John Hampden, Denzil Holles, Sir Arthur Haselrig, and William Strode—whom Charles I. endeavoured to arrest on 4th January 1642. This action, by which Charles had meant to prevent the impeachment of the queen, precipitated the Civil War. See CHARLES I.

Five-mile Act, an Act passed in 1665, enacting that no Nonconforming clergyman should be allowed to come within five miles of a corporate town, or of any place where he had once ministered, nor act as a tutor or schoolmaster, unless he first took the oath of non-resistance, and expressed his willingness to make no attempt to alter the constitution of either church or state.

Fives, a game of hand-ball still popular in England, chiefly at the great public schools. The game existed at least as early as the 14th century, both in France and England, being termed 'palm-play' in the former, and 'hand-tennis' in the latter; its name is derived from its being played with the 'bunch of *fives*'—i.e. hand. The principle of the game is very simple, although the minor rules depend largely on local tradition. In a 'single' one player constitutes a side; in a 'double' there are two on either side. A roomy court is requisite, bounded by a high wall at one end, and against this wall a ball is propelled by striking it with the open hand. A 'close' court has also two side walls, and the whole is sometimes covered. The game is begun by one player striking the ball against the wall, and causing it to rebound anywhere beyond the floor-score, which is about two yards from the wall; the ball as it rebounds is then returned by the opposing sides alternately, a player's stroke counting a failure whenever the ball does not touch the wall higher than three feet from the ground, and the opposite side scoring one. The ball may be struck either from a direct rebound before it reaches the ground, or after it has 'dapped' or hopped from the ground once. Fifteen is usually game. When the players are skilful the ball is kept going by the alternate strikers for many minutes at a time, and the game is thus rendered exciting both for players and onlookers.

Fixed Bodies is a term applied in chemistry to those substances which remain fixed, and are not volatilised at moderately high temperatures.—*Fixed Air* was the name given in 1756 by Dr Joseph Black (q.v.) to what in 1784 was named by Lavoisier Carbonic Acid.—*Fixed Oils* are those oils which, on the application of heat, do not volatilise without decomposition. See OILS.

Fixed Stars. See STARS.

Fixtures, The Law of, is very much the same in England and Scotland. The general idea of a fixture is that a movable has been fastened to the soil or to a house, and has thus become the property of the owner of the soil or house. Such questions arise frequently between vendor and purchaser, heritable and ordinary creditors, heir and executor, landlord and tenant. The last case is that most favourable for the right to remove a fixture. The first question is, however, whether the movable has become a fixture. There are constructive fixtures—e.g. the keys of doors, certain loose pieces of machinery, the bell of a factory, &c. In general, however, there must be physical annexation. Apart from this the main tests are: (1) can the thing be taken away without material injury to itself or to the premises? (2) is it essential, or material, or specially adapted to the enjoyment of the premises? In a famous case saltpans were held to be fixtures, because, though they could be removed without much injury, they were necessary to the use of the premises. But, further, especially between landlord and tenant, it is important to know what was the purpose of annexation, the intention of parties; were the things intended for perpetual or for temporary use? In *non-agricultural* subjects there are two main classes of fixtures—viz. those put up for ornament, convenience, or domestic use, and those put up for purposes of trade. The removability of the first class is a good deal settled by custom. The character of the article may show it to be purely temporary, otherwise the test must be whether the injury of detachment would be substantial. In dwelling-houses, for instance, pier-glasses, ornamental chimney-pieces, grates, book-cases screwed to the wall, are all regarded as

movables, and therefore removable by the tenant. Of course, injury caused to the premises by removal must be repaired by the tenant. In trade, on the other hand, nearly all fixtures are removable by the tenant, if there is no custom or stipulation to the contrary. Bakers' ovens, colliery-engines, spinning-mules, trees and glass frames in a nursery, are not put up by the tenant with any view of benefiting the landlord. Such questions are frequently settled by a remit to a practical man acquainted with the practice of the particular trade. As regards *agricultural* subjects, the law in both England and Scotland is now largely statutory. The English and Scottish Agricultural Holdings Acts of 1883 place the agricultural tenant (which includes pastoral, market-garden, and mixed holdings) in almost as good a position as the commercial tenant. To some extent this had been accomplished for England by a previous act in 1851. Prior to these statutes everything physically annexed by the tenant became the property of the landlord without compensation. The general statutory rule now is that, as regards any engines, machinery, fencing, and other fixtures and buildings for which the tenant is *not* entitled to compensation under the statutes, he is entitled to remove them without damage, if he has given a month's notice, and has paid his rent. The landlord, however, by counter notice, may purchase at a valuation. The Irish land legislation of recent years resolves everything into compensation, but formerly the tenant's right was the same as in England and Scotland.

Flabellum (Lat.). See FAN.

Flaccus. See HORACE, and FESTUS.

Flaccus, C. VALERIUS, a Roman poet, who flourished in the time of Vespasian, but of whose life nothing is known. He wrote the *Argonautica*, an unfinished epic poem, a good example of learned mediocrity rather than of genuine inspiration. The chief editions are those of Thilo (1863) and C. Schenkl (1871). An English metrical translation seems to have been published by one Nicholas Whyte as early as 1565.

Flacius, or VLACICH, MATTHIAS, surnamed Illyricus, a pupil of Luther and Melanchthon, was born at Albona, in Illyria, in 1520. He studied at Basel, Tübingen, and Wittenberg successively, and became professor of the Hebrew Scriptures at this last-named university in 1544. From this time he took an active part in all the theological discussions of the time; and for his attacks upon Melanchthon's compromise, known as the Leipzig Interim, he was, four years later, deprived of his professorship. Nor did he procure another appointment until 1557, when he became professor of Theology at Jena. This post he again lost, after holding it for five years, on account of his doctrine that original sin was essentially inherent in man's nature. After this he led a wandering life, dying in great poverty at Frankfort-on-Main in 1575. Of his numerous works three deserve mention—*Clavis Scripturæ Sacræ* (1567), *Catalogus Testium Veritatis* (1556), and *Ecclesiastica Historia* (1559–74). It is said that Flacius, in order to gather materials for his work, visited, in the disguise of a Franciscan monk, several monastic libraries throughout Europe, and purloined from them such MSS. as were useful to him, amongst those thus stolen being the original of Fordun's *Scotichronicon*, which, with other MSS., was after his death purchased by the Duke of Brunswick for the library at Wolfenbüttel. The history, called Magdeburg Centuries, was only partly written by him. See CHURCH HISTORY, and Preger's monograph (1861).

Flag, a popular name for many monocotyledonous plants with sword-shaped leaves, mostly growing in moist situations. It is sometimes particularly appropriated to the species of Iris (q.v.) or Flower-de-luce, especially to the common yellow flag (*I. pseudacorus*); but is given also very indiscriminately to other plants of similar foliage, as the *Acorus calamus* (see ACORUS), which is called Sweet Flag. It is even frequently applied in the United States to some of the algæ—e.g. Fucus (q.v.).

Flag, a strip of some light fabric attached at one end to a staff, used as a national, local, or corporate emblem, for military and naval purposes, to express rejoicing, mourning, and the like, or to make known some fact to spectators. As a military ensign it was probably developed out of the fixed standard of the Romans and other ancient nations, through the transitional forms of the *vexillum* and *labarum*, in both of which a square piece of cloth was fastened to a cross bar at the end of a spear. It has, however, been asserted that the Saracens used flying flags prior to their adoption by any country of Christendom. One of the earliest known forms of flag was the *Gonfanon* or *Gonfalon*, which was borne near the person of the commander-in-chief, and fixed in a frame in which it could turn. The Bayeux tapestry, in the representation of the Norman Conquest of England, exhibits numerous flags as borne by the knights of William's army. The gonfanon of the Conqueror had three ends, and was charged with a golden cross on a white ground within a blue bordure. The other flags are chiefly small, often three-pointed, and bearing figures which may be considered anticipations of the pales, roundles, and crosses of heraldry. At the battle of Northallerton in 1138 the English standard is said to have consisted of the mast of a ship fitted into a high four-wheeled carriage. On the top of the mast was a silver pyx with a consecrated host. There were displayed from it three banners dedicated respectively to St Peter, St John of Beverley, and St Wilfrid of Ripon. In 1244 Henry III. of England ordered a dragon to be made in fashion of a standard of red silk sparkling all over with fine gold, whose tongue should resemble burning fire, and appear to be continually moving, the eyes being of sapphires or other appropriate stones. Besides the gonfanon, three kinds of flag were much in use in the middle ages—the Pennon, the Banner, and the Standard.

The *Pennon* was an ensign of knightly rank, only, however, to be used by a knight who had followers to defend it; it was carried below the lance-head, and was of a tapering, sometimes swallow-tailed shape, exhibiting in earlier ages some decorative design, and, after the introduction of heraldry, sometimes the badge, sometimes the arms of its owner. The arms were so represented as to be in their right position when the lance was held horizontally. A diminutive flag of the same kind, called the *Pennoncel*, was carried by the esquires.

The *Banner* (q.v.), rectangular in form, was borne by a king, prince, duke, or any other noble down to a knight-banneret (see BANNERET). The owner's coat of arms covered its entire surface, no shield or external ornaments being displayed; such at least was the uniform practice until the 17th century. The *Siege of Caerlaverock*, a Norman-French rhymed chronicle of the 14th century, describes the arms on the banners of all the nobles and knights-banneret who were with Edward I. in his campaign against Scotland in 1300.

The *Standard*, strictly so called, a large, long flag, tapering towards the fly (or edge farthest from the staff), and slit at the end, was much in use among persons of distinction in the last half of the 14th, and in the 15th and 16th centuries. Its

length varied with the owner's rank, and it displayed, not his arms, but his badge or badges. In England the red cross of St George usually occupied the broad end of the standard, different family badges being sometimes separated from each other

Standard of Sir Henry de Stafford, K.G., 1475.

by the motto placed in one or two diagonal stripes across the field, as in the standard of Sir Henry de Stafford, K.G. (*circa* 1475), of which a drawing has been preserved at the Heralds' College in London.

Not only nations and persons, but trades and companies, had their flags, often carried into battle. A flag presented by James III. of Scotland to the trades of Edinburgh, and popularly known as the 'Blue Blanket,' was borne at Flodden, and is still in preservation. It is 10 feet long, swallow-tailed in form, and its ground is blue, now much faded. In the upper corner next the staff is the St Andrew's cross, between the crown and thistle, and two escrols bear separate inscriptions.

An account of military flags is given under COLOURS (REGIMENTAL). The remarks that follow apply chiefly to royal and national flags, as borne in modern times. Though national flags are displayed on certain occasions on shore, their use has become far more extensive and important at sea; and a knowledge of them is necessary for all sailors, whether in the navy or merchant service. In old times every chieftain or knight sailed under his own flag, and ships of war sailed under the flag of the admiral, or flag of the port; but the rule has long been that the ships of all countries shall sail under their national colours.

In most countries the sovereign has a flag personal to himself, which, notwithstanding the name of standard attached to it, is most generally, as in Great Britain, a banner in shape. The *Royal Standard* of the United Kingdom (see plate, fig. 1) is further a banner in this respect also, that it bears over its entire surface the quartered arms of England, Scotland, and Ireland. It is hoisted wherever the sovereign is residing, and on certain fortresses and stations, home and foreign, on royal anniversaries or state occasions, as directed in the Royal Regulations.

The union flag is a combination (somewhat questionable in point of heraldry) of the separate national flags of the three kingdoms, or at least of what have been accounted such. The red cross on a white field was, before the proper beginnings of heraldry, the distinguishing flag of England, and the white saltire on a blue field (the St Andrew's cross) similarly the flag of Scotland. One of the explanations given regarding the origin of the latter is that it represented the initial letter in Greek of our Saviour's name (X), as borne by the Emperor Constantine. The existing union flag had a predecessor, in which Ireland had no place, introduced in 1606, three years after the union of the crowns of England and Scotland. It was ordered by proclamation that all ships belonging to King James's subjects in both South and North Britain should bear in the maintop the crosses of St George and St Andrew conjoined after a form 'made by our heralds, and sent by us to our admiral to be published to our said subjects.' The first union flag blended the two national flags by placing the cross of St George (fig. 2) over the saltire of St Andrew (fig. 3), as in fig. 4, retaining the blue field of the latter, and giving the former a narrow white border or 'fimbriation,' to represent its white or silver field, and avoid the heraldic solecism of colour on colour. The proclamation of 1606 did not, of course, deal with ships-of-war. The king's ships had then, as now, for their principal flag the ensign, to be presently described; but they also bore, as they still do, a miniature union flag as a *jack*—i.e. a flag displayed from a staff at the end of the bowsprit, whence the name of union jack, which has in common parlance come to be wrongly applied to the larger as well as the smaller union flag. From this confusion it has arisen that landsmen unversed in sea phraseology, and in search of an etymology for this misapplied name, have suggested its derivation from King James (Jacques) who introduced it, or alternatively from the *jacque*, or surcoat with a red cross anciently worn by English soldiers. At the Union of 1707 the use of the first union flag was confirmed, and for the first time sanctioned on land as well as sea; and it was also incorporated into the ensign. In consequence of the Union of 1801 the flag just described had to give place to one in which Ireland would be represented, and in which the red saltire on a white ground (as in fig. 5) which had since 1783 contracted an association with St Patrick should be introduced. In the new flag (fig. 6) the St George's cross with its fimbriation remained as it was, and the saltires of Scotland and Ireland were placed side by side, with the white and red alternately uppermost, and a fimbria of white separating the red from the blue field.

The union flag *per se* has ceased to be the distinguishing flag of British merchant-ships; but there are still occasions on which it is displayed both at sea and on shore. The jack, properly so called, is never flown on shore. When flown from the mast with a white border it is the signal for a pilot; and it must also have a white border when flown from the bowsprit of a merchant-ship.

The *Ensign*, a large banner hoisted on a long pole called the ensign-staff erected over the poop, or at the gaff when the ship is under sail, is now, in one or other of its three varieties, the flag under which not British ships-of-war only, but British merchant vessels sail. For more than 200 years the British fleet consisted of three divisions, red, white, and blue, each with an ensign of corresponding colour; the white ensign differing from the others in being charged with a St George's cross; and in 1707 the union device was incorporated into the ensign, occupying the upper corner next the staff, which had before been taken up by the cross of St George. In 1864 these divisions of the fleet were abolished; yet the red, white, and blue ensigns are still in use, each with the union device of 1801 introduced in the way that has been described, and the white ensign still charged with the St George's cross. The red ensign (fig. 7) now belongs to merchant-ships and generally to vessels not belonging to the navy. The white (fig. 8) belongs exclusively to the Royal Navy and the Royal Yacht Squadron. The blue (fig. 9) is borne by the Naval Reserve, and also by certain yacht clubs.

The flag of the lord high admiral (fig. 10), red with an anchor and cable, is hoisted in any ship on board which that high officer is; and the admiral's flag, white with a red cross (as fig. 2), is flown by an admiral when employed afloat, and at the main, fore, or mizzen-topgallant mast-head, according as he is full, vice, or rear-admiral. The union flag and blue ensign are, with certain additions, used occasionally as personal flags, or in

particular departments of the service. The lord-lieutenant of Ireland, for example, has the union flag with a blue shield in its centre charged with a golden harp (fig. 11). The governor-general of India has, in the centre of the union flag, the Star of India with a crown over it (fig. 12). British ministers at foreign courts have also the union flag, and in its centre the royal arms within a white circle surrounded by a wreath (fig. 13). British consuls have the blue ensign with the royal arms in the fly. Vessels in the service of British colonies have the blue ensign with the badge of the colony in the fly.

The *long pendant*, a familiar flag in the navy, is some 20 yards long, and very narrow and tapering. As flown from the mast-head of all ships of the Royal Navy in commission, it is white with a red cross. Such vessels in the service of British colonies as are commissioned as vessels-of-war under Act 28 Vict. chap. 14 wear the long pendant, but blue with a red cross on a white ground next the mast. There is also the *broad pendant* or *burgee*, a slightly tapering and swallow-tailed flag, white with a red cross, flown by a commodore or the senior officer of a squadron to distinguish his ship. If used by a commodore of the first class, it is flown at the main-topgallant mast-head, otherwise at the fore-topgallant mast-head.

The Scottish lion and the Irish harp, taken separately, but figured as they appear on the royal standard, are used in Scotland and Ireland as national flags, but have no official recognition.

In the following notice of the flags of other maritime nations the technical language of heraldry is as much as possible avoided. The word *standard* is used for the flag of the sovereign, and the form of flag is assumed to be rectangular unless otherwise described.

France.—As royal standard, the blue hood of St Martin was succeeded by the plain red oriflamme (the standard of the abbey of St Denis), and the oriflamme in the 15th century by a blue standard powdered with fleurs-de-lis, the fleurs-de-lis being, as in the arms of France, eventually reduced to three in number. The white flag afterwards became the standard in the reign of Henry IV. The history of the national flag is somewhat confused prior to 1794, when the tricolor of three vertical divisions, blue, red, and white (fig. 14), was adopted. The white flag was reintroduced as royal standard and national flag at the restoration of monarchy, giving place again in 1830 to the tricolor, which has ever since been used both in the navy and as mercantile flag. Under the two empires the imperial standard was the tricolor, powdered with golden bees, the central stripe being charged with the eagle of the empire.

Germany.—The standard of the German empire (fig. 15) has the iron cross (technically a cross patée sable fimbriated argent) on a gold or yellow field, each quarter being charged with three black eagles and an imperial crown, and over the whole a yellow or gold shield, with the imperial arms ensigned with a crown and surrounded by the collar of the black eagle. The naval ensign (fig. 16) is white, divided by a black cross of which the arm next the flag-staff is shorter than the other, and in the outer section of the cross is the Prussian eagle on a white field. The upper quarter next the flagstaff is composed of three horizontal stripes of black, white, and red, and has in its centre the iron cross. The flag of the merchant service consists of three horizontal stripes of black, white, and red (fig. 17).

Austria.—The imperial standard (fig. 18) is yellow, displaying the eagle of the empire, and has an indented border of gold, silver, blue, and black. The man-of-war's flag (fig. 19) has three horizontal divisions, the central one white, the other two red: on the central division is a shield striped as the flag, with a narrow gold border, and ensigned with the imperial crown. The flag of the merchant service (fig. 20) is the same, but without the shield or crown. The Austro-Hungarian mercantile flag (fig. 21) has the lower stripe half red and half green, with two shields containing respectively the arms of Austria and of Hungary.

Russia.—The standard is yellow, charged with the arms of the Russian empire. The naval ensign (fig. 22) has a blue saltire on a white ground. The merchant flag (fig. 23) consists of three horizontal stripes of white, blue, and red.

Italy.—The royal standard, white with a blue border, displays the full armorial achievement of the king of Italy. The flag of the navy (fig. 24) has three vertical stripes of green, white, and red; in the centre is a red shield charged with a white cross and bordered with blue (the arms of the dukes of Savoy) ensigned with the crown. The mercantile flag is the same, without the crown.

Spain.—The standard is entirely occupied with the quarterings of the Spanish escutcheon armorially marshalled. The flag of the navy (fig. 25) has three horizontal stripes, red, yellow, and red, the middle stripe being broader, and charged in the end next the staff with a circular shield ensigned with a crown and containing the impaled arms of Castile and Leon. The merchant flag (fig. 26) is yellow, with two horizontal bars of red across it.

Portugal.—The standard is red, charged with the Portuguese arms and crown. The flag of the navy (fig. 27) is of blue and white, divided vertically and similarly charged. The mercantile flag is the same.

Belgium.—The standard is striped vertically black, yellow, and red, the yellow stripe charged with the royal achievement. The mercantile flag (fig. 28) is like the standard, but without the achievement.

Netherlands.—The standard is striped horizontally red, white, and blue, with the royal achievement on the white stripe. The naval and merchant flag (fig. 29) have the same three stripes, without the achievement.

Denmark.—The flag (probably the oldest in existence, dating from the 13th century) is red, with a white cross. In the standard the cross widens into a square in the centre, in which are the royal arms surrounded by the collars of the Elephant and the Dannebrog. Both the standard and the man-of-war's flag (fig. 30) are swallow-tailed. The merchant flag is like the ensign, but rectangular.

Sweden and Norway.—The flag of Sweden being blue with a yellow cross, that of Norway red with a blue cross and white fimbriation, the two were combined in 1817 into one device, somewhat after the manner of the union flag of Britain. The ensign (fig. 31) is the above-described flag of Sweden (blue with a yellow cross), with the union device in the upper quarter next the flagstaff. The standard has the royal achievement in the centre of the Norwegian cross. Both standard and naval ensign are three-pointed; the mercantile flag differs from the latter in being rectangular.

Turkey.—The flag of the navy (fig. 32) is red, charged with a decrescent moon and an eight-pointed star, both white. The merchant flag (fig. 33) is green, with a red circle in the centre, on which is a white decrescent moon.

Greece.—The standard is blue, charged with a white cross, whose inner limb is shorter than its outer, the royal arms, supporters, &c. being in the centre. The flag of the navy (fig. 34) has nine horizontal stripes alternately blue and white, the upper quarter next the staff being blue, with a

white cross, in whose centre is a crown. The merchant flag is the same without the crown.

United States.—The stars and stripes of the United States of America (fig. 35) are said to have been suggested by the coat armorial of the Washington family (argent, three bars gules, in chief three mullets of the second), but it is hardly possible to reconcile this supposition with the actual history of the American flag. The earliest flag consisted of horizontal stripes, with the earlier British union device in the place which it occupies in the British ensign. Soon after the Declaration of Independence congress resolved that the flag of the United States should have thirteen stripes, alternately red and white, and that the British union device should be superseded by a blue field with thirteen white stars, the number both of stripes and of stars being correspondent to the number of states. In 1808 it was enacted that the stripes should continue to be thirteen, that the stars should be twenty in number, there being then twenty states, and that a star should be added for every new state that came into the union. In 1889, owing to the admission of four new states, the number of stars was increased to forty-two. The flag of the American admiral has the stripes alone, and the stars are used separately as a jack.

By a general international understanding, a flag of truce is white, and it is usual to hoist with it the national flag of the enemy, the white flag at the main, and the enemy's ensign at the fore. Striking the flag denotes surrender, and the placing the flag of one country over that of another indicates the victory of the former. The ensign and pendant at half-mast indicate mourning, the red flag mutiny, the black flag a pirate, and the yellow flag quarantine.

For the use of flags as signals, which has of late years been brought to great perfection, see SIGNALLING.

Naval flags are now made of a light woollen fabric called bunting. Their size is expressed by the number of breadths of which they are composed, the regulation bunting being 9 inches wide.

Flag-captain, in the Navy, is the captain of the admiral's ship in any squadron, and is ordinarily his nominee.

Flagellants, the name applied to those groups of fanatical enthusiasts who, at intervals from the 13th to the 16th century, made their appearance in various countries of Europe, proclaiming the wrath of God against the corruption of the times, inviting sinners to atone for sin by self-inflicted scourgings or flagellations, and publicly enforcing this exhortation by voluntarily scourging themselves, as well as by other forms of self-castigation. In large and disorderly bands—frequently headed by priests, and by fanatics in the costume of priests and monks, bearing banners and crucifixes aloft, their breasts and shoulders bare, and their faces concealed by a hood or mask, each armed with a heavy knotted scourge, loaded with lead or iron—they marched from town to town, chanting hymns full of denunciations of vengeance and of woe. In the most public place of each town which they entered they threw themselves upon the earth, and there inflicted upon themselves the discipline of scourging, frequently to blood, and even to mutilation. Each member enrolled himself for thirty-three days, in honour of the thirty-three years of the life of our Lord on earth; and all for the time professed entire poverty, subsisting only on alms or voluntary offerings. These fanatical movements recurred at frequent intervals; the most remarkable, however, are three in number. The first originated at Perugia in 1260, at a time when society in Italy was greatly disorganised by the long-continued struggles of the Guelph and Ghibelline factions. Numbers crowded to follow the new cry, until at last the body became so formidable as to draw upon itself the suspicions of Manfred, the son of Frederick II., by whom it was vigorously suppressed. Later offshoots of the party made their appearance in Bavaria, Austria, Moravia, Bohemia, Poland, and France; when to their extravagant practices they added still greater extravagances of doctrine. In virtue of a pretended revelation, they asserted that the blood shed in self-flagellation had a share with the blood of our Lord in atoning for sin; they mutually confessed and absolved one another, and declared their voluntary penances to be a substitute for all the sacraments of the church, and for all the ministrations of the clergy. The Jews were to them an object of special abhorrence, and suffered dreadfully from their fury in many towns of Germany and the Netherlands. In the second outbreak of Flagellantism, about 1349, the outrages against public decency were much more flagrant than on its first appearance. Men and women indiscriminately now appeared in public half naked, and ostentatiously underwent these self-inflicted scourgings. The immediate occasion of this new outburst of fanaticism was the terror which pervaded society during the dreadful plague known as the Black Death. The same extravagances were again repeated in Upper Germany, the provinces of the Rhine, the Netherlands, Switzerland, Sweden, and even England. Although rigorously excluded from France, these fanatics effected an entrance into Avignon, then the residence of the popes, but were condemned by a bull of Clement VI. The mania gradually subsided, nor do we again find any permanent trace of it till the beginning of the next century. In the year 1414 a new troop of Flagellants, locally called *Flegler*, made their appearance in Thuringia and Lower Saxony, renewing and even exaggerating the wildest extravagances of their predecessors. These new fanatics appear to have rejected all the received religious usages, and indeed all external worship, placing their entire reliance on 'faith and flagellation.' Their leader was called Conrad Schmidt. They rejected not only the doctrines of the church upon the sacraments, but also purgatory and prayers for the dead. Their violence drew upon them the severest punishments of the Inquisition. Many of them were capitally condemned, and Schmidt himself was burned at Sangerhausen in 1414. Their doctrines, comprised in fifty articles, were condemned in the Council of Constance.

These strange extravagances are reprobated by the Roman Catholic Church in common with all other Christian communities; but Roman Catholics (relying on 1 Cor. ix. 27; Col. iii. 5) hold the lawfulness, and even the meritorious character, of voluntary self-chastisement, if undertaken with due dispositions, practised without ostentation or fanaticism, and animated by a lively faith and a firm hope in the merits of Christ. This is the self-castigation known under the name of 'the Discipline'—a form of mortification not unfrequent in the monastic state, and even practised by lay persons, and these sometimes of the highest rank, both in ancient and in modern times. See PENANCE.

See Wadding's *Annales Minorum Fratrum;* Raynaldi's *Continuation of Baronius;* Mosheim's *Church History;* Giesseler's *Kirchengeschichte;* and Milman's *Latin Christianity.* Also the following special treatises: Förstemann, *Die Christlichen Geisslergesellschaften* (1828); Schneegans, *Die Geissler* (1840); W. M. Cooper, *Flagellation and the Flagellants* (new ed. 1887); and Röhricht in the *Zeitschrift für Kirchengeschichte* for 1877.

Flagellum, a vibratile filament of living matter associated with a cell, whether that be an isolated unit as in most flagellate Infusorians, or an

element in a multicellular organism, as in the flagellate chambers of a sponge. A flagellate cell has in most cases a single flagellum, and two are not uncommon; cilia, however, usually occur in numbers. A cilium is simply bent and straightened again; a flagellum wriggles from side to side with a more complex undulatory contraction and extension. A rudder-like flagellum, driving the cell before it, as in spermatozoa and bacteria, has been called a *pulsellum;* while the commoner type, which draws the cell after it, as seen in many Infusorians, has been termed a *tractellum.* A flagellum is usually locomotor or food-wafting in function, and is an expression and outcome of marked activity in the cell to which it belongs. See CELL, CILIA, PROTOZOA.

Flageolet (Old Fr. *flajol*), the modern form of the old *Flute à bec*, or straight flute, the simplest kind of which is the tin whistle with six holes. It is said to have been invented by Sieur Juvigny in 1580. The English flageolet has the same scale as the Flute (q.v.). The French flageolet, which at one time was very popular in dance music, is a smaller variety, having only four holes in front, with two behind for the thumbs, and additional keys. Its compass is a little over two octaves from G on the treble stave. The flageolet is not used in orchestral music.

Flag-lieutenant is an officer who, in the navy, performs such duties for an admiral as would devolve upon an aide-de-camp in the army. He communicates the admiral's orders to the various ships, either personally or by signal.

Flag-officer, in the British Navy, is an admiral, vice-admiral, or rear-admiral. He is so called from his right to carry, at the mast-head of the ship in which he sails, a flag denoting his rank. The Lord High Admiral, or the commissioners appointed to fulfil his duty—i.e. the Lords of the Admiralty, fly the union flag at the main. For an admiral the flag is borne at the main; for a vice-admiral, at the fore; and for a rear-admiral, at the mizzen: the flag being, in either case, a red St George's cross on a white field. For the former division by squadrons, see FLAG.

Flagship, the ship in a fleet which bears the admiral's flag, and therefore forms a sort of centre to which all other vessels must look for orders. It is usually the most powerful vessel in the fleet.

Flagstone, a rock which splits into tabular masses, or flags of various size and thickness, in the original planes of stratification. Flagstones are generally sandstones combined with more or less argillaceous or calcareous matter; some, however, are indurated clays, and others thin-bedded limestones. They are used for paving, cisterns, &c. The most famous are those of Festiniog (North Wales), remarkable for their large size, even grain, and great beauty; those of Yorkshire, also of large size, and of great hardness and toughness; and those of Caithness, which are extremely tough and durable. The Caithness flags belong to the Old Red Sandstone; the Yorkshire are taken from the millstone grit division of the carboniferous system.

Flahault de la Billarderie, AUGUSTE CHARLES JOSEPH, COMTE DE, a French soldier and diplomatist, was born at Paris on 21st April 1785. Entering the army a mere lad, he was rapidly promoted to the rank of aide-de-camp of Napoleon. He distinguished himself in the Peninsular war and the Russian campaign, and in 1813 received the title of Count, and the rank of general of division in the new army. He became an exile after Waterloo; and while in England married a Scottish peeress, the Baroness Keith and Nairne, proprietor of Tulliallan, in Clackmannanshire. After the revolution of 1830 Flahault returned to France, entered the household of the king, and was appointed ambassador at Vienna (1842–48). By Napoleon III. he was sent as ambassador to London (1860–62), and made Grand Chancellor of the Legion of Honour. He died 2d September 1870.

Flail. See THRASHING.

Flambard, RANNULF or RALPH, justiciar of England under William II., was a Norman of obscure birth. Although he entered the church, and in 1099 obtained the bishopric of Durham, he did not scruple to make himself the king's man, ministering to his vices and extravagances by cruel and oppressive extortion of the king's subjects. He it was who taught the king to apply the usages of feudalism to the estates belonging to the church. He died 5th September 1128.

Flamborough Head, a promontory of the Yorkshire coast, forming the northern horn of Bridlington Bay, 18 miles SE. of Scarborough (by road 24). It terminates a range of steep chalk cliffs, 300 to 400 feet high. Its rugged sides are pierced with many caverns, and in the sea close by are picturesque chalk rocks, which swarm with sea-birds. On the Head is a lighthouse, 214 feet above sea-level, and 80 feet high, seen 21 miles off. Across the peninsula, ending in the Head, runs a double entrenchment called Danes' Dyke, but really an ancient British earthwork.

Flamboyant, the latest style of Gothic architecture, which prevailed in France during the 15th and part of the 16th centuries, and corresponds to the Perpendicular (q.v.) in England. The name is derived from the flame-like forms of the tracery of the windows, panels, &c. (fig. 1). The characteristics of this style are minute and elaborate ornament, combined with general bareness of surface. The crockets, for instance, are generally cut into a great number of small leaves, while they are placed far apart; the mouldings are divided into large empty hollows and small thin fillets and beads: the finials have crockets minutely carved, set upon bare pyramidal terminals; the arch-mouldings are divided into a great number of small members, and want the boldness and decision of the earlier styles. These mouldings are frequently abutted on the pillars, or continued down them without any caps; and when there are caps, they are small and without effect (see fig. 2). When mouldings join, they are frequently run through one another, so as to appear to interlace. The effect is intricate rather than beautiful, suggestive, like the rest of the style, of ingenuity in stone-cutting rather than art. The doorways and windows are sometimes large and fine (as in fig. 1); but, while these are highly enriched, the general surface of the building is left too plain. The foliage and running enrichments are

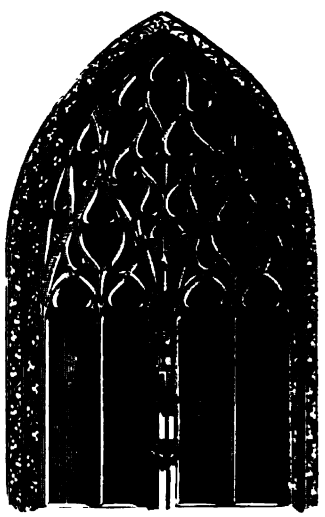


Fig. 1.—Window, Harfleur.

frequently carved with great spirit. There are many large buildings in France executed in this style, but it is usually portions only which are fine, not the general effect. Some of the spires of this period are also very beautiful. The north-western spire of Chartres (q.v.) Cathedral, for example, is considered one of the finest in France.

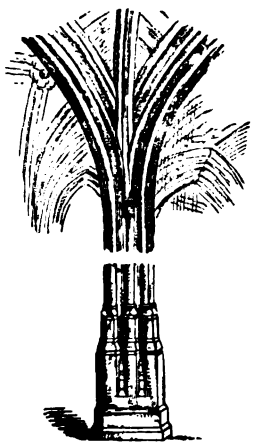
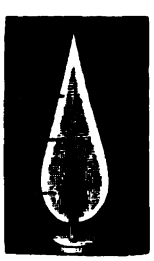


Fig. 2.

Flame consists of gaseous matter undergoing combustion. In this process heat is given out as the result of the chemical combinations effected, and also, generally, light from the incandescence of some of the substances undergoing combustion. When the gas and the supporter of its combustion (i.e. the substance with which it combines in burning), which is usually oxygen or atmospheric air, are thoroughly mixed together, and when any part of it is raised, as by the application of a light, to the temperature of ignition, combination is effected with great rapidity throughout the mass of the gas, and a flame of no particular shape or form is produced. But if the combustible gas issues from a jet or orifice and is burned there, the flame assumes a definite shape, and exhibits certain more or less well-defined parts. The flame of such a substance as coal-gas issuing from a jet consists of three parts: (1) An inner dark space filled with the gas alone, and in which no combustion takes place; it may be termed the *area of non-combustion*, and that it is of this nature may be proved by inserting into it a small piece of phosphorus, when it will be found that the phosphorus does not take fire, as it would were it placed in any other part of the flame. (2) A luminous envelope, completely surrounding the dark inner part except at the jet, and consisting of the combustible gas mixed with oxygen and atmospheric air. Into this part of the flame the oxygen of the air penetrates and effects combustion; but, as it is not present in sufficient quantity to completely burn all the constituents of the gas, part of the carbon is separated; this portion of the flame is therefore termed the *area of partial combustion*. (3) An outer portion in which the separated carbon particles are raised to incandescence and completely burned, as also are any other products the combustion of which has not been completely effected in the area of partial combustion; hence this is known as the *area of complete combustion*.



Flame of a Candle: Showing 1, area of non-combustion; 2, area of partial combustion; 3, area of complete combustion.

The colour of a flame depends partly on its temperature, but principally on the nature of the substances undergoing combustion or incandescence. The luminosity of flames varies also with the nature of the gas; it is due to the incandescence of carbon particles, and also of dense hydrocarbons present. Feebly luminous flames, such as those of hydrogen, can be increased in luminosity by the admixture with the combustible gas of such substances as benzole vapour; also by an increase in pressure of the agent supporting the process of combustion, or by heating the gas before it enters the flame. Of 100 units of light emitted by a gas flame burning under an atmospheric pressure of 30 inches of mercury, 5·1 units are lost by each reduction in pressure of 1 inch.

Singing and Sensitive Flames.—If the flame of coal-gas or, better still, hydrogen issuing from a blowpipe-nozzle be slowly passed up a wide glass tube, it will be found that at a particular position up the tube the flame alters its character; being rapidly extinguished and rekindled, while at the same time it gives forth a peculiar musical note. To this is given the name of a *singing flame*. The sound is caused by longitudinal vibrations of the air in the tube, originally set up by a decrease in pressure above the flame, caused by the upward draught; a downflow is thus momentarily produced, which in its turn is checked by the upward motion of the air; and so on.

When an inflammable gas issues from a narrow vertical jet, and is ignited above a sheet of wire-gauze held horizontally about two inches above the orifice, a flame is produced which is easily affected by any sound-waves which strike it, and is hence termed a *sensitive flame*. Such a flame will respond to sounds, especially those of high pitch, produced in its neighbourhood, by sinking down to the wire-gauze. A flame which is highly sensitive and responsive to sounds too acute to be perceived by the human ear can be made by igniting gas issuing under great pressure from an exceedingly narrow jet.

Flamens were priests in ancient Rome devoted each to some special deity. There were fifteen in all. The chief of these (*Flamines Majores*) were the flamen of Jupiter (*Flamen Dialis*), of Mars (*Martialis*), and of Quirinus (*Quirinalis*), who were always patricians; the remaining twelve (*Flamines Minores*) were chosen from the plebeians. The flamens were elected at first by the Comitia Curiata, but afterwards by the Comitia Tributa, and were installed into their office by the supreme dignitary of the Roman official religion, the pontifex maximus. The flamen of Jupiter was a privileged person; he was not required to take an oath, was attended by a lictor, his house was an asylum, and he had a seat in the senate. But all this was attended by numerous restrictions: he might not have a knot on any part of his attire, nor touch flour, or leaven, or leavened bread; he might not touch or name a dog, or mount a horse, or be a night out of the city, &c. His wife, called Flaminica, was subjected to similar restrictions, and when she died the flamen was obliged to resign. The majority of Roman writers attribute the institution of flamens to Numa.

Flamingo (*Phœnicopterus*), a genus of remarkable birds, usually regarded as forming a distinct family, Phœnicopteridæ, near the Anseres or ducks and geese, considered by Huxley as 'completely intermediate between the Anserine birds on the one side and the storks and herons on the other.' The genus includes eight species, four of which are American (in Chili, Galapagos, Mexico, West Indies), while the others are distributed in Africa, South Europe, India, and Ceylon. The bill is very peculiar, longer than the small head, and suddenly bent downwards in the middle; the neck is very long and thin; the same adjectives are even more applicable to the legs; the short toes are webbed. The flamingoes live sociably on marshy shores, usually of the sea, but sometimes of fresh water. They wade in the water, stirring up the bottom with restless feet, and grub for small animals. In thus fishing, the neck is bent upon itself so that the upper half of the spoon-like bill is turned downwards. The edges of both upper and lower jaw are

furnished with small transverse plates, which serve, as in common Anseres, for a sieve, allowing the escape of the mud, but retaining the small worms, crustaceans, molluscs, fishes, &c., on which the birds feed. The upper surface of the tongue is beset on the sides and base with flexible, recurved, horny spines.

Flamingo (*Phœnicopterus ruber*).

The flamingoes are birds of powerful flight, and fly like geese in strings or wedge-shaped flocks. They also swim in deep water, but the legs are too long to be well adapted for this purpose. They are habitual waders, and the webbed membrane of the feet helps to support them on soft muddy bottoms. Hundreds feed and nest together, and, being large and richly coloured, form a brilliant assembly, their exquisite pink plumage sometimes making a striking contrast against a background of dark-green mangroves. The nests are mounds of mud, from 8 to 15 inches in height, gradually raised year after year, and built at distances of 3 to 4 feet apart. During incubation the females, according to some, sit with their legs dangling down behind; but Mr Blake, who watched them carefully, says that the limbs are folded under the birds in the usual fashion. The nesting occurs about the end of May, the hatching about a month later. There is usually only one egg. One species (*Ph. ruber* or *antiquorum*) occurs in Europe, from spring to autumn, on Mediterranean coasts, and within the century as far north as the Rhine. It measures about four feet from bill to tail, and stands about six feet high from bill to feet. The male in full plumage is for the most part of a rose-red colour; the female, and the young for several years, are less brilliant. The young birds were among the delicacies of the ancients. See H. A. Blake, 'Flamingoes at Home,' *Nineteenth Century* (December 1887, pp. 886–890).

Flaminian Way (*Via Flaminia*), the great northern road of ancient Italy, leading from Rome to Ariminum (*Rimini*) on the Adriatic. It was constructed by C. Flaminius during his censorship (220 B.C.) in order to secure a free communication with the recently conquered Gaulish territory, and was one of the most celebrated and most frequented roads of Italy both during the period of the Republic and of the Empire. Its importance may be estimated from the fact that, when Augustus (27 B.C.) appointed persons of consular dignity road-surveyors for the other highways of his dominions, he reserved the care of the Flaminian Way for himself, and renewed it throughout its whole length.

Flammarion, CAMILLE, French astronomer, was born in 1842 at Montigny-le-Roi, entered the Paris Observatory in 1858, and shortly afterwards made a reputation by his popular lectures on astronomy. The titles of his principal books will sufficiently indicate the line of his activity: *The Plurality of Inhabited Worlds* (1862; 30th ed. 1884); *Imaginary Worlds and Real Worlds* (1864; 19th ed. 1884); *God in Nature* (1866; 18th ed. 1882); *Celestial Marvels* (1865; Eng. trans. 1870); *Studies and Lectures on Astronomy* (1866–81; 9 vols.); *History of the Heavens* (1872); *The Atmosphere* (1872; Eng. trans. 1873); *The Stars and the Curiosities of the Heavens* (1881); *The Lands (Terres) of the Heavens* (8th ed. 1882). In 1868 Flammarion took considerable interest in ballooning, made several ascents, and wrote a work entitled *Travels in the Air* (Eng. trans. by James Glaisher, 1871).

Flamsteed, JOHN, the first astronomer-royal of England, for whose use the Royal Observatory at Greenwich was built, was born near Derby in 1646. He early devoted himself to mathematics and astronomy with such success as to attract the notice of Sir Jonas Moore, and through him he was appointed astronomer to the king in 1675, in which capacity he endured the unhappy conjunction of too much work and too little pay. The year after, the Observatory at Greenwich was built, and Flamsteed began the series of observations that really commenced modern practical astronomy. He formed the first trustworthy catalogue of the fixed stars, and furnished those lunar observations on which Newton depended for the verification of his lunar theory. Extracts from the papers of Flamsteed, found in the Observatory by Francis Baily, and published by authority of the Admiralty in 1835, brought to light a very sharp quarrel that had taken place between Flamsteed and Newton and Halley with regard to the publication of the results of Flamsteed's labours. His great work is his *Historia Cœlestis Britannica*, an account of the methods and results of astronomical observation up to his time, published in 3 vols. in 1723. Flamsteed, while following his scientific pursuits, took holy orders, and in 1684 was presented to the living of Burstow, in Surrey, which he held till his death on 31st December 1719. See Baily's *Account of Flamsteed* (1835).

Flanders (Flemish *Vlaenderen*), the country of the Flemings, a territory lying adjacent to the North Sea, between the Scheldt and the Somme, which embraced the present Belgian provinces of East and West Flanders, the southern portion of Zealand in Holland, and the greater part of ancient Artois in France. This region was originally inhabited by Belgic tribes, on whose subjection by one of Cæsar's lieutenants their territory was incorporated in Roman Gaul. Under the supremacy of Rome they attained to a certain degree of civilisation, being renowned for their agriculture, their industry, and their commerce. The region was afterwards overrun by the Franks on their way to Gaul, many of them settling there permanently. By the Treaty of Verdun (843) Flanders was assigned to Neustria. The real nucleus of Flanders as a political state was the patrimony of a noble family whose possessions were grouped around Bruges and Sluys. In 862 the king of France, as suzerain, changed the title of the head of the family from forester or ranger to count. The first recipient of the honour was Baldwin I., Iron-arm (837–877), who was likewise invested with the maritime region of north-east France, on condition that he defended it against the Normans. His descendant, Baldwin IV. (989–1036), having seized upon the emperor's town of Valenciennes in 1006, and proving himself able to keep what he had

taken, was allowed to retain it (1007) as a feudatory of the empire. At the same time the emperor invested him with Ghent and the Zealand islands (Walcheren, Beverland, &c.). Thus the Count of Flanders held of the emperor as well as of the king of France. Under this count's son and successor, Baldwin V. (1036–67), the county of Alost (Aalst), Tournai, and Hainault were added to the principality. On his death the Netherlands portion of Flanders was erected into an appanage for his younger son, Robert the Frisian, who on the death of his elder brother, Baldwin VI. (1067–70), also wrested Flanders from Baldwin's widow Richilde, leaving to her and her son Hainault only. From this time down to the end of the 12th century the Flemish territories remained thus divided. The counts of Flanders of the 10th and 11th centuries were active in promoting the well-being of their people: they built churches and monasteries, and encouraged the industries of the towns, whereby Flanders rose to be the chief centre of woollen-weaving and fulling in Europe. At this period Ghent, Arras (the capital of the county), Courtrai, Rousselaere, Valenciennes, Cassel, Tournai, Lille, St Omer, Ypres, and Bruges were prosperous cities, the centres of the intelligence and public spirit of the country. Robert II. (1093–1111), son of Robert the Frisian, distinguished himself in the first crusade. His son, Baldwin VII. (1111–19), rigorously suppressed the private feuds of his nobles, and administered justice with Draconian severity. As he left no heir, the county was held by a succession of alien princes, as Charles of Denmark (1119–21); William, son of Robert of Normandy, till 1129; Thierry (Diedrich) of Alsace (1129–69), who took part in more than one crusade; and Thierry's son Philip (1169–91), who, besides championing the Christian faith against the Saracens, did much to foster industry and trade at home.

The accession of these foreign princes was turned to account by the Flemish cities, which extorted from them important charters of liberty and self-government. On Philip's death, Baldwin of Hainault reunited the two Flemish counties under one sceptre. But he had a rival for Flanders proper in Philip of France, who, having married Baldwin's own daughter, the niece of Philip of Flanders, claimed this district as her dowry; and Baldwin was constrained to buy off his more powerful antagonist by the cession of the county of Artois, a large part of southern Flanders, and the towns of St Omer, Hesdin, and some others. From this time forth Ghent superseded Arras as the capital. The next prince of Flanders was Baldwin IX. (1194–1206), son of Baldwin of Hainault, who, after winning back from France most of southern Flanders (though not Artois), took the crusader's cross and became the founder of the Latin empire of Constantinople. Baldwin was followed successively by his two daughters, Johanna (1206–43) and Margaret (1243–78), and by Margaret's son, Guy of Dampierre (1278–1305), who spent a large part of his life as a prisoner in France. Under these rulers the king of France first began to exercise a determining influence upon the government of Flanders. In 1256 the Zealand islands were given to the Count of Holland, and to Holland they have ever since belonged. The next century presents a series of disputed successions, mostly fomented by the kings of France, who made strenuous efforts to unite Flanders to the French crown. The country was in fact divided between two streams of preponderating influence: on the one hand the nobles, headed by the counts, were enamoured of France, and French society, and French institutions (*Leliaerts*); and on the other the burghers of the towns (*Claeuwaerts*) clung tenaciously to their national independence and municipal freedom. It was the latter party that constituted the backbone and strength of the country. From the middle of the 12th century the cities, growing more independent and more turbulent with the increase of wealth, began to play an increasingly important part in the politics of Flanders, warring one against another, and even waging civil strife within their own walls, taking up arms against their counts, and by their factions either consolidating or marring the fortunes of the rulers of the country. It was especially under Johanna and Margaret that the burghers of such cities as Bruges, Ypres, Ghent, and Lille made rapid progress in commercial prosperity and in the establishment of democratic principles of local government. Each of these cities possessed nearly 40,000 looms for weaving cloth; whilst Damme was a thriving seaport, doing a large shipping trade in wool, corn, cattle, wine, beer, &c. The struggle of the cities, represented chiefly by Bruges, Ghent, and Ypres, against the counts and other rulers, lasted more or less down to the Treaty of Utrecht (1713).

Philip IV. of France, having for some years steadily fanned the dissension in Flanders, at length got Count Guy into his hands and took possession of his country (1300), which he governed by means of a regent, Châtillon. This man's oppressive rule, however, provoked a general revolt of the Flemings, who in the battle of the Golden Spurs, fought near Courtrai on 11th July 1302, almost destroyed the army sent against them by the king of France. The contest continued until 1320, during all which time the Flemings successfully repelled the attempts of Philip to invade their country; and at last wholly shook off the claims of France. Under Louis, who became Count of Flanders in 1322, and who neglected his country to spend most of his time at the court of France, the cities frequently broke out into open revolt; Bruges even held Louis a prisoner for several months, nor were the rebels quelled except with the aid of a large French army (1328). In 1336 Jacob van Artevelde (q.v.), who had acquired supreme influence and power in Ghent, induced the chief cities, in defiance of their count, to make an alliance with Edward III. of England to help him in his quarrel with France. From this time down to 1345, when he was slain by a rival in Ghent, Van Artevelde was the real ruler of Flanders, though he found it an impossible task wholly to restrain the violence and disorder in the restless cities. Under Louis II., who succeeded his father, Louis I., in 1346, it was Ghent and Ypres that at first refused to submit to his rule. Then, in 1379, the keen rivalry of Ghent and Bruges came to a head in a civil war, which soon swelled into a general uprising of the entire country, led by the Ghent faction of the White Caps, against the count. The people of Ghent held out stubbornly under Philip van Artevelde, who, however, was slain in battle against the French, 27th November 1382, at Roosbeke. Two years later Count Philip died, leaving an only daughter, married to Philip of Burgundy (q.v.), with which duchy the history of Flanders became thenceforward intimately associated, until in 1477, by the marriage of Mary of Burgundy to Maximilian of Austria, both states passed to the empire, Flanders becoming part of Austrian Netherlands. Against this arrangement France vainly protested; and in 1526 she was compelled finally to renounce her claims as suzerain. With the accession of Philip II. to the throne of Spain the history of Flanders becomes identical with that of the Spanish Netherlands (see HOLLAND). By the Treaty of Westphalia Dutch Flanders was transferred to the United Netherlands, whilst by the treaties of the Pyrenees (1659), Nimeguen (1678), and Utrecht (1713) Louis XIV. succeeded in adding to France Artois and a large part of French Flanders. By

this last treaty and by that of Rastatt (1714) the rest of Flanders was assigned to Austria, and became known as the Austrian Netherlands. On the formation of the new kingdom of Belgium in 1831, the provinces of East and West Flanders were incorporated with it.

See Oudegherst, *Chroniques et Annales de Flandre* (1571); Warnkönig, *Flandrische Staatsgeschichte* (Tübingen, 1835–39); Conscience, *Geschiedenis van België* (1845); and the more recent works of Kervyn de Lettenhove. For the Belgian provinces of East and West Flanders, see BELGIUM; for the Flemish language, see HOLLAND; and for the Flemish School of Painting, see PAINTING.

Flandrin, JEAN HIPPOLYTE, historical and portrait painter, was born at Lyons, 23d May 1809, the son of a miniature-painter. After studying in his native town, he proceeded in 1829 to Paris, where he attended the School of Fine Arts. But he also worked under Ingres, who was his true master; and from him he imbibed that love of severe and definite form and that classical feeling which he used for his own ends in his religious painting. He had a severe struggle with ill-health, and endured many privations; but in 1832 he won the *Prix de Rome* by his 'Recognition of Theseus;' and before his five years' residence in Italy was completed he had produced his fine rendering of 'St Clair healing the Blind,' now in the cathedral of Nantes. Henceforward he was mainly occupied with decorative monumental work, though he also executed many admirable portraits. In 1842 he began his great frescoes of 'Christ entering Jerusalem,' and 'Christ going up to Calvary,' in the sanctuary of the church of St Germain-des-Près, Paris, deeply impressive works, which already entitled their painter to rank as the greatest religious painter of the century. The choir of the same church he adorned (1846–48) with figures of the Saints and the Virtues. He also decorated the church of St Paul at Nîmes (1847–49), the church of St Martin d'Ainay at Lyons (1855), and painted the frieze of St Vincent de Paul, in Paris, with a noble series of saints and martyrs. In 1855 he began his last great work in the nave of St Germain-des-Près, consisting of subjects from the Old and New Testaments, of which some were left uncompleted at his death, at Rome, 21st March 1864. His *Lettres et Pensées*, with a memoir and a catalogue of his works, were issued by the Count Delaborde, in 1865. See also Lives by Poncet (1864) and Montrard (1876).

Flank ('the side'), a word used in many senses in military matters. *Flanks of an army* are the wings, or bodies of men on the right and left extremities. *Flank files* are the soldiers marching on the extreme right and left of a company or any other body of troops. *Flank company* is the company on the right or left when a battalion is in line. *Flanking parties*, or *flankers*, are cavalry or infantry marching some distance from the sides of the main column to prevent a sudden attack upon them.—Flank, as applied in Fortification, will be best described under that article. Generally it is any part of the works from which fire sweeps, or flanks, the front of any other part. The *flanks of a frontier* are certain salient points on it, strong by nature and art, between which an enemy dare not penetrate, at the risk of their garrisons attacking his rear, and cutting off communication between him and his base.—In manœuvring, 'to flank' is either to protect the flanks of one's own army by detached bodies of troops, or field-works, or to threaten those of the enemy by directing troops against them. To *outflank* is to succeed by manœuvres in overlapping the flank of an enemy who has been, on his part, endeavouring to flank one's own force.

Flannan Islands, or THE SEVEN HUNTERS, a small group of uninhabited islets off the outer Hebrides, 20 miles NW. of Gallon Head in Lewis.

Flannel (Welsh *gwlanen*, close to which is the provincial *flannen*). The processes in the manufacture of flannel are similar to those employed for woollen cloth, which differs in its nature from worsted cloth. For flannel the wool, after passing through the preparatory processes of scouring and devilling, is carded, spun, woven, and fulled or milled. Those kinds with a fleecy pile on the surface are passed through the teazling-machine (see under Wool, WOOLLEN CLOTH MANUFACTURE). Yarn for ordinary flannel is loosely spun to impart softness to the fabric. Flannel wears better and shrinks less if the pile is slightly raised than if it is much raised, and it is better to get it of the natural white colour than slightly blued, as this tint gives way at the first washing.

Welsh flannel made from the wool of the Welsh mountain-sheep fetches the highest price. But it is well known that the supply of this wool is not nearly enough to make the quantity of flannel sent into the market as 'real Welsh.' Some of the Lancashire flannels made of other wools are hardly inferior to those made in Wales. Yorkshire flannels are lower in price than either of these. Special kinds of flannel are made, such as the comparatively firmly spun and closely woven flannel for cricket dresses and fancy shirts; thin all-wool gauze flannel for use in India and other warm countries; similar flannel made with a silk warp; dometts made of wool and cotton; and gray, dyed, and printed flannels. The manufacture of flannels is chiefly carried on in England at various places in Lancashire and Yorkshire, and in Wales at Newtown, Welshpool, and Llangollen. Flannel shirtings are made on a considerable scale at Auchterarder in Scotland.

In the United States flannels are manufactured on a very extensive scale. In order to prevent shrinkage these are made of yarns more closely twisted than those used for English flannels. American flannels are also less highly fulled, and smoother in the face. The French excel in the manufacture of fine dyed flannels. On the Continent, also, a substitute for flannel is made of the fibre of the leaf-needles of the Scotch Fir (see FIBROUS SUBSTANCES).

Flat, a musical character, shaped thus ♭, which, when placed before a note, lowers that note half a tone. The double flat, ♭♭, lowers a note two semitones. Singing or playing is called flat when the notes are at all below the right pitch.

Flat, a story or floor of a building, especially when fitted up as a separate residence for a family; four, six, or more such dwellings (often only half-floors) being approached by a common stair. This tenement system is much more common in Scotland and on the Continent than in England, though of late years it has been largely adopted in London, both in the richer and in the poorer districts. In New York and other large American towns, besides the older tenement houses, there are more expensive modern flats, often fitted with conveniences unknown in similar houses in Europe.

Flatbush, a former post-village of Kings Co., N. Y., now embraced in the 29th ward of the city of Brooklyn, to which it was annexed in 1894. It is contiguous to Prospect Park.

Flat-fish (*Pleuronectidæ*), an important family of marine bony fishes, in the order Anacanthini, with the body compressed from side to side, and markedly unsymmetrical. The turbot (*Rhombus maximus*), the halibut (*Hippoglossus vulgaris*), the flounder, plaice, and other members of the genus Pleuronectes, and the soles (Solea) are well-known

examples, valuable as food-fishes. There are about three dozen genera and two hundred species. They occur in all seas, and some thrive in fresh water. The adults keep to the bottom, especially on sandy coasts, and come nearer shore in the spring spawning season and during summer. They are all carnivorous. Many of them alter the colour of their exposed upper side in sympathetic and automatic adjustment to the nature of the ground on which they lie concealed. They are all destitute of a swim-bladder, but the most remarkable feature is the asymmetry of the skull, eyes, and musculature. Unlike the gristly skates, which are flattened from above downwards, the Pleuronectidæ are flattened sideways, and swim or rest on one side, either right or left. The under side is virtually uncoloured, the upper side is often markedly pigmented, and bears both the eyes. The young forms, however, are striking contrasts to the adults. They are almost transparent, occur in the open sea, are quite symmetrical, with an eye as usual on either side, and swim vertically. With increasing size the normal structure and habit are lost, the fishes become asymmetrical, and keep to the bottom. While the skull is still gristly and plastic it is twisted, and the lower eye comes to lie beside its fellow on the upper surface. The exact mechanism is not yet clear. See FISHES, FLOUNDER, PLAICE, SOLE, TURBOT, &c.

Flatheads, a term officially but incorrectly applied to the Selish Indians, a small tribe dwelling on Clarke's Fork, in Idaho. The men are industrious and willing to learn, and have become good farmers; preferring peace, they nevertheless make brave warriors, but have never fought against the whites. A grammar of their difficult language has been published by Mengarini (New York, 1861). The term Flatheads refers to the very ancient practice of flattening the skulls of young infants by various mechanical means, such as was prevalent in Peru, both before and after the arrival of the Incas, among the Caribs in Central America and Mexico, in Florida, and among the mound-builders of the Ohio and Mississippi valleys. Among modern Indians it is mostly confined to the Chinooks (q.v.) and other tribes of the north-west coast of North America.

Flattery, CAPE, a headland of Washington state, U.S., washed on the NE. by the Strait of Juan de Fuca, and on the SW. by the Pacific.

Flatulence, distension of the stomach or bowels by the gases formed during digestion. See INDIGESTION.

Flaubert, GUSTAVE, who is considered by competent judges the most remarkable French novelist of the second half of the 19th century, was born at Rouen on the 12th December 1821. He was the son of a physician of eminence, and inherited, though not wealth, a fortune sufficient to enable him to choose his own way of life. He hesitated long between his father's profession and literature; and in literature he began with poetry, which, however, he definitely gave up before long for prose. Flaubert's life was extremely uneventful in outward incident, the turning-point of it being, according to his intimate friend M. Maxime du Camp (whose account, though traversed by some of Flaubert's other friends, seems to be accurate in the main), the access when he was still a young man of some obscure form of brain-disease, which altered, and even to some extent arrested, his intellectual development. M. du Camp goes so far as to hold that almost all the original part of Flaubert's work was conceived, if not actually sketched, before this time. But however this may be, Flaubert was a very late producer, and his work, when it did appear, was marked by a very strong and somewhat morbid idiosyncrasy. He had comparatively early (before 1849) written some fragments of a work only completed much later on the Temptation of St Anthony, but his first published book was the famous novel of *Madame Bovary*, which appeared in 1857. This is the history of a girl of some education, with strong aspirations after elegance of life and depth of passion, whose fate condemns her to live in the country as the wife of a well-intentioned but utterly stupid and commonplace doctor. Her successive lapses into vice, her desertion by each of her lovers, her extravagance, and her final suicide form the central part of a story, the outline of which is filled up by a series of the most wonderful studies of scene and character, charged with satiric melancholy, and expressed in an extraordinarily careful and vivid style. Style, indeed, was the object of Flaubert's main devotion, and as he advanced in years he for the most part shut himself up in his small country-house near Rouen to wrestle, as his own favourite phrase expressed it, with the language which was to clothe his thought. Although *Madame Bovary* is not constructed according to English ideas of decorum, its license in that respect does not exceed what had long been common in French, and the author was most indignantly surprised at its prosecution as an offence against morals, a prosecution which did not succeed. His second work, *Salammbô* (1862), dealt with the last struggle of Rome and Carthage. The author had taken immense pains to study the locality and all the authorities; and he put into his book in consequence an amount of archæological detail and local colour which sometimes seems to overweight the story. *Salammbô* is moreover deeply tinged with the sombre horror which was one of Flaubert's notes.

In 1866 Flaubert was decorated with the Legion of Honour. Three years later *L'Éducation Sentimentale*, a much longer book, appeared, but was far less popular. No book of Flaubert's displays more accurate observation of life, but the absence of central interest and the disheartening effect of a mere succession of disillusions undergone by the hero make it a book for few. In 1874 appeared the splendid phantasmagoria of *La Tentation de St-Antoine*, worked up from the early fragments already referred to, and the masterpiece of its kind; while in the same year the author produced a play, *Le Candidat*, with little success, and of no merit. In 1877 there followed his last book (exclusive of posthumous work), *Trois Contes*, which represents all his best manners; the first tale, on the daughter of Herodias, being a *Salammbô* in little, *Un Cœur Simple* displaying all the power of *Madame Bovary* with a perfectly harmless subject, and *St-Julien l'Hospitalier* being in the same vein as the *Tentation*, with the addition of something like a central thread of interest. Flaubert died on May 9, 1880, and after his death appeared a novel, *Bouvard et Pécuchet*, which had not received his final revision, and which is somewhat undigested. It tells of the attempts of two retired men of the middle class to interest themselves in literary and scientific researches. There has been published (also posthumously) an extremely interesting correspondence with George Sand; and other letters throwing much light on Flaubert's character have followed. In his last years he was a member of a small set of distinguished writers (the other three being the great Russian novelist Turgenieff, M. Daudet, and M. Zola), who frequently met, and who acquired the reputation as of a sort of headquarters-staff of what has been successively called realism and naturalism in fiction. Flaubert, however, never belonged to either of these schools, least of all to

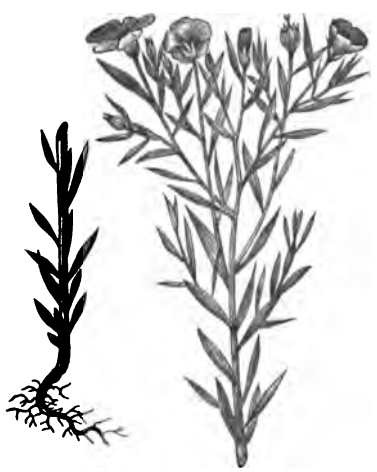
that of naturalism. His minute and exhaustive description was indeed a point in common with both; but this description was always subordinated to a strictly romantic conception of the general scheme of story-telling. Flaubert was in fact a pure romanticist who came late and had engrafted on the earlier romanticism not a few characteristics rather inherited than borrowed from Balzac on the one hand, and Stendhal on the other. It is improbable that any more remarkable examples of this combined mode will ever be created than *Madame Bovary* and *Salammbô*, each in its kind, though from the mere fact of the combination it follows that some readers will fix their attention most on the realism, others on the romance. A splendid 'édition définitive' of Flaubert's works was issued in 8 vols. (1885).

Flavel, JOHN, an English Nonconformist divine, born at Bromsgrove in Worcestershire, most probably in 1630, was educated at University College, Oxford, took Presbyterian orders in 1650, and had already held livings at Diptford (in Devon) and Dartmouth, when he was ejected by the Act of Uniformity of 1662. He continued to preach privately at Dartmouth, and after the Declaration of Indulgence (1687) was minister of a Nonconformist church there till his death at Exeter, 26th June 1691. He was four times married. His writings were long popular, and do not entirely deserve the neglect into which they have fallen. His best books are the *Treatise on the Soul of Man*, *The Method of Grace*, *A Token for Mourners*, and *Husbandry Spiritualised*. An edition in 6 vols. was issued in 1820.

Flavian Cæsars were Vespasian (q.v., Titus Flavius Vespasianus) and his sons and successors, Titus and Domitian.

Flavine, a concentrated preparation of quercitron bark imported from America. Until recently it was an important yellow dye, but cheaper colouring materials are now being substituted for it. See DYEING.

Flax (*Linum*), the typical genus of Linaceæ, a sub-order of Geraniaceæ, consisting of about 140 species of annual and perennial herbaceous plants, with a few small shrubs, all inhabitants of temperate climates, most abundant in Europe and northern Africa. Some are cultivated as showy



Common Flax (*Linum usitatissimum*).

garden annuals—e.g. *Linum grandiflorum*, &c., while the allied *Radiola millegrana* (Allseed) is the smallest of our phanerogamic weeds. *L. catharticum*, an annual weed, is the Purging Flax, long a standard resource of domestic medicine. But all essential interests centre round the Common Lint or Flax, well named by Linnæus *L. usitatissimum*, since in its importance for civilised man it rivals the staple food plants. There are two main varieties or sub-species—*vulgare* and *crepitans*, the latter distinguished by its shorter and more branched stems and rather larger leaves, but more easily by its larger capsules, which burst open when ripe with a characteristic sound, so scattering the seed. Though shorter, this yields the finer, softer, and whiter fibre. In both the flower is a loose corymb of beautiful blue flowers. *L. austriacum* is also cultivated in France, *L. maritimum* in southern Europe, and *L. Levisii* in North America, but all yield a coarser fibre. The flax of prehistoric times found in the Swiss pile-dwellings, and in the remains of the stone age in northern Italy, was derived from *L. angustifolium*, as not only the manufactured product but the actual remains of the stems, fruit, and seeds clearly show. The common lint of the Aryan peoples was, however, *L. usitatissimum*, and the occurrence of the name lint with little modification in all European languages is usually interpreted as indicating that its use dates from the remote antiquity of their common home. The same culture is shown by an examination of the mummy-cloths of Egypt, which are always of linen: and the species is also recognisably delineated upon the walls of the tombs.

The quantity of flax produced in Great Britain, once large, has steadily decreased, and is now quite inconsiderable; but the flax grown in Ireland is still an important crop. While in Scotland and England the total area under flax was in 1888 but 2208 acres, in Ireland there were in that year 113,586 (as against 108,147 in 1885, and 95,935 in 1883). The crop of Ireland produced 3,937,259 tons of flax in 1883, and 4,156,095 in 1885. But by far the most important producing country is Russia, which mainly supplies the manufactories of Britain, as well as in large measure those of Germany. The acreage in flax in Russia in 1881–85 was above 1,950,000 acres; Germany had about 260,000 acres; France only 126,000. In the United States flax was grown as early as 1626; bounties for its production in Virginia were given in the middle of the 17th century, and the British parliament made grants to the patentees of Georgia in the middle of the 18th century. Manufactories of sailcloth were established at Salem and Springfield in 1790. In 1880 the American crop of flax produced 7,170,951 bushels of seed, and 1,565,546 lb. of fibre.

For an account of the mode of preparation of its bast as a textile fibre, see below; for processes of manufacture, see LINEN; and for a description of the useful applications of its seed, see LINSEED, OILCAKE, OILS.

FLAX-DRESSING.—Growing stems of flax are not cut by scythe or reaping-machine, but pulled up by the roots. The best time for doing this is when the stalks begin to turn yellow at the base, and the seeds begin to change from green to a pale brown. A heavier crop is obtained when the plant is riper, but the quality of the fibre is injured. It is of importance that the stems of equal length should be separated, uniformity in this respect simplifying the dressing processes.

Rippling, the process of removing the seeds, follows the harvesting. The ripple, or rippling-comb, consists of a row of round iron teeth set in a wooden frame which is fixed to a plank. In length the teeth are about 18 inches, and at the pointed tops they are about half an inch apart. The rippler, taking up a bundle of flax, spreads out the tops like a fan, and generally draws first the one half of it and then the other through the teeth, a sheet being placed on the ground to receive the seeds or bolls as they fall. One or two machines

have been introduced for rippling flax. One of these removes the seeds by passing the stems between two cast-iron cylinders. Another performs the operation by means of beaters which loosen the seeds, and shakers which then shake them out of the bundles of flax-straw.

Retting is the name given to the next process in the treatment of the stems of flax. Its object is to facilitate the separation of the useful fibre from the boon or woody part of the stem through the removal, by fermentation, of the gummy or resinous matters present in the plant. This is done either by dew-retting or by water-retting with or without the aid of heat. Dew-retting consists in spreading the flax on the grass, and exposing it to the influence of dew, rain, air, and light for a considerable time. It is a method practised in Russia, and produces a soft and silky fibre. Water-retting or steeping is the plan most generally followed. Soft water is essential, and the dam or pond should not be more than four feet deep. In this the flax bundles or 'beets' are placed in rows, roots downwards, and then covered with weeds or straw weighted with boards and stones, or with turf and stones, to keep the flax below the water. If the weather is warm fermentation begins soon, a change which causes the flax to rise in the water, and it must then be more heavily weighted. The flax sinks again as the fermentation slackens, the extra weight being then removed. Great judgment is required to determine when the retting has proceeded far enough. The stems are examined with much care, and if one finds on breaking them at one or two places, or twisting them in the middle in opposite directions, that the woody core called 'shore' or 'shive' separates freely from the fibre, the flax is ready for removal from the pond. From ten to fourteen days are required for the process with water at ordinary temperatures. The smell that accompanies the process is most offensive, and water in which flax has been steeped is valuable as a liquid manure.

A quicker process of retting, in which water at a temperature of 75° to 90° F. is used, was introduced by an American, R. B. Schenck, in 1847. Wooden vats are employed, and the fermentation goes on so much more rapidly that the time of steeping is reduced to from 50 to 60 hours. By another invention (Pownall's) the flax is passed between heavy rollers after it is taken from the vats, clean water being kept flowing over the stems during the operation to remove the gummy matters. Schenck's method is not much favoured now.

Grassing follows the ordinary retting process. The flax stems are spread in rows of thin layers upon short grass for a few days, during which time they are sometimes turned with a pole; but if this is not done, the tips of the stems of one row should overlap the root ends of the next. The flax is lifted when it is found that a slight rubbing suffices to separate the woody core from the fibre.

Breaking.—After the retted stems are dried they undergo 'breaking' to prepare them for the scutching process. One simple and efficient machine for breaking consists of two pairs of horizontal fluted rollers—one pair having finer flutes than the other—mounted in a frame, and turned by the necessary gearing. There is also a feed-table. In passing between the rollers the brittle woody parts of the stems are broken throughout their length. Later breaking-machines have more numerous fluted rollers, some of which have a reciprocating motion. The more efficiently the breaking is performed the less will be the amount of scutching required.

Scutching.—The woody matter of the flax stems being broken up and ready to be separated from the fibrous portion, this is done either by hand-scutching or, as is chiefly now the case, by scutching-machines. In the hand-process the flax is hung up in such a position that it can be struck repeatedly with the blade of a scutching-knife, so as entirely to remove the woody portion. In scutching-mills—which are usually driven by water-power—the scutching is performed by a series of vertical wheels, on each of which are mounted a few wooden blades projecting considerably beyond the rim. These blades take the place of the scutching-knife, and work against wedge-shaped projections in a partition, striking the flax in the direction of its length, a workman sliding the 'broken' flax gradually forward as the scutching proceeds. Besides this arm-scutch in scutching-mills there are scutching-machines of more elaborate construction used in the dressing of flax. Brushing-machines are sometimes employed to give the flax a final cleaning before baling it for the market. For the manufacture of flax into cloth, see LINEN, and SPINNING.

Flax, NEW ZEALAND, a valuable fibre quite different from common flax, and obtained from the leaf of a monocotyledonous, instead of the stem of a dicotyledonous plant. The plant yielding it is *Phormium tenax*, often called New Zealand Flax, and sometimes Flax Lily and Flax Bush (Harakeke of Maoris). It belongs to the order Liliaceæ, and is an evergreen growing wild over large areas, and very easily cultivated, even upon the poorest soils; it has also been introduced into southern France and Dalmatia, and is familiar in colder climates as

New Zealand Flax (*Phormium tenax*):
a, inflorescence; *b*, separate flowers, enlarged.

a decorative plant in greenhouses and sheltered gardens. Its leaves resemble those of an Iris, and are from two to six feet long and one to two or three inches broad. The flowers are produced in a tall branched panicle, and are numerous, brownish-yellow, and not very beautiful; the fruit is a three-cornered capsule, with numerous compressed jet-black seeds. The fibre of the leaves is both very fine and very strong, and was used by the New Zealanders, before their country was discovered by Europeans, for making dresses, ropes, twine, mats, cloth, &c. New Zealand flax is imported into Britain for making twine, ropes, sailcloth, and other uses to which its strength and durability alike well adapt it. To obtain the fibre the leaves are cut thrice yearly, and the fibre is easily separated by maceration. But the New Zealanders procure the fibre in its greatest perfection, very long and slender, shining

like silk, by a more laborious process, and without maceration, removing the epidermis from the leaf when newly cut, separating the fibres by the thumb-nails, and then more perfectly by a comb. The root-stocks are bitter and purgative, and have been used as a substitute for sarsaparilla. The leaves, when cut near the root, exude a viscid juice, which becomes thick and gummy, and is then eaten; the New Zealanders prepare a sweet beverage from the flowers.

Flaxman, JOHN, R.A., sculptor, was born at York, 6th July 1755. His father, a moulder of plaster figures, removed to London when his son was six months old; and the delicate, slightly-deformed child, confined to home-pleasures and stimulated by the works of art which surrounded him, soon developed a taste for drawing. Seated in his little chair behind the counter, with his crutches by his side, he attracted the attention of some of his father's customers. The Rev. Mr Mathew found him attempting to teach himself Latin, and forthwith befriended him, introducing him to his cultured and refined home-circle, where his wife read Homer and Virgil to the boy. At the age of ten his health greatly improved, and he devoted himself to art. In 1767 and 1769 he exhibited models at the Free Society of Artists, and in the latter year he was admitted a student of the Royal Academy, whose silver medal he won in 1770, when he began to contribute to its exhibitions. From this period he was constantly engaged upon works of sculpture; but patronage was long of coming, and from 1775 till 1787 his chief source of income was the Messrs Wedgwood, whom he furnished with exquisite designs and decorations for their pottery, work for which he was admirably fitted by his unrivalled skill in modelling in relief. In 1782 he quitted the parental roof, established himself in a small house and studio in Wardour Street, and married Ann Denham, a cultivated and estimable woman, who was his true helpmate for thirty-eight years. He now began to be employed upon monumental sculpture, into which he infused much of pathos and of grace. Among his works of this class may be named his monument to Chatterton, in St Mary Redcliffe, Bristol; to Collins, in Chichester Cathedral; to Mrs Morley, in Gloucester Cathedral; and to the memory of Miss Cromwell. By 1787 he had gained enough by his art to warrant a visit to Italy, and, accompanied by his wife, he proceeded to Rome, and studied there for seven years. During this period he executed a group of Cephalus and Aurora; his ill-remunerated group of 'The Fury of Athamas,' from Ovid; and his restoration of the Hercules torso; and began his great series of designs to the *Iliad* and the *Odyssey* (published 1793), to Æschylus (1795), and to Dante's *Divina Commedia* (1797), which were engraved in Rome by Piroli, under his own supervision, and widely extended his fame. They were followed by his designs to Hesiod, engraved by Blake in 1817. Returning to England in 1794, he occupied himself upon his fine monument to Lord Mansfield, in Westminster Abbey. In 1797 he was elected A.R.A., in 1800 R.A., and in 1810 he became professor of Sculpture to the Royal Academy. His lectures, which were collected in a volume in 1829, are judicious and well considered, but somewhat wanting in lightness, point, and charm of style. Among the works of his later life are his monuments to Sir Joshua Reynolds, to Lord Howe, and to Lord Nelson; 'Michael and Satan,' his most important example of ideal sculpture, executed for Lord Egremont; and his drawings and model for his great 'Shield of Achilles,' completed in 1818. He died 7th December 1826, and was buried in the church of St Giles-in-the-Fields, London.

Personally Flaxman was a man of extreme gentleness, modesty, and courtesy; simple and abstemious in his tastes; devout in spirit, a follower of Swedenborg. As an artist he ranks at the very head of English sculptors on account of his inventive power and felicity, and of the purity, grace, and sweetness of his style. Never has the beauty of Greek sculpture found a more perfect embodiment and reutterance in modern work. Occasionally, however, his productions are wanting in force and strength, and he was unequal to the suggestion of strenuous motion, or to the portrayal of the intenser passions. He was more skilful as a modeller than as a sculptor in marble, and more successful in bas-relief than in his treatment of the round. But, indeed, the simple and exquisite grace of his design is often seen most completely in the slighter of his pencil sketches in outline, which, along with his other works, may be studied in the Flaxman Gallery, founded by his wife's sister, his adopted daughter, in University College, London. See Allan Cunningham's *Lives of the Most Eminent British Painters, Sculptors, and Architects*, vol. iii. (1830); and Professor S. Colvin, *The Drawings of Flaxman in Thirty-two Plates, with Descriptions and an Essay on his Life and Genius* (fol. 1876).

Flea, a name applicable to any member of the small order Siphonaptera or Aphaniptera, of which *Pulex irritans* is a familiar example. They are wingless insects, probably related to flies; with saw-like, biting jaws (mandibles); with other mouth-appendages (labial palps) adapted for sucking; with legless, biting, maggot larvæ. The compressed shape of the body, the long, powerful, bristly legs, which are able to take such relatively gigantic leaps, and the abdomen with eight rings bearing bristles may be readily perceived on the common species; while microscopic examination will show the biting and sucking mouth-appendages, the small eyes and minute antennæ, and two pairs of little bristly scales, like remnants of wings, on the second and third segments of the thorax. The eggs, usually not numerous, are laid in safe corners, or in the fur, feathers, &c. of the animal infested; the hatching is rapid (six to twelve days), and bristly, footless larvæ emerge; after a few (eleven) days' voracity these form cocoons, and so rest in pupa quiescence for variable periods. In summer the entire development of *Pulex irritans* occupies about a month. The fleas

Metamorphoses of Common Flea (*Pulex irritans*), magnified:
a, larva; b, pupa or nymph; c, perfect insect.

are all ectoparasitic on warm-blooded animals, and the numerous species are more or less rigidly confined to diverse furred and feathered hosts. The common flea (*Pulex irritans*) is sometimes regarded as the only species of the genus Pulex, and the others are ranked as species of Ceratopsyllus, &c.; but this seems rather in honour of man as being the host of the first-named flea than from any real difference. It seems probable that the flea of the dog is an intermediate host of a tapeworm common in that animal. The muscular energy of these pests has

been utilised in 'flea-exhibitions,' in which tamed captives drag miniature carriages, and perform similar exercises. As regards their leaping powers, Kirby and Spence have the following note: 'Aristophanes, in order to make the great and good Athenian philosopher, Socrates, appear ridiculous, represents him as having measured the leap of a flea. In our better times scientific men have done this without being laughed at for it, and have ascertained that, comparatively, it equalled that of the locust, being also two hundred times its (the flea's) length.' Where fleas prevail in spite of cleanliness, recourse may be had to insecticide preparations, the modern substitutes for the old-fashioned fleabane and wormwood. According to Tusser, 'where chamber is swept and wormwood is strown, no flea for his life dare abide to be known.' The more formidable Chigoe (q.v.) or Jigger is separately noticed. See Frank Buckland, *Curiosities of Natural History;* Taschenberg, *Die Flöhe* (1880); W. A. L. Philopsyllus, *Der Floh, von literarischer und naturwissenschaftlicher Seite beleuchtet* (1880).

Fleabane (*Pulicaria*), a genus of Compositæ (sub-order Tubulifloræ, family Inuleæ), readily recognised by a peculiar aromatic smell, sometimes compared to that of soap, which is said to be efficacious in driving away fleas. There are two British species, *P. vulgaris* and *P. dysenterica*, and the latter has a considerable reputation in diarrhœa and dysentery. *Conyza squarrosa*, also called fleabane, belongs to a closely allied genus.

Flèche, in French, a spire generally, is also used specially for the slender spire that sometimes rises from the intersection of the nave and transepts of large churches. A good illustration will be seen in the picture of Cologne Cathedral given in Vol. III. p. 353.

Flèche, LA, a town of France, in the department of Sarthe, on the Loir, 60 miles NW. of Tours by rail. It has manufactures of paper, oil, leather, and timber, and since 1764 has been the seat of a famous military school (*Prytanée*), founded in 1607 as a Jesuit college, where Eugene of Savoy and Descartes were educated. Here, too, are the heart and a statue (1857) of Henri IV.; and here David Hume spent three years (1734–37). Pop. 7977.

Flecknoe, RICHARD, an Irish Roman Catholic priest and playwright, who after some ten years' travels in Europe, Asia, Africa, and Brazil (1640–50) came to London, mingled in the wars of the wits, wrote several plays, all of which are now forgotten, and died about 1678. His name is now remembered only as that of the stalking-horse over whom Dryden applied the merciless lash of his satire to Shadwell, the most virulent of his literary assailants. His famous satire, entitled *Mac Flecknoe*, is partly the model of Pope's more famous *Dunciad*. Flecknoe is represented as seeking for a successor to the throne over the realms of nonsense, on which he had long sat supreme, and as having fixed on Shadwell as the one of all his sons best fitted for it.

Fleet (that which floats), a collection of ships, whether of war or commerce, for one object or for one destination. 'Division' and 'squadron' are portions of a fleet. In the royal navy of Great Britain a fleet is ordinarily the command of an admiral or vice-admiral, and should, strictly speaking, consist of ten ships or more of the first class, with an appropriate number of cruisers, sloops, gun-vessels, torpedo-boats. Great Britain maintains a fleet in the Channel and another in the Mediterranean; whilst the number of her war-ships in the West Indies, India and China, and the Pacific enables these squadrons to assume the dimensions of a fleet by very trifling additions from other quarters.

Fleet Prison, a celebrated London gaol, which stood on the east side of Farringdon Street, on what was formerly called Fleet Market. The keeper of it was called the Warden of the Fleet. It derived its name from the Fleet rivulet (A.S. *fleót*, 'a bay;' afterwards applied to any shallow stream where small craft could float), which flowed into the Thames. The Fleet was the king's prison so far back as the 12th century. In the 16th century it acquired a high historical interest from its having been the prison of the religious martyrs of the reigns of Mary and Elizabeth; and the victims of the Star Chamber were confined here in the reign of Charles I., and numbers of Puritans in that of his son. Afterwards it became a place of confinement for debtors and persons committed for contempt from the Courts of Chancery, Exchequer, and Common Pleas. During the 18th century it was the scene of every kind of atrocity and brutality, from the extortion of the keepers and the custom of allowing the warden to underlet it. The Fleet was several times rebuilt; the last building was erected after the burning of the older one in the Gordon riots of 1780, the predecessor of which had been destroyed in the great fire of London in 1666. In 1776 Howard found here 243 prisoners, their wives and children numbering 475; there were also 78 outdoor *détenus* for debt, privileged to live within the 'rules.' In 1830–34 the annual number confined in the Fleet for debt ranged from 700 to 884. The prison was abolished in 1842, and the debtors transferred to the Queen's Bench, under the new name of the Queen's Prison. The buildings were demolished in 1845–46, and part of the site is now occupied by the Congregational Memorial Hall.

FLEET MARRIAGES.—The practice of contracting clandestine marriages was very prevalent in England before the passing of the first marriage act (see MARRIAGE). The chapels at the Savoy and at May Fair, in London, were long noted for the performance of these marriages; but no other place was equal in notoriety for this infamous traffic to the Fleet Prison. The first notice of a Fleet marriage is in 1613, and the first entry in a register is in 1674. Up to this time it does not appear that the marriages contracted at the Fleet were clandestine; but in the latter year, an order having been issued by the ecclesiastical commissioners against the performance of clandestine marriages in the Savoy and May Fair, the Fleet at once became the favourite resort for those who desired to effect a secret marriage. At first the ceremony was performed in the chapel in the Fleet, but by 10 Anne, chap. 19, sect. 176, marriages in chapels without banns were prohibited under certain penalties, and from this time rooms were fitted up in the taverns and the houses of the Fleet parsons for the purpose of performing the ceremony. Mr Besant's romance gives a vivid description of the persons who celebrated these marriages—real or pretended clergymen of the Church of England, who had been consigned for debt to the prison of the Fleet, and who shamelessly employed touters to bring to them such persons as required their office. The sums paid for a marriage varied, according to the rank of the parties, from half-a-crown to a large fee. During the time that this iniquitous traffic was at its height every species of enormity was practised. Young ladies were compelled to marry against their will; young men were decoyed into a union with the most infamous characters; and persons in shoals resorted to the parsons to be united in bonds which they had no intention should bind them. Registers of the marriages were kept by the various parties who officiated; a collection of these books, purchased by government in 1821, is deposited at Somerset House. In 1840 they were declared inadmissible as evidence in a court of law.

Various ineffectual attempts were made to stop the practice by acts of parliament, and at length, the nuisance having become intolerable, in 1753 an act was passed which struck at the root of the matter by declaring that all marriages, except in Scotland, solemnised otherwise than in a church or public chapel, where banns have been published, unless by special license, should be utterly void. The public, however, were unwilling to surrender their privilege, and on the 26th March 1754, the day before the act came into operation, there were no less than 217 marriages entered in one register alone. See Burn's *History of Fleet Marriages* (1833), and Ashton, *The Fleet: its River, Prison, and Marriages* (1888).

Fleetwood, or FLEETWOOD-ON-WYRE, a modern seaport and military station of Lancashire, at the mouth of the Wyre, 21 miles NW. of Preston by rail. Founded in 1836, it has an excellent harbour, and is a favourite resort for sea-bathing. A new dock was opened in 1877. Steamers ply daily to and from Belfast, and there is a regular service to the Isle of Man. Within the town is a lighthouse, the light, 90 feet high, being visible for 13 miles. Rossall School (q.v.) is two miles to the south-west. Pop. (1851) 3121; (1891) 9274.

Flegel, EDUARD ROBERT, born of German parentage at Wilna, in Russia, 13th October 1855, made it the principal object of his life to acquire for Germany the preponderating share of the commerce of the Niger. His first ascent of this river was made in 1879, in the steamer of the London Missionary Society, and his second a year later, when he reached Sokoto by a left-hand tributary of the river. But his next journey, in 1883, was the most fruitful in results, for during the course of it he discovered the sources of the Benuë, to the south of Adamawa. After a short visit to Europe, he again started for Africa in April 1885, having been commissioned by the German African Society and Colonial Company to explore the country stretching between the sources of the Benuë and the Cameroons; it was also his intention to penetrate from the Benuë to the Congo, but he was suddenly struck down by death, near the mouth of the Niger, on 11th September 1886.

Fleischer, HEINRICH LEBERECHT, Orientalist, was born at Schandau, in Saxony, 21st February 1801. Having studied theology and oriental languages at Leipzig, he was for some years after 1828 engaged in cataloguing the oriental MSS. in the royal library at Dresden, the catalogue being published at Leipzig in 1831–34. After acting for five years as teacher in a school at Dresden, Fleischer was appointed professor of Oriental Languages at Leipzig in 1836. He edited Abulfeda's *Historia Moslemica* (1831–34), the continuation of Habicht's edition of the original of the *Thousand and One Nights* (vols. ix.–xii. 1842–43), Ali's *Hundred Sayings* (1837), Baidhavi's *Commentary to the Koran* (1846–48), and wrote an account of the Arabic, Persian, and Turkish MSS. in the town library of Leipzig, printed in Naumann's *Catalogue* (1838); also a *Critical Dissertation on Habicht's Glosses to the First Four Volumes of the Thousand and One Nights* (1836). He died 10th February 1888.

Fleming, JOHN, naturalist, born near Bathgate, Linlithgowshire, in 1785, entered the ministry, was professor of Natural Philosophy at Aberdeen, 1832–43, and filled the chair of Natural Science in the New College, Edinburgh, from 1845 till his death in 1857. His works include the *Philosophy of Zoology* (2 vols. 1822), a *History of British Animals* (1828), and *Molluscous Animals* (1837).

Fleming, PAUL, one of the best German poets of the 17th century, was born 5th October 1609, at Hartenstein, in Vogtland. He studied medicine at Leipzig, and accompanied embassies sent by the Duke of Holstein to Russia and to Persia. He returned in 1639, married, and resolved to settle as a physician in Hamburg, but died there, 2d April 1640. Fleming stands at the head of the German lyric poets of the 17th century. His *Geistliche und weltliche Poemata* (1642) contain many exquisite love-songs, which for more than a century remained unequalled in finish and sweetness. Others are full of glowing enthusiasm, ardent patriotism, and manly vigour, while his sonnets are marked by strength and thorough originality. The most complete collection is that of Lappenberg (2 vols. 1866), who had already edited his Latin poems in 1863.

Flemish Language and Literature. See HOLLAND (LITERATURE OF).

Flensborg, a shipping-town in the Prussian province of Sleswick-Holstein, at the extremity of Flensborg fjord, an inlet of the Baltic, 19 miles N. of the town of Sleswick. Its principal industrial establishments embrace iron and machine works, copper and zinc factories, shipbuilding-yards, brick, cement, and lime works, and breweries; fishing and fish-curing are also carried on. Along with Sleswick-Holstein, Flensborg passed from Denmark to Prussia in 1864. Pop. (1875) 26,525; (1885) 33,094; (1890) 36,894.

Flers, a town of France, in the department of Orne, 41 miles S. of Caen by rail. It has large spinning, bleaching, and dyeing establishments, and is the centre of a busy manufacturing district, where linen and cotton goods, especially fustian and tickings, are produced. It contains an old castle, which was burned down in the Chouan war, but since restored. Pop. (1872) 8011; (1886) 11,257; (1891) 11,364.

Flesh. While in common parlance the term flesh is applied to those parts of the body composed of muscular tissue (see MUSCLE), it is now, in physiological language, used as a term including all the living protoplasmic matter of the body which has a chemical composition closely resembling that of muscle. This use of the word (*Fleisch*) we owe chiefly to the Munich school of physiologists, who have done so much to advance our knowledge of the chemical changes in the tissues. In such investigations the terms loss of 'flesh,' gain of 'flesh,' &c. are to be understood in this inclusive sense.

This flesh has something of the following composition:

Water	75	per cent.
Solids	25	"
Inorganic	1	"
Organic	24	"
Proteids	16–19	"
(Nitrogen)	3·4	"

Flesh-fly. See BLUE-BOTTLE FLY.

Fleta, the title of an early treatise on the law of England, presumably written about 1290 by a judge who was confined in the Fleet prison. It consists of six books, the language being Latin. Selden edited it in 1647.

Fletcher, ANDREW, of Salton, a famous Scottish patriot, was born in 1655, the son of Sir Robert Fletcher, himself of English descent, and of Catharine Bruce, whose father, Sir Henry Bruce of Clackmannan, was directly descended from Robert Bruce. His father dying when he was still an infant, he was brought up under the care of the celebrated Gilbert Burnet, and early imbibed his preceptor's passion for political freedom, but not his prudence. After some years of continental travel, he sat in parliament in 1681 as commissioner for his native county, and offered so determined an opposi-

tion to the measures of the Duke of York that he found it necessary to flee to England, and thence to Holland. Here he formed fast friendship with the refugee English patriots, and on his return to England in 1683 shared the counsels of Russell, Essex, Howard, Algernon Sidney, and John Hampden, the greater patriot's grandson. Though a republican, Fletcher was very far from being a modern democrat, for one of his favourite schemes was to utilise the hosts of vagrants and paupers of the time like the slaves of ancient Greece and Rome. On the discovery of the Rye-house Plot, Fletcher fled to Holland, returned as a volunteer with Monmouth, but was obliged almost at once to leave the army for having shot the mayor of Lyme in a personal quarrel about a horse. He now fled to Spain, but had no sooner landed at Bilbao than, at the instance of the English ambassador, he was flung into prison, from which he was soon mysteriously delivered by an unknown guide. In disguise he passed through Spain, not without further more than romantic adventures, in Hungary distinguished himself greatly as a volunteer against the Turks, and returned to Scotland at the revolution. He was the first patron of William Paterson, the founder of the Bank of England and projector of the Darien expedition, and it was the bitterness caused in Scotland by the base treatment the unfortunate Darien colonists received from King William's government that gave Fletcher and the nationalist party their strength in the struggle against the inevitable union with England. His famous 'limitations' aimed at constructing a federative instead of an incorporating union—a frail structure that would have borne neither the burden of recent irritation nor the weight of ancient hatreds. Fletcher's orations in the Scottish parliament still glow with eloquence, and carry the stamp of genuine sincerity, but the modern reader has feelings other than admiration for a statesman whose eyes were too much blinded by prejudice to recognise that the only salvation for a country distracted by intestine jealousies and hopelessly corrupt domestic government lay through incorporation with the larger and healthier life of the great southern kingdom. After the consummation of the union, Fletcher retired in disgust from public life, devoting himself to promoting agriculture. His fanners for winnowing corn and his mill for making *pot*-barley were better gifts to his country than all his speeches. He died at London in the September of 1716. His writings were collected and reprinted at London in 1737. Fletcher is described as follows by a contemporary pen: 'He is a low, thin man, of a brown complexion, full of fire, with a stern, sour look; of nice honour, with abundance of learning, brave as the sword he wears, a sure friend and an irreconcilable enemy, would lose his life readily to serve his country, and would not do a base thing to save it. His thoughts are large as to religion, and not such as can be brought within the bounds of any particular set, and his notions of government are too fine-spun, and can hardly be lived up to by men subject to the common frailties of nature.' Fletcher of Salton's name survives popularly only in the famous but usually misquoted saying, in his *Account of a Conversation concerning a Right Regulation of Government for the Common Good of Mankind:* 'I knew a very wise man, so much of Sir Christopher's sentiment, that he believed if a man were permitted to make all the ballads, he need not care who should make the laws of a nation.'

Fletcher, GILES and PHINEAS, poets, were cousins of Fletcher the dramatist, and sons of Giles Fletcher, LL.D. (1549–1611), himself a poet and writer on Russia, and Queen Elizabeth's minister in negotiations in Germany and at the court of Russia.—GILES, the younger of the two brothers, was born about 1588, was educated at Trinity College, Cambridge, and died at his living at Alderton, in Suffolk, in 1623. Fuller tells us that his 'clownish low-parted parishioners, having nothing but their shoes high about them, valued not their pastor according to his worth, which disposed him to melancholy and hastened his dissolution.' His chief poetical work is a sacred poem, entitled *Christ's Victory and Triumph in Heaven and Earth over and after Death*, published at Cambridge in 1610. It is full of splendid versification and imagery, and is saved from the fatal dullness of most professedly religious poems by a quickening glow of genuine enthusiasm. It is of course based upon Spenser, and most of his distinctive characteristics are imitated and overdone. The metre is original and not entirely successful. Each stanza has eight lines, the last an Alexandrine, rhyming thus: *ababbccc;* and a lyrical interlude occurs here and there. The poem, although once admired, is now unknown to general readers, and is chiefly remarkable for having to some extent influenced the majestic muse of Milton. His poems were edited by Dr Grosart in the 'Fuller Worthies Library' (1868), and in 'Early English Poets' (1876). —PHINEAS was born in 1582, educated at Eton and King's College, Cambridge, and in 1621 became rector of Hilgay, in Norfolk, where he died in 1650. His most important poem, the *Purple Island, or the Isle of Man*, was published in 1633, in twelve cantos of seven-lined stanzas, a regular elegiac quatrain taking the place of the irregular quintett of Giles's poem. It contains an elaborate description of the human body, given with great anatomical minuteness. The body is an island, the bones its foundations, and the veins the streams by which it is watered. The vices and virtues that affect it are similarly allegorised with laborious ingenuity. Although to a large extent formal and pedantic, the *Purple Island* abounds in fine passages, in which the splendour of Spenser and the gravity of Milton are curiously mingled. His poetical works were edited by Dr Grosart in the 'Fuller Worthies Library' (4 vols. 1868).

Fletcher, JOHN (1579–1625). See BEAUMONT AND FLETCHER.

Fleur-de-lis, a heraldic device representing very imperfectly, as Littré says, three flowers of the white lily (Lilium) joined together; though often said to be a representation of the white iris, which is on that hypothesis called Flower-de-luce (q.v.). The Fleur-de-lis, or Fleur-de-lys, came to be the arms of the Bourbons and of France (see FLAG). The three heads of the fleur-de-lis have been said to typify the Trinity.

Fleur-de-lis.

Fleurus, a market-town (pop. 5084) of the Belgian province of Hainault, on the Sambre, 15 miles W. of Namur, has been the scene of three great battles: (1) in 1622, when the Germans, under the Duke of Brunswick and Count Mansfield, defeated the Spaniards; (2) in 1690, when the French, under Luxembourg, routed the allied Germans and Dutch, commanded by the Prince of Waldeck; and (3) in 1794, between the French, under Jourdan, and the Austrians and their allies, under the Duke of Coburg, on which occasion the latter, although he had virtually beaten his antagonist, gave the signal to retreat.

Fleury, or FLORY, in Heraldry, signifies that the object is adorned with fleurs-de-lis; a cross-fleury, for example, is a cross the ends of which are in the form of fleurs-de-lis. See, in article Cross, CROSS IN HERALDRY, &c.

Fleury, ANDRÉ HERCULE DE, CARDINAL, Louis XV.'s prime-minister, was born in 1653, at Lodève, in Languedoc, became in 1677 almoner to the queen, and after her death (1683) filled the same post under Louis XIV., who in 1698 made him Bishop of Fréjus. Under Louis's will he was appointed preceptor to the heir-apparent, a child of five years, who in 1715 succeeded as Louis XV. In 1726, at the age of seventy-three, Fleury was raised by the young king to be prime-minister; in the same year he received the cardinal's hat. Fleury was honest and well meaning, but not a statesman: the extortions of the farmers-general were not checked, although it was probably for the people's sake that the minister practised a rigid economy that approached avarice and even crippled the power of France; whilst in foreign affairs he was earnestly desirous of peace, and yet was dragged by court intrigues into two wars over the succession to foreign thrones (see SUCCESSION WARS). The war of the Austrian Succession was not finished when he died, 29th January 1743, in the ninetieth year of his age, leaving the king thenceforth to the unchecked guidance of his mistresses. Fleury was an academician, and the friend and patron of learning; he sent out two expeditions to measure arcs of the meridian, gathered rare MSS. from Egypt and Greece, and completed the Bibliothèque Royale (now Nationale). See Verlaque, *Histoire du Cardinal Fleury* (Paris, 1879).

Fleury, CLAUDE, church historian, was born at Paris in 1640, and forsook the law for an ecclesiastical career. In 1672 he became tutor to the young Princes de Conti, and at a later period to the Comte de Vermandois, natural son of Louis XIV. After the death of the young count in 1683, the French monarch appointed Fleury abbot of the Cistercian monastery of Loc-Dieu, and afterwards, under Fénelon, tutor to the Dukes of Burgundy, Anjou, and Berri. He was elected to fill La Bruyère's place in the Academy in 1696; and ten years later, on the completion of the prince's education, he was rewarded with the priory of Argenteuil. The Duke of Orleans selected him for confessor to the young king, Louis XV., giving as his reason for so doing that Fleury was neither Jansenist, nor Molinist, nor Ultramontanist, but Catholic. He died 14th July 1723. Fleury was as learned as he was modest, and as mild and kind-hearted as he was simple in his manners and upright in his conduct. Among his numerous works may be mentioned *Mœurs des Israélites* (1681); *Mœurs des Chrétiens* (1662); *Institution du Droit Ecclésiastique* (1687); and, above all, the *Histoire Ecclésiastique* (20 vols. Paris, 1691–1720). On this work, really the first complete and systematic history of the church, its organisation, doctrines, and rites, Fleury laboured thirty years. It is marked by great learning, and, on the whole, by a judiciously critical spirit. The work was translated into many languages, and praised by orthodox and heretics, both for its matter and style. Fleury's own work only reached to 1414; it was continued to 1778 by Fabre, Lacroix, and others.

Flexure is the bending or curving of a line or figure (see CURVE). In building, flexure denotes the bending of loaded beams; see STRENGTH OF MATERIALS.

Fliedner, THEODOR, founder of the Protestant order of Deaconesses (see under Deacon in Vol. III.), was born in Nassau in 1800, and in 1822 became pastor of Kaiserswerth, near Düsseldorf, where in 1836 he founded the first deaconesses' home and a seminary for infant-school teachers, besides other institutions. He died 4th October 1864.

Flies, FISHING. See ANGLING.

Flight. See FLYING.

Flinders, MATTHEW, an English navigator, who surveyed a great portion of the Australian coasts, was born at Donington, in Lincolnshire, 10th March 1774, and in 1790 entered the navy. Going out to Australia in 1795, he determined to investigate the coast south of Port Jackson, about 250 leagues of which were laid down in the charts as 'unknown.' With an equally daring and ambitious young surgeon in his ship, named Bass, he departed on the enterprise in a small decked vessel, with a crew of only six men. Their chief discovery was the strait between Van Diemen's Land (now Tasmania) and the mainland of Australia, which was named after Bass. In 1801 Flinders obtained from the British government the command of a scientific expedition for the investigation of the Australian coasts and their products. Commencing his examination at Cape Leeuwin, Flinders in the course of two years gradually explored the coast to Bass Strait (q.v.), thence northwards—laying down carefully the Great Barrier Reefs—to the Gulf of Carpentaria, which he thoroughly surveyed across to Timor, then back to Cape Leeuwin, and round the south coast to Port Jackson (1803). On his way home he was first wrecked, and then detained a prisoner by the French governor of Mauritius, and not allowed to proceed to England until 1810. He gave the world the result of his explorations in *A Voyage to Terra Australis*, and died July 19, 1814, the day on which his book was published.—The coast of South Australia was long called after him Flinders Land. His name is still attached to the southernmost county in Eyre Peninsula, and to Flinders Island, off that coast; to the Flinders Range in South Australia, rising near the head of Spencer Gulf, and running north (highest peaks, 3100 feet); as also to a small town in Victoria, 61 miles SE. of Melbourne.

Flindersia, a sub-genus of Swietenia (Cedrelaceæ), of which *F.* (*S.*) *senegalensis* and *F. australis* yield timber in their respective countries little inferior to true mahogany (*S. Mahagoni*), and largely imported as African mahogany, Madeira mahogany, or Calcedra wood.

Flint, a mineral which may be regarded as a variety of quartz, allied to chalcedony, consisting almost entirely of silica, with a very little lime, oxide of iron, water, carbon, and sometimes even traces of organic matter. It has a flat shell-like fracture, is translucent or semi-transparent, and varies in colour from a very dark brown, or almost black, to light brown, red, yellow, and grayish-white, and is sometimes veined, clouded, marbled, or spotted. Dark-coloured flints are most common in the chalk, in which principally flint occurs imbedded, forming tabular sheets and nodules of various sizes, sometimes large nodular masses, of irregular and often grotesque shape; but gravel formed of light-coloured flints is very common, and it is disputed whether or not a change of colour has taken place by exposure to atmospheric and other chemical agencies. Flint is sometimes found in beds or veins. It is very abundant wherever the chalk formation extends, in England and other countries; rolled flint nodules are also often found in conglomerate rocks, and in alluvial soils—vast alluvial tracts being sometimes full of them. Flint geodes often contain crystals of quartz. Flint nodules are usually moist in the interior if broken when newly taken from their beds.

Flint is sometimes harder than quartz, sufficiently so to scratch it. The readiness with which it strikes fire with steel is well known, and it would seem that the sparks are not all merely incandescent particles, heated by the friction, but that in some of them a chemical combination of silica and iron

takes place, causing great increase of heat. The use of the flint and steel for igniting tinder, once so common, has been almost superseded by that of lucifer matches, and gun-flints have given place to percussion-caps. The most ancient use of flint was probably for sharp weapons and cutting instruments; and flint knives, axes, arrow-heads, &c. are among the most interesting relics of rude antiquity. In East Anglian churches squared flints have been used for centuries to ornament the porches, towers, buttresses, &c.; but at present the principal use of flint is in the manufacture of fine earthenware, into the composition of which it enters, being for this purpose first calcined, then thrown into cold water, and afterwards powdered.

The origin of flint is a subject of considerable difficulty. Siliceous deposits are sometimes the result of a purely chemical operation, as in the case of the siliceous sinter formed round the geysers of Iceland, from the evaporation of water largely charged with silica. But at the bottom of the sea, as no evaporation could take place, some other agent than springs of water saturated with silex must have supplied the materials. It is a fact of considerable importance in this inquiry that almost all large masses of limestone contain siliceous concretions, or flints. Thus, chert is found in carboniferous and other limestones, and menilite in the tertiary limestones of the Paris basin. The conditions necessary for the deposition of calcareous strata seem to be those required for the formation of siliceous concretions. The materials of both exist in solution in sea-water, and, as it needed the foraminifer, the coral, the brachiopod, and the mollusc to fix the carbonate of lime which formed the chalk deposits, so the silex was secreted by innumerable diatoms and sponges, and their remains most probably supplied the material of the flint. The discovery by Dr Bowerbank and other microscopists of the spicules of sponges and the frustules of diatoms in almost every specimen of flint has clearly shown that flint to a large extent, if not entirely, owes its origin to these minute organisms. After the death of the organisms their silica appears to have been redissolved and redeposited, perhaps through the agency of decomposing animal matter, sometimes in the form of irregular concretions, and sometimes replacing the calcareous skeletons and exuviæ of other organisms.

Flint, a parliamentary borough and seaport in the east of Flintshire, North Wales, on the left side of the estuary of the Dee, 13 miles by rail NW. of Chester. In the vicinity are very extensive alkali-works, besides copper-works, collieries, and lead-mines. Pop. (1851) 3296; (1891) 5247. It unites with Caergwrle, Caerwys, Holywell, Mold, Overton, Rhuddlan, and St Asaph in sending one member to parliament. Flint Castle, built by Edward I., captured by the parliament in 1643, and four years later dismantled, exists in a ruined condition. Here Richard II. surrendered to Bolingbroke, 19th August 1399. See Taylor's *Notes on the History of Flint* (1873).

Flint, a maritime county of North Wales, bounded on the NE. by the river Dee, on the E. by Cheshire, on the S. and W. by Denbighshire, and on the N. by the Irish Sea. The main portion of the county is 26 miles long by 10 to 12 broad, and the detached hundred of Maelor, lying 8 miles SE. of the main part, measures 9 miles by 5. Flintshire is the smallest of the Welsh counties, its area being 289 sq. m. The coast is low and sandy, but along the Dee estuary fertile. The county is bisected by a low range of hills, stretching almost due north. The geological basis consists of rocks of the Carboniferous series. Coal, iron, lead, copper, calamine, zinc, and limestone are the chief mineral products. Some chemical works and potteries of coarse clay give employment. There are numerous well-watered and picturesque valleys, the soil of which is for the most part fertile and well cultivated. The uplands afford good pasturage. The Dee in the east and the Clwyd in the west of the county are the principal rivers. The Chester and Holyhead Railway skirts the east and north shores. Pop. (1801) 39,469; (1881) 80,587; (1891) 77,189. Flintshire returns one member to parliament; its county council consists of fifty-six members. The chief towns are Flint, Mold, St Asaph, Holywell, and Hawarden. Flintshire has traces of Roman lead-mines, and is traversed by Watt's and Offa's Dykes. In the 7th century Saxon invaders massacred all the Christian monks of the monastery of Bangor-iscoed (q.v.). Several barrows and menhirs occur in the county. See D. R. Thomas, *History of the Diocese of St Asaph* (1874).

Flint, capital of Genesee county, Michigan, on the Flint River, 64 miles NNW. of Detroit by rail, with numerous sawmills, and manufactures of beer, flour, bricks, paper, machinery, &c. There is a large state institution for the deaf, dumb, and blind here. Pop. (1884) 9087; (1890) 9803.

Flint, Robert, theologian, was born at Dumfries in 1837, educated at the university of Glasgow, and ordained in 1859 to the East Church, Aberdeen, whence he was transferred in 1861 to the parish of Kilconquhar in Fife. In 1864 he was called to the chair of Moral Philosophy at St Andrews, and in 1876 to that of Divinity at Edinburgh, receiving at the same time the degree of D.D. from the latter. His *Philosophy of History in France and Germany* (vol. i. 1874) established his reputation as a profound thinker and scholar of unusually wide erudition, and procured him the honour of being elected a corresponding member of the French Institute. This was followed in 1876 and 1877 by two series of admirable lectures on the Baird foundation, *Theism* and *Anti-Theistic Theories*, and by a monograph on Vico (1884), in Blackwood's 'Philosophical Classics.'

Flint Glass. See Glass in Vol. V., page 243.

Flint Implements and Weapons of the primitive peoples of prehistoric times are commonly found in the graves or on the sites of settlements of the earlier inhabitants of almost every country in Europe. They also occur not only in the surface soil or *humus* and in peat-bogs, beds of rivers and lakes, but naturally imbedded in such superficial or quaternary deposits as the old terraces of river-valleys. These terraces, which are formed of gravel and sand deposited by the river, are the marginal remains of the old river-bed, which, having been gradually deepened by the erosion of the current, has left here and there portions of the fringes of earlier deposits on the slopes of the valley. Flint implements, however, are not universally distributed through the diluvial drifts; for, while they occur pretty generally over the south-eastern area of England, they have not been found in the northern and western areas, nor in Scotland. Similarly, on the Continent, although they are found somewhat abundantly in the north-western area of France, they do not occur in Denmark, Sweden, or Norway. The types of flint implements found in these river-gravels closely resemble those from the caves of Perigord in France, and from Kent's Cavern and other caves in England. Besides possessing similar typical forms, the flint implements from the river-drifts and caves are in both cases found associated with the remains of animals which either are extinct or are no longer indigenous. For this reason, and also because the flint implements found in these associations are fashioned by chipping alone, they have

been assigned to the earlier part of the Stone Age (q.v.). On the other hand, the flint implements, whether fashioned by chipping alone or finished by grinding and polishing, which are found in the surface soil, or in graves, or in lake-dwellings, &c., and in association with remains of the common domestic animals, are assigned to the later part of the age of stone. The types characteristic of these two divisions being thus distinguished by their form and finish, as well as by their associations, are classified by archæologists as palæolithic and neolithic implements.

The palæolithic implements of rudely chipped flint are reducible to three classes. The first or best finished is an oval, sharp-rimmed implement, with a cutting-edge all round, the second a long, pointed implement, and the third a tongue-shaped implement. They differ from the neolithic types most markedly in this, that they do not obviously reveal their special uses and purposes, and that their conceivable uses or purposes are few in comparison with those so obviously disclosed by the more specialised forms and the more elaborate finish of the neolithic types, which a glance suffices to classify as arrow and spear heads, daggers, knives, saws, borers, scrapers, chisels, axes, &c. Most of the neolithic implements are finely shaped and carefully finished, while some varieties, such as the long thin knife-blades and the handled dagger-blades of Denmark and Sweden, which are finished by chipping only, are perfect marvels of workmanship—so skilfully executed that experienced lapidaries and scientists can only speak of the process of their manufacture as a lost art. No modern savages or barbarous tribes of the historic period have produced anything approaching to the masterpieces of prehistoric flint-working. Flint, from its conchoidal fracture, is the only kind of stone that is capable of being readily worked into a variety of shapes by flaking and chipping, and this is probably the chief reason why the palæolithic implements have been formed almost exclusively of this material. The methods of manufacture appear to have been in all ages pretty much the same, and in general they seem to have been analogous to those employed in the manufacture of gun-flints and strike-lights of flint still carried on at Brandon (q.v.) in Suffolk, the principal differences being that steel tools are now used instead of tools of stone and bone, and that the finer processes of surface chipping and flaking are not now practised. Detailed descriptions of the various processes of flint-working, and of the ancient and modern methods of manufacture, are given in the first part of Mr Evans's work on the *Ancient Stone Implements, &c. of Great Britain* (Lond. 1872); and, for the finer forms of flint implements, see Madsen, *Afbildninger af Danske Oldsager* (Copen. 1869), and Montelius, *Civilisation of Sweden in Heathen Times* (Lond. 1889).

Flintlock. See FIREARMS.

Flint River, in Georgia, U.S., rises about 10 miles S. of Atlanta, and unites, after a southerly course of some 400 miles (of which 150 are navigable for steamboats), with the Chattahoochee, at the south-west angle of the state, to form the Appalachicola (q.v.).

Flintshire. See FLINT.

Flinty Slate is an impure quartz, assuming a slaty structure. It contains about 75 per cent. of silica, the remainder being lime, magnesia, oxide of iron, &c. Its fracture is rather splintery than shell-like. It is more or less translucent. It passes by insensible gradations into clay-slate, with which it is often in most intimate geological connection. Lydian Stone (q.v.) is a variety of flinty slate.

Floating-battery, a hulk heavily armed and made as invulnerable as possible, formerly used in defending harbours or in attacks on marine fortresses. They were used by the French and Spaniards in the memorable siege of Gibraltar (q.v.) in 1779–83, when ten of these vessels, carrying 212 large guns, were brought to bear on the fortress; they had sides of great thickness, and were covered with sloping roofs, to cause the shot striking them to glance off innocuously. But General Eliott succeeded in destroying them with red-hot cannon-balls. Steam floating-batteries of iron were constructed for the war with Russia in 1854, both by the British and French governments; but, notwithstanding that they rendered good service before Kinburn, they have since been discarded. They are interesting as a stage in the development of the modern ironclad.

Floating-docks. See DOCK.

Floating-islands are formed either by the aggregation of driftwood in the creeks and bays of tropical rivers and the deposition thereon of soil and vegetable matter, or by the detachment of portions of a river-bank or lake-shore, on which the interlacing roots of plants constitute a foundation sufficiently strong to support soil whereon herbage, and occasionally even trees, are able to grow. Such islands are sometimes seen 50 or 100 miles distant from the mouth of the large rivers of America, Asia, and Africa. Portions of the alluvial soil from river-deltas, held together by the roots of mangroves and other trees, are sometimes detached by hurricanes or typhoons and then swept out to sea; such islands have been met with in the Philippines, in the seas of the East Indies, and in the Pacific. A floating-island is mentioned by Herodotus as existing in Egypt. Others were known to Roman writers: Seneca speaks of them as being in the Vadimonian, Cutilian, and Stationian lakes in Italy; to these Pliny adds the islands floating on lakes near Cæcubum, Reate, and Modena, and two others in Asia Minor. Those on Lake Vadimona were, according to the Younger Pliny, capable of supporting sheep. Varenius, in the middle of the 17th century, cites a lake in Honduras with floating-islands. Passing over others in Prussia, Italy, and South America, we come to Great Britain, where we find it recorded that Loch Lomond long possessed a floating-island, which has now, however, disappeared or become attached to one of the stationary islands of the loch. In Ireland large masses of peat float about some of the bogs—the Bog of Allen, for instance. In England, in Lake Derwentwater, there is an instance of an island which appears and disappears from time to time in the same spot. Perhaps the most satisfactory of the many theories which have been proposed to account for this phenomenon is that which attributes its rising from the bottom of the lake, where it ordinarily rests, to the permeation of its mass by marsh-gas during hot weather, the upward motion being assisted by the growth of buoyant water-plants on its surface. See Symons, *Floating Island in Derwentwater* (1888).

Between 1696 and 1829, similar islands were observed at irregular intervals, generally, however, after great droughts and violent storms, in Lake Rålang in the Swedish province of Småland. Oceanic floating-islands sometimes perform important service in the transportation of vegetable seeds from place to place, also in the distribution of animal species, by carrying insects, land mollusca, and small mammalia, more rarely reptiles. Darwin met with islands floating on Lake Tagua-Cagua in Chili which passed from side to side of the lake and carried 'cattle and horses as passengers.' Between 1863 and 1881 the rivers of the central

Nile system were rendered almost unnavigable owing to the accumulations of floating vegetable matter getting set fast across the channels, practically forming dams, which in some instances gave rise to serious inundations. The vale of Cashmere contains many lakes, which frequently overflow and drown the surrounding country. This has taught the inhabitants to construct floating-gardens for the cultivation of their vegetables. The gardens are in reality portions of the marshy ground made to float artificially by cutting through the roots of the reeds and other plants about two feet below the surface. The Chinese, too, devote considerable attention to this style of horticulture, but more by way of ornamentation. Floating-gardens, or *chinampas*, also existed in Mexico before the Spanish conquest. Clavigero describes them as formed of wicker-work, the stems of water-plants, and mud, the largest sometimes having on them a tree or a hut. Both flowers and vegetables were grown on them.

Floatstone, a variety of quartz, consisting of fibres—delicate crystals—aggregated so that the whole mass is sponge-like, and so light, owing to the air confined in the interstices, as to float for a while in water. It is found in a limestone of the chalk formation near Paris, in imbedded masses, or incrusting flint nodules.

Flodden, BATTLE OF, fought between James IV. of Scotland and an English army under the Earl of Surrey, September 9, 1513, the most grievous defeat ever Scotland suffered. King James, with 30,000 men, had taken up a strong position on Flodden Hill, one of the east and lowest spurs of the Cheviots, about 6 miles south of Coldstream, and on the morning of the 9th the Earl of Surrey, with 32,000 men, advanced from the south-east, crossed the Till by a skilful movement, and thus cut off all communication between King James and Scotland. James neglected the opportunity of attack while the English were crossing the river, but, seeing that they were aiming at taking up a strong position to the north-west of Flodden Hill, ordered his tents to be set on fire, and advanced to the attack about four o'clock in the afternoon. The Earls of Huntly and Home, who commanded the left wing of the Scottish army, charged the English right, which was led by Sir Edmund Howard, and entirely defeated it, but Home's borderers threw away the advantage of their success by commencing to pillage the baggage of both armies. On the Scottish right the clansmen under Lennox and Argyll, goaded to fury by the English archers, rushed heedless of order upon their opponents, but were routed with great slaughter and put to flight. Meantime a desperate resistance was made by the Scottish centre, where the king fought on foot among his nobles. Night fell upon them still fighting heroically, the ring still unbroken, though within it the king lay dead. The Scots held the hill during the night, but at dawn retreated with a loss of from 5000 to 12,000 men, including the flower at once of bravery and of rank. The Archbishop of St Andrews and as many as twelve earls were among the slain, and long after, indeed, there 'was not a worshipful Scots family that did not own a grave on Brankstone Moor.' The English loss amounted at most to 4000; but Surrey's victory was so nearly a defeat that he was unable to prosecute the war with any vigour. The sixth canto of Sir Walter Scott's *Marmion* contains a splendid and fairly accurate description of the battle. See Robert White, *The Battle of Flodden* (Newcastle, 1859).

Flogging. Corporal punishment, which, in deference to public opinion, was abolished in 1881, had existed from time immemorial in the British army and navy. It was often inflicted upon slight occasion, and with barbarous severity. Thus, at the beginning of the 19th century court-martial sentences of a thousand lashes were very common for mutiny and other grave offences even in time of peace. After the Crimean campaign, however, it became usual, unless the troops were on active service, to remit the sentence of corporal punishment, which a court-martial could still legally award to the extent of fifty lashes, administered with a whip or 'cat' of nine tails on the bare back. The Act of 1879 went further in this direction, and made it illegal to inflict corporal punishment except on active service, for offences punishable by death, and limited the amount to twenty-five lashes. Finally this provision was repealed by the Army Act of 1881, and summary punishment provided as a substitute. This consists of hard labour, personal restraint by being kept in fetters, and, in its severest form, of being attached to a fixed object in such a manner as to be kept in a fixed position for two hours at a time. Soldiers are still liable to corporal punishment, limited to twenty-five lashes, when in prison, for an offence against the prison rules, and for highway robbery with violence.—In European armies recruited by conscription from all classes of society, flogging is not a military punishment, but sentence of death is more often inflicted.

As a punishment for misdemeanours at common law whipping has never been formally abolished, though it has never been exercised in modern times except under the provisions of some special statute. Local police acts give power to whip juvenile offenders; and by a statute of 1863 (which does not apply to Scotland) flogging was made a competent punishment for certain forms of robbery with violence, as garrotting. Sir James Stephen says of this statute that it is 'an act so capriciously worded, that if a man beat a woman about the head with intent to rob her he may be flogged, but not if his object is to ravish or murder her.'

At common law the instrument to be used for whipping and the number of strokes are left to the discretion of the person who inflicts the punishment. When sentence of whipping is pronounced by justices, the order must specify the instrument and the number of strokes. If the offender is under fourteen years of age, the number of strokes must not exceed twelve, and the instrument must be a birch rod. Under the Act of 1863 a court may direct a person convicted of robbery to be privately flogged—not more than three times. If the offender is under sixteen, the number of strokes at each whipping must not be more than twenty-five; and, no matter what the offender's age, the number must not be more than fifty. In Scotland no offender above sixteen years can be whipped for theft or for any crime committed against person or property.

Flood, HENRY, Irish orator, was born in 1732, and educated at Trinity College, Dublin, and at Christ Church, Oxford. Elected to the Irish parliament as member for Kilkenny in 1759, and for Callan in 1761, he soon became a leader in the popular party. His oratory was vigorous and impressive, but was marked by all the offensive personalities of his time. In 1769 he was unfortunate enough to kill an electioneering opponent in a duel, and was brought to trial, but acquitted. In 1775 he took office as vice-treasurer of Ireland, but was removed in 1781 on account of his strong nationalist sympathies. Disliking Grattan's Irish Bill of Right as not going far enough, Flood strove without success to carry a more sweeping measure, and became involved in a bitter quarrel with his former friend, which would have resulted in a duel but for the timely intervention of the authorities. In 1783 he

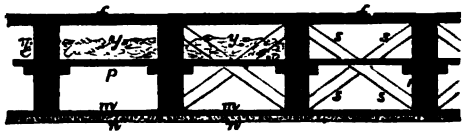
was returned for Winchester to the English House of Commons, and two years later for Seaford, but he failed to make as great a mark at Westminster as in Dublin. He died at Farmley, his seat near Kilkenny, December 2, 1791, leaving £5000 a year to Trinity College, Dublin. See his *Life and Correspondence*, edited by W. Flood (Lond. 1838).

Floods and **Inundations** are caused by excessive rains, giving rise to an overflow of the rivers; by the bursting of the banks of rivers, lakes, and reservoirs; by the sudden melting of ice and snow; and by irruptions of the sea, produced by high tides, wind-storms driving the sea-water inland, earthquakes, volcanic outbreaks, and the bursting of sea banks. The felling of forest trees throughout extensive tracts of mountainous country also tends to make the rivers which have their origin there swell rapidly after a heavy rainfall; good and complete drainage of land has the same tendency. For the Noachian flood, see DELUGE. The subjoined list embraces some of the most disastrous floods and inundations of which we have record.

684 A.D. Japan; 780 sq. m. of Isle of Shikoku covered by sea.
968. Persian Gulf; many cities destroyed, and new islands formed by irruption of sea.
1014. Many English seaports destroyed by sea.
1098 or 1100. East of Kent inundated; Goodwin Sands formed.
1100 or 1108. Flanders inundated.
1161 or 1165. Sicily; irruption of sea; thousands drowned.
1170. Holland and Friesland; great flood.
1173. Holland; Zuyder Zee much enlarged.
1219. Nordland, Norway; lake burst; 36,000 people perished.
1223. Friesland; invasion of sea; 100,000 people drowned.
1277. Friesland; the Dollart formed.
1286–87. Holland on both sides of Zuyder Zee inundated in consequence of a storm.
1396. Holland; islands of Texel, Vlieland, and Wieringen separated from mainland, and Marsdiep, the channel between Texel and North Holland, formed.
1421 or 1446. Holland; 72 villages inundated, of which 20 permanently, about 100,000 persons drowned, Biebosch formed east of Dordrecht, and this town separated from mainland.
1521. Holland; 100,000 lives lost by an inundation.
1570. Holland; storm drove in the sea, destroying numerous villages and 20,000 people in Friesland.
1617. Catalonia, Spain; 15,000 perished in floods.
1629. Mexico (city) inundated.
1642. China, at Kaifong: 300,000 drowned.
1646. Holland and Friesland inundated; loss of life, 110,000.
1726. Floods and inundations all over Europe.
1745. Peru; Callao destroyed by irruption of sea caused by earthquakes.
1767. England; irruption of sea on east coast.
1782. Formosa; west side of island submerged, and Taiwan destroyed.
1787–88. India, in North-western Provinces and Punjab; 15,000 lives lost by floods.
1791. Cuba; floods from excessive rain; 3000 drowned.
1811. Hungary; 24 villages swept away by overflow of Danube.
1813. Austria, Hungary, Poland, and Prussian Silesia; floods caused by rains; 4000 perished in Poland, 6000 in Silesia.
1824. St Petersburg and Cronstadt; 10,000 lives lost from overflow of Neva.
1825. Denmark; sea broke through from North Sea to Limfjord, making northern Jutland an island; one-third of Friesland submerged by rising of sea and rivers.
1840. France; overflow of Saône and Rhone swept away many villages and inundated Lyons, Avignon, Nimes, Marseilles, &c.
1851. Northern China; Yellow River burst its banks, and made a new outlet into Gulf of Pechili.
1852. Floods throughout Europe from Belgium to Switzerland.
1856. South of France; floods did damage to extent of £5,600,000.
1868. Peru; Arica and Iquique nearly destroyed by earthquake waves.
1874. United States; Mill River valley (Massachusetts) inundated by bursting of a dam; 144 drowned. Also floods in western Pennsylvania; 220 drowned.
1875. Disastrous floods throughout central Europe, in United States, Burmah, India, and West Indies.
1876. China; floods in northern provinces; in Bengal 200,000 persons perished from inundation of a tidal wave.
1883. Java and Sumatra; west coast of former and east coast of latter submerged by volcanic wave, new islands formed in Sunda Straits, whilst part of Krakatoa disappeared.
1887. China; floods in Ho-nan, caused by the Hoang-ho bursting its southern bank; millions of lives lost.
1889. Johnstown (Pennsylvania), United States; 2209 lives lost from bursting of a reservoir.

There are certain parts of the world which are periodically submerged, such as extensive tracts in the North Valley of Siam, Cochin-China, Annam, &c. See, for a detailed list of floods and inundations, C. Walford, in *Journal of Statistical Society*, 1878, pp. 451–467.

Floor. The floors of the upper stories of ordinary houses are nearly always constructed of wood, but in many large public and other buildings all the floors are fireproof, some of these, for example, being formed of a series of flat brick arches between iron girders. Basement floors and others near the level of the ground are often laid with flagstones, tiles, or cement, but many of these are also of wood. According to the nature of their construction, wooden floors are of three kinds—viz. *single*, *double*, and *framed floors*. When the span between the walls does not exceed 15 feet, a single-joisted floor is sufficiently strong. Sometimes it is even adopted



Section of a Single Floor:

a, *b*, *c*, *d*, joists; *s*, strutting; *f*, flooring-boards; *p*, sound or deafening boarding; *y*, pugging or deafening; *m*, ceiling-lath; *n*, plaster.

for a 20-feet span. The annexed figure shows the section of a floor of this kind. The joists vary in section; but 9 inches by 3 inches for moderate, and 11 inches by 3 inches for larger spans are common sizes, and they should not be more than 16 inches apart from centre to centre. They are laid at the ends on wall-plates of wood. If their lengths much exceed 10 feet, joists should be strutted in order to stiffen them and keep them in position. This can either be done by herring-bone strutting, shown in the figure, which is the better way, or by key strutting with solid pieces of wood morticed through the joists with small tenons. The latter method is called 'dwanging' in Scotland, and the rows of dwangs or keys are usually nailed between the joists. The lines of struts or keys should be at intervals of about 7 feet. Flooring-boards are nailed on the top of the joists, and Laths (q.v.) on the bottom of them to support the plaster of the ceiling of the room below. To prevent the passage of sound to and from rooms between which the floor forms the horizontal partition, what is called 'pugging,' or (in Scotland) 'deafening,' is required. It consists of coarse plaster, &c., laid on rough boards or laths supported on fillets nailed to the sides of the joists (see BUILDING).

Double-joisted floors are constructed by laying strong timbers, called *binders* or *binding-joists*, from wall to wall, at a distance of about 6 feet apart; and a double set of joists, one above for the flooring-boards, and one below for the ceiling, are laid across these, and notched down upon them. Of these the upper ones are called *bridging-joists*, as they bridge over the interval between the larger binding-joists. A *bay* is the general name for the space between binders; if between a binder and wall, it is called a *tail bay*.

The *framed floor* is one degree more complex than the double-joisted. Binding and bridging joists are used in the framed floor, but the binding-joists cease to be the primary support, as for this purpose strong balks of timber, called *girders*, are used: They are laid across, at distances of from 8 to 10 feet, and the binding-joists are framed into them by a *tusk-tenon* joint. The bridging-joists are notched to these in the same manner as for double-joisted floors. When the span is too great for a wood-girder, either a girder wholly of iron is used, or one formed of a wrought-iron plate with

wood on each side, all three pieces being bolted together. The latter is called in Scotland a 'sandwich beam.'

Flooring-boards are jointed in several ways. Perhaps the most common is the *grooved and tongued* joint, in which a tongue worked on one edge of a board fits into a groove in the next board. In a *ploughed and tongued* joint each board is grooved on both sides, and a separate tongue of wood or iron inserted. A *rebated* joint means that each board is checked along the edges, and these fit into reverse checks on the two adjoining boards. In a *dowelled* joint the edges of the boards are square and unbroken, and small oak pins or dowels are inserted at intervals in holes bored along the edges. Flooring-boards should not be more than 6 inches broad, and in the best floors they do not exceed 3 or 4 inches. They are from 1 inch to 1½ inch thick—very commonly 1½ inch. On the continent of Europe polished oak floors are very common. In America, and occasionally in Britain, two thicknesses of flooring-boards are used in floors of a superior description.

For fireproof flooring, see FIRE; and for special kinds of ornamental and other floors, see ASPHALT, CONCRETE, ENCAUSTIC TILES, MOSAIC, and PARQUETRY.

Floorcloth. There are several kinds of floorcloth. Formerly the name was confined to painted canvas, which is now called oilcloth; but the more recently introduced linoleum and other fabrics in which ground cork bulks largely are now extensively used for covering floors.

Oilcloth.—The basis of oilcloth is a coarse canvas generally made of jute, but it is stronger when made of flax tow. It is woven into pieces often as long as 150 yards and as wide as 8 yards. The first step is to fix a piece of this, say 75 feet in length by 24 feet in width, upon an upright frame provided with screws by means of which the canvas can be uniformly stretched. Stages or platforms are placed at convenient heights to enable the workmen to cover the canvas. Before paint is applied the canvas receives a coating of size, the chief object of which is to prevent injury to the cloth by acid products arising from the oxidation of the linseed-oil with which the paint is made up. When the size is thoroughly dry and pumiced, a layer or coating of paint is put on with steel trowels like those used by plasterers. Yellow ochre is much used for this thick coating, which if unaided by artificial heat sometimes takes fourteen days to dry. A second coat is applied in the same manner to finish the back, but the face receives five or six trowel coats, the surface being once or twice pumiced between the coats. The wearing surface receives a coat of paint with a brush if some other colour than that of the last trowel coat is wanted for the ground shade. In the case of cheap oilcloths, the coats of paint, instead of being applied by trowels, are put on by a roller machine. A man keeps pouring the prepared paint out of a bucket on the moving canvas, and a long blunt knife-blade, almost touching its surface, regulates the thickness of the coat of paint. When made by this method, the oilcloth receives nine coats.

In printing, wood blocks are chiefly used, a separate one being required for each colour of the pattern. These are about 18 inches square, and the face is commonly made of pear-wood, with a pattern cut out by steel tools. There is an ingenious way of producing patterns on wood blocks by heated iron punches. Sometimes the raised portions of these printing-blocks consist of type-metal or brass. Figs. A, B, C, D (Vol. II. p. 645) of the article CALICO-PRINTING will give an idea of how the impressions from several blocks complete a pattern. Beside the printers there is a table upon which are placed the colour-pads. Another table, padded with felt or flannel, supports the floorcloth, each pattern block, charged with colour, being applied by means of a small screw-press. A machine is in use for printing floorcloth which to a certain extent imitates hand-printing. The blocks which form the pattern are depressed by cams carried on shafts. Roller machines are not applicable to this kind of printing, because the paint would 'run' on a revolving surface. The durability of oilcloth depends very much on the length of time given for the paint to harden, and also upon its quality.

Linoleum.—The floorcloth called by this name suits the purpose for which it is made admirably, being lasting, comfortable, and noiseless when trod upon. Its wearing face consists chiefly of pulverised cork and oxidised linseed-oil, with smaller quantities of common and kauri resin, all well mixed together, and made to adhere to canvas backed with size and pigment.

The chief operations in the manufacture of linoleum are based upon processes patented by F. Walton in 1860 (specification No. 209) and in 1863 (specifications No. 1037 and 3210).

Of these the more important are the preparation of the cork, the oxidising of the oil, the formation of the mixture of all the ingredients for the coating, and the application of this to the surface of the canvas. Pulverised cork, of which linoleum most largely consists, is obtained from waste cork-cuttings. These are exposed to the action of a series of toothed steel discs revolving on a shaft and working against steel plates, the ends of which have also teeth like those of a saw. By this machine the cork is reduced to the size of peas. It is afterwards ground with millstones.

The oxidised linseed-oil is produced by diffusing or 'flooding' the boiled oil in thin films upon the surface of long pieces of calico or scrim, placed in an upright position. This is repeated daily till the successive films of oil reach half an inch in thickness. It takes six or eight weeks to effect this, and the scrim with its many films is then called a skin. Owing to the injurious action upon vegetable fibre of the vapours given off during the oxidation of the oil the scrim becomes completely rotten. Even mineral substances are attacked by these vapours. The gain in weight shows that a large quantity of oxygen is absorbed by the boiled oil, and that a good supply of air in the oxidising buildings is therefore necessary. After being cut into small pieces the skins are ground by means of grinding-rollers. Care must be taken not to heap up the pulverised material, as in bulk it is very liable to char or ignite by the rapid oxidation of such particles as have not undergone this change previous to grinding.

A mixture is now made consisting of from 4 to 8 cwt. of the oxidised oil to 1 cwt. common resin and 1 cwt. kauri resin, the mixing operation being conducted in a pan with an outer jacket or casing containing steam. The pan has an air-tight lid, and at a valve at the bottom and inside there are stirrers. Resin is first put in and melted, the oil and kauri being separately added. As soon as the mixture is warmed the steam is shut off, the oxidation of the materials keeping up a sufficient heat till the charge becomes homogeneous. The valve at the bottom of the pan is then opened, and the mixture, now called cement, passes down between grinding-rollers. The cement is next cooled, but before mixing it with ground cork it is again heated to at least 120° F. The proportions of these two ingredients are about equal, but sometimes the cork is rather in excess of the cement. The colouring materials (ochre and oxide of iron) are either added with the cork or previously to the cement.

There is still another mixing-machine—the most

important of all. Here the material is fed by a hopper into a cylinder in which both fixed and revolving knives are placed. It has a steam jacket. When the linoleum mixture leaves this machine, the cork and cement are so thoroughly mixed that they are scarcely distinguishable by the naked eye. The next operation is to pass the mixed material between two rollers, one of which is steam heated, and the other kept cool by a current of cold water. Here it is formed into a sheet, which is then broken up by a similar arrangement of rollers, one of them being studded with points for the purpose of breaking up the linoleum material into small pellets. Finally the mixture is spread over and pressed into the canvas by a pair of rollers of chilled cast-iron heated by steam to a high temperature. The canvas afterwards receives a backing of size and pigment, and then the linoleum is finished if it is to be left plain. When a pattern is required it is printed in the same way as upon oilcloth. A mosaic linoleum has been recently made in which the pattern is not merely on the surface, but the different colours which form parts of the design go through nearly the whole thickness of the coating of the canvas. The separate pieces or tesseræ are cut out of sheets of coloured linoleum by metal projections on a pattern block, and these pieces are made to adhere to a thin backing of linoleum fabric by some adhesive substance and pressure. This particular kind of linoleum is built up somewhat in the same way as a floor of coloured tiles. See patent specification, No. 6039, 1882, F. Walton.

Kamptulicon, which is made of ground cork and india-rubber, was introduced earlier than linoleum, but its manufacture has almost ceased.

Cork Carpet, a floorcloth the manufacture of which has been quite recently begun. It is made of cork bound with oxidised linseed-oil, but differs from linoleum in having the particles of cork larger and purer in colour, as no pigment is mixed with it. It has a canvas backing, and is the warmest kind of floorcloth.

Flora, an ancient Italian deity, the Roman goddess of flowers and vegetable productiveness, also of exuberant youthful vitality. At Rome she had two temples, one on the Quirinal, the other near the Circus Maximus. On the occasion of her festival (*Floralia*), held in the end of April, the dwellings were decked with flowers, whilst feasting, with dance and song, prevailed everywhere. Flora was represented as a flower-crowned maiden in the full bloom of maidenly beauty.—*Flora* is used botanically to designate the collective plants or vegetable species of a region, country, or district, cryptogamic as well as phanerogamous, or to any work containing a descriptive enumeration of these.

Florence—the Cathedral and the Palazzo Vecchio—from the Palazzo Pitti.

Florence (Ital. *Firenze*), a city of Italy, capital of the former duchy of Tuscany, is situated in the valley of the Arno. It is about 123 feet above the level of the sea, 194 miles NW. of Rome, 62 E. of Leghorn by rail. Pop. (1881) of town, 132,039; of commune, 169,001 (in December 1888, 178,342). The Arno, spanned by four fine bridges, divides the city into two unequal parts, the chief on the northern bank of the river. Beyond the line of the ancient walls are thickly peopled suburbs, and a lovely, fertile, and salubrious neighbourhood, encircled by sloping hills, and studded with picturesque villas and fruitful vineyards and gardens. Florence and its environs, viewed from the heights of Fiesole, appear but one vast city. The influx of population consequent on the establishment here, in 1864–65, of the seat of the Italian government, necessitated a considerable extension of the city, and it is now nearly double its former extent. The ancient walls of the city have been razed; but several of the old towers pertaining to the various gates are retained, and constitute an interesting historical feature of modern Florence and a useful topographical indication of the former limits of the city. Many improvements and embellishments have been effected in the Florence of our day, and amongst these none ranks higher than the magnificent carriage-way known as the Viale dei Colli. It ascends from the Porta San Niccolo to the historic church and cemetery of San Miniato, and gradually slopes down to the Porta Romana. From the highest level of the drive, the Piazza Michel Angiolo, the panorama of Florence, the Arno, with the surrounding hills and distant Apennines, is quite unique for beauty and variety of scenery. Fine new streets, which stretch along the Arno, also add much picturesque attraction to the town, and the hygienic conditions of Florence have been greatly improved by the thickly planted avenues which encircle the greater part of the city, by the opening of several spacious squares, and by the erection of extensive new market-halls. Many causes render this city a most attractive place of residence to foreigners—a lovely country and healthful climate, cheap living, and the universal courteous intelligence of the people, united to the immense sources of interest possessed by the city in her grand historical monuments and collections of art.

The massive and austere forms of Florentine architecture impart an air of gloomy grandeur to the streets, for the most part regular and well kept. The chief building in the city is the Duomo, or Cathedral, the foundations of which were laid with great solemnity in 1298; while in 1887 the completed façade was uncovered amidst equal pomp and ceremonial in the presence of the Italian sovereigns. The Florentines having ambitiously resolved on erecting a monument which for architectural splendour and proportions should outvie all preceding structures, the honour of preparing the design was entrusted to Arnolfo di Cambio. On his death Giotto superintended the

works; and many eminent architects were employed before this splendid edifice was completed. Brunelleschi, the last, conceived and erected the grand dome, so much admired by Michelangelo as to have served him as model for that of St Peter's. The church contains sculptures by Ghiberti (q.v.), Luca della Robbia (q.v.), Michelangelo, Sansovino, Bandinelli, and other famous artists. At the side of the cathedral springs up the light and elegant Campanile (q.v.), detached, according to the custom of the times. In front is the Baptistery of San Giovanni, in form an octagon, supporting a cupola and lantern; all three edifices being entirely coated with a varied mosaic of black and white marble. Three bronze gates in bassorilievo are a great additional adornment of the Baptistery; the two by Ghiberti (q.v.) have been immortalised by Michelangelo, with the name of Gates of Paradise. The church of the Santa Croce, the Pantheon of Florence (1294—architect, Arnolfo di Cambio), contains monuments to Galileo, Dante, Machiavelli, Michelangelo, Count Alfieri, &c. The church of San Lorenzo was consecrated as early as 393 by St Ambrose, and rebuilt by Brunelleschi in 1425, by command of Giovanni and Cosimo de' Medici. It contains an interesting monumental memorial of Cosimo il Vecchio, bearing inscribed the title *Pater Patriæ*, which had been conferred on his memory by public suffrage the year following his death. In the *Nuova Sagrestia*, or New Sacristy, are the two famous monuments by Michelangelo to Giuliano and Lorenzo de' Medici. The Medicean chapel, gorgeous with the rarest marbles and most costly stones, agate, lapis lazuli, chalcedony, &c., stands behind the choir, and contains the tombs of the Medici family and their successors of the House of Lorraine. Annexed to the church of San Lorenzo is the Laurentian Library, with its inexhaustible store of rare MSS., founded by Giulio de' Medici. The beautiful church of Santa Maria Novella, formerly Dominican, dates from 1278 to 1360, and has famous frescoes by Cimabue, Orcagna, Filippino Lippi, and Ghirlandajo. The church of San Marco dates from 1436; adjoining it is the former monastery of San Marco, now secularised as the Museo Florentino di San Marco. Fra Angelico, Savonarola, and Fra Bartolommeo were inmates, and it is still adorned with the famous frescoes of Fra Angelico.

Amongst the numerous palaces *Il Bargello*, long a prison, but now restored and opened as a national museum, is one of the most ancient, and was formerly the abode of the republican magistrate, the Podestà. In 1841 some interesting portraits were brought to light by the removal of a coating of whitewash from the revered features of Dante, Brunetto, Latini, Corso Donati, &c., in the chapel of the palace. The Palazzo Vecchio, the seat of the republican government from its establishment till its abolition in 1530, is an imposing mass of building, surmounted by a lofty tower 260 feet high, the great bell of which used to warn the citizens of danger or summon them to defence. Adjoining the palace is the Piazza della Signoria, a square containing a fine collection of statues, and a noble arcade, the Loggia dei Lanzi, under the porticoes of which are magnificent groups of sculpture. In one of the halls of the Palazzo Vecchio there now stands a colossal statue of Savonarola a few paces distant from the spot where the reformer perished at the stake. The Palazzo degli Uffizi is a handsome building adjoining the Palazzo Vecchio, founded by Cosmo I., in the first floor of which are deposited the archives of the court of justice and other public offices, also the Magliabecchi Library, now united with that of the Pitti Palace to form a national library of 200,000 volumes and 10,000 MSS. On the second floor, in a circular suite of twenty-three rooms, is contained the famous Florentine gallery of art; rich in paintings, engravings, sculpture, bronzes, coins, gems, and mosaics. A splendid apartment, known as the Tribuna, contains the rarest treasures of the collection. The Palazzo Pitti, formerly the grand-ducal residence, boasts of a superb gallery of paintings. Behind it are the beautiful Boboli Gardens, royal, but accessible to the public. The Palazzo Riccardi, now public property, is the residence of the prefect. The Palazzo Strozzi is a fine type of Tuscan architecture. Florence abounds in other public edifices and monuments, too numerous to mention, and there are several fine libraries besides those already named.

Since Italy has become a united kingdom, Florence, in common with the other cities of the country, enjoys a greatly improved educational organisation. Although not in possession of a university, the Florentines have the advantage of several superior and special educational institutions. The foremost of these, the Instituto di Studi Superiori, has adopted the ordinary university curriculum, and confers various degrees. Its success has been largely due to the able and enlightened direction of Italy's chief historian, Professor Pasquale Villari. The School of Social Science was founded by the Marchese Alfieri di Sostegno. In the Museum of Natural History medical students derive exceptional advantage from the admirable anatomical wax models of Susini; and, since 1871, in the same museum a most interesting collection of Galileo's instruments has been placed. Florence contains also a good school of art and a musical institute.

The hospital of Santa Maria Nuova contains an ancient college of medicine and surgery. The Academy of the Fine Arts and the Museum of Natural History afford unlimited resources to the public interested in their collections. There are three hospitals, one lunatic asylum, nine theatres. The Academy della Crusca (see ACADEMY) is entrusted with the care of sifting and preserving uncorrupted the Italian language. The Academy dei Georgofili was established in the interests of agriculture. Florence is the see of an archbishop, the seat of a prefecture and of numerous provincial courts, as well as the military headquarters of the district. Its railway communications are ample. The chief industrial occupations of the Florentines are the fabrication of silk and woollen textures, and of straw-plaiting for hats, &c., jewelry, and exquisite mosaics in rare stones. The Florentines are famous for their caustic wit and natural gifts of eloquence, as well as for their shrewd thriftiness and unflagging labour. In their moral superiority may be recognised the effects of a better and more upright government than those which existed in most parts of the peninsula previous to the recent union of Italy.

History.—The city of Florence sprang originally from Fiesole (q.v.), at the foot of which it lies extended. The inconvenient and hilly site of the Etruscan Fiesole, perched on the crest of an irregular height, rendered that town so difficult of access to the traders who resorted to its market-places with their varied merchandise that it was at length decreed they should assemble at the base of the hill, in the fertile plain traversed by the Arno. The few rough shelters erected for the accommodation of these traders may be considered the original nucleus of the important and splendid city of Florence. It would seem that as early as the time of Sulla there was a Roman colony here; another was established after the death of Julius Cæsar, and it soon became a thriving town. The *Florentini* are mentioned by Tacitus, 16 A.D., as sending delegates to Rome, but

it was not till the time of Charlemagne that Florence began to rise out of obscurity. It was now governed by a political head with the title of Duke, assisted by various subordinate officers, who were elected by the united suffrages of the duke and citizens. In the 11th century Florence and a great part of Tuscany were bequeathed to Pope Gregory VII. by his friend and partisan the Countess Matilda, who inherited from her mother, the Countess Beatrix, her jurisdiction over the city. Under the protection of Rome, Florence speedily adopted the forms and institutions of a free city; and the republican spirit which then arose amongst the people imparted an impulse to national life, and awoke a spirit of patriotism and enterprise. As early as the 11th century the Florentines were European traders and the possessors of commercial depôts in the seaports and cities of France and England, and their skill as workers in gold (see FLORIN) and jewels had grown famous. The 'arti' or trade-guilds were of great importance. In proportion as papal preponderance increased in Florence, that of the empire sank; and in 1113 the citizen forces routed the troops and slew the delegate of the emperor at Monte Cascioli, near Florence. During the bitter wars between pope and emperor which raged throughout Italy, Florence and all Tuscany seemed to have been saved from the feuds of Guelphs and Ghibellines —the former adherents of the papacy, the latter of the empire. But in 1215 Florence became involved in the great party struggle, owing to a private feud breaking out between two noble families, chiefs of the contending principals. A Guelph noble, Buondelmonti, mortally incensed the Ghibelline family of the Amidei, by breaking off his alliance with a daughter of their house, and contracting marriage with a member of a Guelph family. To avenge this insult the Amidei appealed to their powerful kinsmen, the Uberti, and in fact to all the Ghibelline party of Florence. Buondelmonti was stabbed to death as he crossed the Ponte Vecchio, and was speedily avenged by the Guelphs in the blood of his enemies. Thus for thirty-three years was Florence distracted by the deeds of bloodshed and violence of these two rival factions, who assumed the names and adopted the respective causes of Guelphs and Ghibellines. See the article GUELPHS AND GHIBELLINES.

In 1250 the animosity of these parties seemed somewhat blunted, and public attention was directed to wise internal reforms. Twelve magistrates, or anziani, were appointed in place of the consuls, each of the six sections into which the city was divided being entrusted to two of these magistrates, whose tenure of office was annual. To avoid all local dissensions, two other magistrates, strangers by birth, were elected: the one, invested with supreme authority in civil and criminal cases, was called the podestà; the other, with the title of captain of the people, had the chief command of the militia, in which were enrolled all the youth of the state, who were bound, at the call of this magistrate, to join their company fully equipped for fight: twenty companies defended the town, ninety-six the country. After the death of the Emperor Frederick II., the great protector of the Ghibellines, the Guelph or papal party gradually rose in power in Florence, and during ten years of their predominance the city increased in grandeur and prosperity, until it stood not only the first in Tuscany, but one of the first of all Italy. Its forces successively humbled the adjoining towns of Siena, Arezzo, Pisa, and Pistoia, and in 1254 captured Volterra. In 1260 the standard of civil war was again raised by the Ghibellines of Florence, who, in league with Manfred of Naples, attacked the Guelphs, and cut their forces to pieces in the sanguinary battle of Monte Aperto. The conquerors entered Florence forthwith, and in the name of Manfred abolished all trace of the popular institutions, establishing an exclusively aristocratic executive; they even strongly advocated the entire destruction of the city, the hotbed of Guelphism. This barbarous scheme was indignantly repudiated by their own famous leader, Farinata degli Uberti, immortalised by Dante for his patriotism. He even declared his intention of heading the Guelphs, were such a sacrilege perpetrated by his own party.

Pope Urban IV., French by birth, summoned against the Ghibelline Manfred a French army, led by Charles of Valois, to whom he offered the prospective kingdom of the Two Sicilies. Manfred was defeated and slain in the famous battle of Benevento, and Guelph ascendency was restored anew throughout Italy and Florence. Charles fully restored to the Florentines their internal institutions, and received their offered allegiance for ten years in 1266. In 1282 the *Priori*, a new executive power, was established in Florence; and in 1293, by the consent of the Priori, a higher chief than their own order was elected, with the title of *Gonfaloniere*. In 1300 Dante became one of the Priori, and the former feud was recommenced with new vigour between two factions, who now bore the names of Bianchi (Whites) and Neri (Blacks). Their dissensions were, however, interrupted by the appearance of Charles of Valois, sent by Boniface VIII. to restore tranquillity, in 1301. Charles espoused the part of the Guelphs or Neri, and sanctioned every outrage on the Bianchi, who were plundered and murdered barbarously, the survivors being exiled and beggared; among these were Dante and Petracco dell' Ancisa, the father of Petrarch. In 1306 Pistoia was besieged and taken by famine with great barbarity. In 1315 the Florentines met with a severe check from the Ghibellines of Pisa, under the command of Uguccione della Faggiula; and in 1325 they were completely defeated by Uguccione's successor in command, the valiant Castruccio Castracani, in the battle of Altopascio. Florence, weakened by long dissensions, and alarmed by Castruccio's threat of marching on the city, appealed to the king of Naples for aid. They received joyfully an officer of the king, entitled the Duke of Athens, sent as viceroy; and, such was the public demoralisation of the moment, they proclaimed him dictator of the republic, unanimously suppressing the offices of priori and gonfaloniere. The intrigues of this ignoble schemer to overturn the republic being discovered, he was ignominiously expelled by a general popular rising, and barely escaped with his life. An attempt to admit a proportion of the nobles into the government signally failed at this time, and only led to renewed animosity between them and the citizens. This was the last effort of the nobles to secure power.

A terrible pest decimated Florence in 1348, sweeping off 100,000 inhabitants (see BLACK DEATH). The chief power of Florence about this time seems to have been alternately wielded by the democratic families, the Alberti and the Ricci, and by their patrician rivals, the Albizzi, who for the space of fifty-three years guided the republic in the path of progress. In 1406 the ancient and illustrious republic of Pisa (q.v.) fell under the sway of Florence, after a heroic resistance. From 1434 the history of Florence is intimately bound up with the House of Medici, distinguished for their patronage of art and literature—especially Lorenzo the Magnificent (see MEDICI). The Medici were repeatedly banished from Florence for aiming at sovereign power; and to their intrigues Florence owes her final loss of republican rights and institutions. The extraordinary labours of Savonarola (q.v.), his trial and

execution at the stake, belong to the last decade of the 15th century. Pope Clement VII., of the House of Medici, formed a league with the Emperor Charles V., by which the liberties of Florence were to be extinguished and the sovereign power to be invested in Alexander de' Medici. In September 1529 an army of imperialists, under the Duke of Orange, entered Tuscany; and on the 8th August 1530 the siege of Florence terminated, after a defence of unexampled devotion and bravery on the part of the citizens.

Thus fell the name and form of the republic of Florence, quenched in the best blood of the city. From this period Florence loses her distinctive history, and is only known as capital of the grand-duchy of Tuscany, Pope Pius V. having conferred on Cosmo de' Medici the grand-ducal dignity. On the extinction of the Medici in 1737, Tuscany fell to the Duke of Lorraine; and in 1808 was given by Napoleon to his sister Elise. Florence continued to be the seat of the grand-ducal court until 1859; and after the constitution of the united kingdom of Italy the city held the position of provisional capital of the country from 1864 until 1871. The departure of the court gave for a time an inevitable check to the prosperity of the town. Some idea of the splendour of Florence as a republic may be gathered from the facts that her capitalists were so enormously wealthy that they supplied the chief sovereigns of Europe with funds; her manufactures of wool, silk, and gold brocade were exported throughout the world; and she possessed great commercial establishments in all the countries of Europe.

In art Florence holds a unique place: the Florentine school of painting, from Cimabue to Andrea del Sarto, is admittedly the most important in Italy. In Italian literature the position of Florence is only hardly less conspicuous. Florentine eminence is attested by the names of Florentine worthies such as Dante and Boccaccio; the painters Cimabue, Gaddi, Orcagna, Masaccio, Ghirlandajo, the Lippis, Andrea del Sarto, Carlo Dolci; the sculptors Luca della Robbia, Donatello, Ghiberti, Bandinelli, Cellini; the architect Brunelleschi; the musicians Lully and Cherubini; Machiavelli and the historian Guicciardini; the navigator Amerigo Vespucci; the Medici, &c. Through the works of its writers the Florentine Italian, not that of Rome, became classical.

See the articles MACHIAVELLI, DANTE, BOCCACCIO, SAVONAROLA, MEDICI, &c., and works quoted there; the histories of ITALY and of PAINTING; Capponi, *Storia della Repubblica di Firenze* (1875); Perrens, *Histoire de Florence* (5 vols. 1877–80); T. A. Trollope, *History of the Commonwealth of Florence* (4 vols. 1865); Mrs Oliphant, *The Makers of Florence* (1876); Yriarte's great illustrated work, *Florence* (1880; Eng. trans. 1882); A. J. C. Hare's *Florence* (1884); Ruskin's *Mornings in Florence;* and George Eliot's *Romola.*

Florence of Worcester, a chronicler of whose life nothing is known beyond the fact that he was a monk in the monastery of Worcester, where he died in 1118. His *Chronicon*, which comes down to 1116, in its earliest part is scarce more than a compilation from the Saxon Chronicle and Marianus Scotus; but about the year 1030 it becomes of greater value as an independent authority, meriting the approbation of Mr Freeman. It was edited by Benjamin Thorpe for the English Historical Society (2 vols. 1848), and translated by Forester (1847) and Stevenson (1853).

Flores, the name of two islands. (1) One of the Sunda islands in the East Indies, lying due south from Celebes. It is of an oblong shape, with an area of 6026 sq. m., is heavily timbered, and mountainous in the interior, forming, in fact, an eastward continuation of the Sumatra-Java volcanic girdle. The western half, called Mangarai, is subject to a native chief; the eastern half, known as Endeh, belongs to Holland. Pop. 250,000. Trade, principally in tortoiseshell, cinnamon, sandalwood, and edible birds'-nests, is almost exclusively in the hands of Bugis (see BONI).—(2) An island of the Azores (q.v.).

Flores, JUAN JOSÉ, first president of Ecuador, was born in Venezuela in 1800, and fought with distinction through the long war of independence. He was elected president of the new republic in 1830, resigning in 1835, and was re-elected in 1839 and 1843. He died in 1864.—His son, ANTONIO, born at Quito in 1833, was minister at Washington in 1860–64, and again in 1884–88, acting also, during the latter period, as ambassador to France and (in 1887) to Great Britain and Belgium. He was president of Ecuador from 1888 to 1892.

Floret, a term applied to the flowers of any small and closely-crowded inflorescence which resembles at first sight a single flower—e.g. composites, teasels, scabiouses, grasses, &c.

Florian, JEAN PIERRE DE, a French novelist and fabulist, who was born in 1755, and died in 1794. He was a literary pupil of Voltaire, by whom he was held in very high esteem. He wrote two prose romances (*Numa Pompilius* and *Gonzalve de Cordoue*), and a number of pastorales, *nouvelles*, plays, and fables. He appears to most advantage in his *Fables*, which are neatly and often wittily turned. His romances are cold and languid in interest; they are fair examples, however, of the correct but colourless French prose of the 18th century.

Floriculture. See FLOWER, GARDENING.

Florida ('Land of Flowers') is a large peninsular state in the extreme south-east of the United States, bounded E. by the Atlantic Ocean, N. by Georgia and Alabama, and W. by the Gulf of Mexico. It lies in about 25—31° N. lat. and 80—87° W. long. The state is nearly 400 miles in length, and about 84 miles in mean breadth, its coast-line embracing about 1150 miles, and its area 58,680 sq. m., or 37,555,200 acres. About one-fifteenth of this area is water surface. Florida has nineteen navigable rivers, making an aggregate of 1000 miles; swamps and marshes are still extensive, and the lakes and isolated ponds number at least 1200. Of the lakes the largest is Okeechobee, a shallow fresh-water expanse of about 1000 sq. m., in the southern part of the peninsula; the Everglades (q.v.) form a delta-like expansion of this lake. No general survey of Florida has yet been made, but from a preliminary inspection the state geologist finds the formations to be the equivalent of the Tertiaries of the Paris and Thames basins. There are indications that there is an upheaval of the land still in slow progress; and this, together with the drainage operations, points to the possibility of at least a great part of the Everglades being reclaimed. The best bays, harbours, and estuaries are Fernandina, St John's River, St Augustine, Indian River, Key West, Caloosahatchie, Charlotte Bay, Tampa Bay, Cedar Keys, Deadman's Bay, Appalachee Bay, Appalachicola, St Andrew's Bay, and Pensacola Bay. The long coast-line is dotted with innumerable islands of all sizes, from Santa Rosa and Key Largo, 30 to 50 miles long, to the smallest possible sandy keys.

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In climate and products Florida is like a great tropical island. It is cooled by delightful seabreezes from the gulf, making the climate remarkably equable and healthful; and the state is a favourite winter-resort, both for tourists and invalids, although malarial fevers prevail in some

parts, and yellow fever has occasionally, as in 1889, visited the seaports heavily. Even in the southernmost portions the summer heat is not extreme. The range between the mean summer and winter temperature is only about 20°; but the observations published by the Signal Service present the recorded extremes as 105° and 10° F., showing a difference of 95°. The soil, while much of it seems a sterile sand, is helped to fertility by the moisture, the rainfall being about 54 inches annually. Florida furnishes abundantly the rich fruits and valuable products of the tropics. Large areas are devoted to orange orchards, while lemons, limes, grapes, pine-apples, bananas, pears, guavas, &c. grow with equal luxuriance; and coffee, rice, cotton, and tobacco are natural products. Sea-island cotton, so valuable, and elsewhere limited to a few islands, here grows far inland. Cocoa-nuts also are grown in the subtropical region. Horticulture is one of the most profitable pursuits, and of late years market-gardening has assumed considerable dimensions in many parts of the state. An abundance of fruits and vegetables may be had fresh every month in the year, and during the winter and early spring months they are in great demand in northern markets. Florida is not rich in minerals, but there may be found some iron ore, a little coal, peat, corals, silicified shells, ochre, amethyst, topaz, agate, carnelian, chalcedony, and calcareous limestone. The *coquina*, a shell conglomerate, furnishes an excellent building-stone; but concrete of sand, shells, and lime or cement is now more extensively employed, as in the vast hotel at St Augustine (q.v.). Mineral springs are numerous. Large tracts of alluvial swamp and shallow lake-lands are being reclaimed by drainage. Next to these are the low hummocks or bottom-lands, dry enough for cultivation, and producing large crops of cotton, sugar-cane, grain, fruits, and vegetables. The high hummocks have a dark, gray soil, very rich at first, but soon running out if not kept well fertilised. Then come first-class pine, oak, and hickory lands, sandy, but containing a good deal of lime. Oranges and other citrus fruits grow well on these lands. There is a second-class pine land that is barren, but supplies a tolerably good pasturage. The forest trees are live-oaks and other evergreen oaks, cypress, hickory, magnolia, holly, great dog-wood, bay-laurel, satinwood, lignum-vitæ, mahogany, palmettos, Jamaica kino, mangrove, manchineel, torch-wood, &c. Figs are grown in great abundance. Indian corn is largely raised. Numerous wild animals abound in the central and southern parts of the state, such as the black bear, the cougar, the panther, wild-cats, wolves, foxes, raccoons, opossums, fish-otters, deer, and smaller game; alligators are found in nearly all rivers, lakes, and swamps; turtles are taken among the keys; and manatees are found on the Atlantic side as far north as latitude 27°.

Among the industries of Florida is a large business in the production of pine and other lumber, and live-oak timber for shipbuilding. The preparation of naval stores, turpentine, tar, rosin, and pitch employs many hands; cigars are manufactured in large quantities; all along the coast there are valuable fisheries, oysters abound in many parts, and the inland waters also teem with fish; and the evaporation of salt, the production of cotton-seed oil and meal, the manufacture of fertilisers, and sponge and coral fisheries are among the profitable industries.

During the latter half of the decade 1880–90 many capitalists and energetic northern men have invested and settled in Florida, contributing greatly to its wealth and the development of its resources. The assessments for taxation show a remarkable advance from $32,794,383 in 1879 to $86,265,662 in 1887. The state is traversed by numerous railroad lines, the principal of which are the Florida Railway and Navigation Company; the Florida Central and Peninsular; the Savannah, Florida, and Western; the Jacksonville, Tampa, and Key West; the South Florida; and the Florida Southern. The chief towns are Tallahassee (the capital), Pensacola, Appalachicola, Jacksonville, Fernandina, St Augustine, Tampa, Key West, Bartow, Orlando, Ocala, and Gainesville. There are forty-five counties of irregular shape, but many of the large ones are to be divided with the increase of population. In 1870 there were 187,748 inhabitants; in 1880, 269,493 (142,605 white; 126,888 coloured, including 18 Chinese and 180 Indians); in 1890, 391,422.

The common-school system is popular and efficient. There are over 2000 public schools, and the enrolled pupils in 1887 numbered 82,453. There are numerous institutes and colleges, including the State College at Lake City, which is endowed by the United States, and offers free tuition.

Florida was discovered on Easter Day (*Pascua Florida*), 1512, by Juan Ponce de Leon (q.v.). In 1539 it was explored by De Soto (q.v.), and in 1565 a body of French Calvinists, who had established a settlement three years previous, were butchered or driven out by the Spaniards. The latter held possession till 1763, when Florida was ceded to England in exchange for Cuba. The Spanish regained the country in 1781, and two years later were confirmed in their occupation by the Peace of Versailles. Florida was ceded to the United States as a territory in 1819, received a constitution in 1833, and was admitted into the Union as a state in 1845. In 1835–42 it was the theatre of a desperate war between the aborigines (Seminoles, q.v.) and the white settlers, a war which was only terminated after a sacrifice of hundreds of lives, and at a cost to the United States government of over $20,000,000. Florida passed an ordinance of secession, January 10, 1861, siding with the Confederates; but the battle of Olustee in February 1864 was the only important fight within its boundaries. It was one of the first states to return to the Union, framing a new constitution in October 1865, but was not re-admitted till June 1868. It is represented in the United States senate by two members, and in the House of Representatives also by two. See Davidson, *The Florida of To-day* (1889); Whitehead, *The Camp-fires of the East* (1891); Powell, *The American Siberia* (1892).

Florida, capital of the Uruguayan department of the same name, 67 miles N. of Montevideo by rail. Pop. 2500.—The *department* has an area of 4650 sq. m., and a pop. (1886) of 26,411.

Florida Strait is the name given to the channel separating the American state of Florida from Cuba on the S. and the Bahamas on the E. It is 310 miles long, and varies from 50 to 100 miles in width, and from 2220 to 5070 feet in depth. The Gulf Stream flows through the strait at a rate varying from ½ mile to 5 miles an hour.

Florin was the name of a gold coin first struck in Florence in the 11th century. It was the size of a ducat, and had on one side a lily, and on the other the head of John the Baptist. The silver florin, with the same designs as the gold florin, was first struck in 1181. These coins were soon imitated all over Europe. It was out of them that the German gold and silver gulden of the middle ages and the silver gulden of modern times arose. These last are still marked with the letters *Fl.* The gulden or florin is the unit of account in Austria, and has a value of about 2s. Till 1876 a florin or gulden of 1s. 8d. was the unit in the South German

States. The Dutch florin or guilder is also worth 1s. 8d. The English 2s. piece is called a florin; the 4s. pieces first coined in 1887 are double florins.

Florio, JOHN, the translator of Montaigne, was born in London about 1553. His father was a Protestant exile and Italian preacher in London, but his labours came to a discreditable conclusion. Wood says that for safety's sake he kept his family out of England till after the death of Mary. John Florio appears as a private tutor in foreign languages at Oxford about 1576, and two years later published his *First Fruits, which yield Familiar Speech, Merry Proverbs, Witty Sentences, and Golden Sayings*, accompanied by *A Perfect Induction to the Italian and English Tongues*. In 1581 Florio was admitted a member of Magdalen College, and became a teacher of French and Italian. He enjoyed the patronage successively of Leicester, the Earl of Southampton, and other noble persons. His next work was *Second Fruits, to be gathered of Twelve Trees, of diuers but delightsome Tastes to the Tongues of Italian and English men*, with, annexed to it, the *Garden of Recreation*, yielding six thousand Italian Proverbs (1591). His Italian and English dictionary, entitled *A World of Words*, was published in 1598. Florio was appointed reader in Italian to Queen Anne, and afterwards groom of the privy-chamber. In 1603 he published in folio his famous translation of Montaigne, of which it is praise enough to say that it is a version worthy of its original. A copy of this work in the British Museum bears the authentic autograph of Ben Jonson; another, that of Shakespeare, although its authenticity is more than dubious. At anyrate it is certain from the *Tempest* that the great dramatist was familiar with the book. It was long believed that the pedantic Holofernes in *Love's Labour's Lost* was a study after Florio; but it is satisfactory to lovers of Montaigne to know that for this there is no foundation. Florio died of plague at Fulham in 1625. Second and third editions of his Montaigne appeared in 1613 and in 1632. A reprint of the first of the three books of this noble monument of Elizabethan English was issued in the 'Stott Library' (1889).

Florists' Flowers. See FLOWERS (FLORISTS').

Florus, generally, but on insufficient evidence, called L. Annæus Florus, was a Roman historian who flourished in the reign of Trajan or Hadrian, but of whose life we know nothing. He wrote an epitome of Roman history (*Epitome de Gestis Romanorum*), based mainly on Livy, from the foundation of the city to the time of Augustus, in an inflated and metaphorical style. The best edition is that of O. Jahn (1852), as revised by C. Halm (1854). See the books by Sprengel (1861) and Reber (1865).

Flory. See FLEURY.

Flotow, FRIEDRICH, FREIHERR VON, an operatic composer, born at Teutendorf in Mecklenburg, 27th April 1812. He was at first intended for the diplomatic profession, but on his arrival at Paris in 1827 his sense of his own musical abilities was awakened, and he began to study under Reicha. His reputation was made by his earliest operas, *Le Naufrage de la Méduse* (1839), *Stradella* (1844), and *Martha* (1847), the last two characterised by pleasing melody and by the light and lively character of the music. Of Flotow's later operas only three have attained marked success—*Indra* (1853), *La Veuve Grapin* (1859), and *L'Ombre* (1869). In 1856 he was appointed intendant of the theatre at Schwerin; but this position he resigned in 1863, and returned to Paris. He died at Wiesbaden, 24th January 1883.

Flotsam, JETSAM, and LIGAN, terms of English law used to denote goods cast away from a ship that is wrecked or sunk. *Flotsam* is the term where the goods continue to float or swim upon the surface of the water; *jetsam*, where they are cast into the sea and sink; *ligan*, where they are sunk in the sea, but fastened to a cork, bladder, or buoy in order to be found again. Unless the owner appear to claim them within a year and day, goods in each of these states belong to the crown. Jetsam, flotsam, and ligan did not fall within the meaning of the term 'wreck' in its original meaning at common law. In that sense wreck was the part of the cargo of a lost ship that came to land and belonged to the crown. A grant of 'wreck' from the crown accordingly did not carry flotsam, jetsam, and ligan. At the present day, however, 'wreck' has come to include these classes of goods in the provisions of the Merchant Shipping Acts and other statutes. Statutory officers, called Receivers of Wreck, preserve wreck until it is claimed by the owner, or, if not claimed, sell it and pay the proceeds to the Exchequer. All such matters are under the general supervision of the Board of Trade. Jetsam must not be confounded with *jettison*, which means the throwing overboard of goods in order to save the ship, as where she must be lightened in a storm, or to gain speed to escape from capture, or for other good cause. In such a case the loss for the general good is apportioned by general average. See AVERAGE.

Flounder (*Pleuronectes flesus*), a common species of flat-fish, of wide distribution in the shallow waters round Britain and other north temperate countries. It is the Scotch 'fluke,' and the Swedish 'flundra,' and differs but a little from the plaice and dab, two of the commonest neighbour-species. Like other flat-fishes, the flounder is asymmetrical, and swims or rests on one side, almost always the left, the eye of which is in early youth brought round to the upturned surface. It measures about a foot in length, and about a third as much between the dorsal and the ventral edge, without including the fringing fins. The colour of the eye-bearing surface varies in sympathetic adaptation to that of the sandy or muddy bottom on which the fish lives. The upper side is olive-green or brownish, sometimes with yellow spots; the blind side is yellowish-white, with small, dark points. The mouth-aperture is narrow; the teeth are conical, and most developed on the blind side; the dorsal fin begins at the eye; the scales are minute and smooth, but rough tubercles occur on the side of the head and along the bases of the dorsal and anal fins.

Of the two dozen related species, the Plaice (*P. platessa*), the Dab (*P. limanda*), the Smear-dab (*P. microcephalus*), and the Craig-fluke (*P. cynoglossus*) are the commonest. In the soles (Solea) the dorsal fin begins in front of the eye, and the upper eye is slightly anterior to the lower.

The flounders spawn at the mouths of rivers, and the young are hatched in May. The fish often leave the sea and go up the rivers, ascending the Avon to near Bath, and the Moselle as far as Treves. They are even able to thrive in ponds. Sea-birds prey largely upon them, breaking the bones to make swallowing possible. Though inferior to the plaice, the flounder is an esteemed food-fish. See DAB, FLAT-FISH, PLAICE, SOLE.

Flour. See FOOD, and BREAD.

Flourens, MARIE JEAN PIERRE, a French experimental physiologist, was born on 15th April 1794, at Maureilhan, Hérault. After having obtained his degree of doctor of medicine at Montpellier at the early age of nineteen, he proceeded to Paris, where he soon became acquainted with the Cuviers, Geoffroy St-Hilaire, Destutt de Tracy, Chaptal, &c. He first attracted attention by a

series of works dealing with the nervous system in its relations to the different sensations, wherein he sought to determine upon experimental grounds the specific sensational functions of the cerebellum, cerebrum, and corpora quadrigemina. After lecturing for Cuvier in 1828 and 1830, he received a professorship in the museum of the Jardin du Roi, and in 1855 at the Collége de France. In 1833 he was nominated perpetual secretary of the Academy of Sciences, and in 1840 he succeeded Michaud in the Academy. He also took some interest in politics; he was elected to the Chamber of Deputies in 1838, and was made a peer of France in 1846. He died at Montgeron near Paris, 6th December 1867. Flourens also wrote instructive books on the development and nutrition of the bones, on the skin and mucous membranes, on the longevity of man, on animal instinct and intelligence, on the works of his predecessors and contemporaries, Buffon, Cuvier, Geoffroy St-Hilaire, and Darwin, and a series of useful *Éloges Historiques* (3 vols. 1856–62).—His son, GUSTAVE, born at Paris, 4th August 1838, first distinguished himself by his book, *Science de l'Homme* (1865), a series of lectures on the origin of the human race, delivered at the Collége de France in 1863. Of ardent republican sympathies, he took a very active part in the Cretan insurrection against the Turks in 1866, and subsequently in the Commune at Paris, fighting in behalf of which he met his death on 3d April 1871.

Flower. The observations of childhood, like the popular language in which these so largely tend to survive, are apt to deny flowers altogether to plants in which these are not conspicuous. Yet the unmistakable succession of the flower by the fruit and seed compels us in some measure to argue back from the presence of one or other of these to the previous existence of flowers, even where they may not usually have been noticed, as, for instance, in the oak. The observant walks of spring and early summer soon convince us that not one even of the soberest forest-trees but has its blossoming time, while no one can escape noticing in midsummer the abundant blooms of the grasses and nettles. Horticultural experience, too, convinces us that the overpowering majority of plants brought from other lands flower sooner or later if the right conditions can be insured them, and thus we gradually reach the generalisation that among the plants which exhibit stems and leaves, none save the mosses, the ferns and horse-tails, the club-mosses and selaginellas, with a very few other inconspicuous and unimportant forms, fail to agree in the production of flower and seed. We have here evidently a broad principle of classification, and if our knowledge of the reproductive function of the flower has meantime developed so far as to repeat the discovery of its definite sexuality, we shall feel the appropriateness of Linnæus's general term of *Evident-flowering* or Phanerogamia (q.v.), yet also approve the mingled caution and speculativeness which made him apply that of Cryptogamia (q.v.) to the latter, since it was reasonable to suppose that the reproductive process (Gr. *gamos*, 'wedlock') evident (Gr. *phaneros*) in the former might in the latter be concealed (Gr. *cryptos*).

The examination of so many flowers, or even of a few representative ones, will have shown us that the central organs in which the seed arises exhibit considerable variety alike in number and detail. Thus, distinguishing the essential 'seed-box' as the *ovary*, we find that there are many simple separate ones in the buttercup or the rose, while the apparently single ovary of the apple or the tulip turns out on section to be five- or three-celled respectively, each cell containing the future seeds or *ovules*. We find, too, above the ovary a surface usually viscid or hairy, to which pollen readily adheres, and this we call the *stigma*, noting also that while sometimes practically sessile upon the ovary, as in buttercup or poppy, this is oftener raised upon a column, the *style*.

Encircling the seed organs we find the *stamens*, their stalks or *filaments* bearing heads or *anthers*. We see the latter shedding forth a yellow dust, the *pollen*, the same as that which we have noted upon the stigma of some of the flowers. This suggests one or two simple experiments. If we cut off the stigma, or cover it so that pollen cannot reach it, the incipient seeds or ovules will never mature into seeds proper capable of germination. Conversely, if we remove the stamens of this and other flowers, so that the same isolation of the stigmas from pollen comes to pass, the same failure of the seed follows. Whereas, when pollination of any particular stigma is effected (whether by the natural agency of insects or the wind, or more convincingly, by the actual help of the experimenter), seed forthwith matures in the corresponding ovary. And if the pollen be from a plant exhibiting some characteristic varietal difference, the resulting seed, when grown in its turn, will show the influences of this 'crossing' in a more or less marked degree (see HYBRID, HEREDITY). In this way the conception of sex in flowers, of immemorial date as respects those of the Date-palm (q.v.), has been extended in quite modern times. The carpels and stamens being thus the 'essential organs,' we recognise as merely 'accessory organs' the parts lying external to these, despite their frequent conspicuousness and beauty. In both monocotyledons and dicotyledons we have usually two circles or *whorls* of these parts, but in the former they are usually very similar, and so are usually spoken of merely as inner and outer *perianth-whorls* respectively, and their parts as *perianth-segments*. In most dicotyledons the corresponding whorls are known as *corolla* and *calyx*, since the colour and magnificence of the blossom usually depend upon the former (Lat. *corolla*), while the latter is commonly reduced to a mere verdant cup (Gr. *calyx*). The parts of the corolla or *petals*, and those of the calyx (*sepals*) are hence usually recognisable at a glance, as in the buttercup or rose. Yet the corolla may be reduced to inconspicuousness, as in the Christmas rose or globe-flower, or even vanish altogether; while the calyx may assume splendours which would be noteworthy even for a corolla, witness the marsh-marigold or garden clematis. Petaloid characters may be even assumed by Bracts (q.v.). Sepals, and still more frequently petals, may become more or less completely *united*, as so familiarly in the common primrose. In monocotyledons both whorls of the perianth may unite, as in the lily of the valley. Peculiar specialisations of form also abound, especially in the corolla, witness pansy or balsam, dead nettle or snapdragon. The calyx, too, may have its peculiarities, as in wallflower or poppy. The very modes of their arrangement in the bud differ widely (see ÆSTIVATION); while the position and arrangement of the separate flowers opens up a new field of study (see INFLORESCENCE).

Applying to the essential parts corresponding collective names, we have then innermost of all the *pistil* or *gynæcium* (its separate or constituent members being termed carpels); next the *androecium* of stamens. We have thus four whorls of organs, each presenting apparently independent and often wide differences in different flowers; hence we understand how in the attempt conscientiously to take note of all this multiplicity of floral detail the nomenclature of descriptive botany almost inevitably became so intricate and cumbersome (see BOTANY) as to obscure and retard that

very progress towards the recognition of the order and unity of the floral world which it was the aim of the whole science to reach. Keeping this aim, however, in view, we are compelled to rise from the description of separate plants to the problem of classifying them into groups (species, genera, orders, classes, &c.) according to the degree of their common resemblance. It soon becomes evident, as it did to the earliest systematists, that it is mainly upon the flowers that our classification must depend. And having seen the multifariousness of these, we are in a position to appreciate the aid of the Linnean or 'Artificial System' of orders and classes, when to ascertain or record all that is known of a new plant our primary task is but the simple one of noting the number of its carpels and stamens. We comprehend better, too, the reluctance with which the claim of the 'Natural System'—that classification must depend upon the sum of like characters—was conceded, since this principle leads us back to unravel all the perplexing intricacies of which the device of Linnæus so summarily cut the knots.

A principle of fundamental importance for the natural system was however reached, and descriptive botany made a vast step, from the empirical to the rational level, as the conception of the morphology of the flower (see MORPHOLOGY) became gradually established. Sepals and petals, stamens and carpels thus lost their utter distinctness, and fell into a single category with the leaves as the *appendages* of an *axis;* their differences thus becoming understood as specialisations for their respective physiological purposes, in no way inconsistent with fundamental unity of structure and development. The simplest observer soon realises that a sepal is a sessile leaf, and a stamen a stalked one, and only needs to dissect a double rose or a white water-lily to convince himself by the discovery of a perfect series of transitional forms between petal and stamen of the essential unity of these. The spiral instead of whorled arrangement which we find in some simpler floral types (Ranunculaceæ, &c.) is thus immediately intelligible as a transition to the ordinary phyllotaxis of leaves. But the botanist has hardly yet exhausted the more refined applications of this principle; thus, since a leaf may not only have stalk and blade, but side pieces or stipules, we have frequently to take note of these in the flower, just as in the analogous case of leaves reduced as bud-scales (see BUD). Nor does the utmost detail fail us: thus, since the stipules of opposite leaves, although normally separate (nettle), constantly tend to unite (wood-geranium) or may even develop like the ordinary leaves (bedstraw), so it happens in many flowers. What the descriptive botanist empirically termed the outer calyx or epicalyx of a strawberry or lady's mantle is thus rationalised as the united stipules of adjacent sepals; and similarly the perplexing whorl of external yet younger stamens in the Geraniums (q.v.) and a few other types is easily interpreted as similarly united stipular developments of the ordinary whorl of stamens. By help of the leaf, in short, we are learning more and more completely to interpret and unify the peculiarities of floral structure.

Returning to simpler cases, the union of sepals and petals not only recalls that of opposite leaves, but anticipates what we exceptionally find among stamens, as in the filaments of the mallows, or the anthers of the composites; or among the carpels in a majority of orders. That in the types with united corolla such union of the inner parts should also be more frequent and thorough than in those of separate parts is not to be wondered at; hence, for instance, the clubbed stigma of the lily of the valley as compared with the distinctly lobed—i.e. more separate stigma of the tulip.

Another great series of structural differences becomes cleared up when we bear in mind that appendages, however crowded and united, must arise upon an axis, however shortened. One or more internodes of the floral axis are, indeed, occasionally well developed, as in a lychnis or a passion-flower; but, generally speaking, their growth is checked at a quite embryonic stage. Since the early days of the natural system great attention has been paid to the position and origin of the floral parts. In the lily or the buttercup the stamens are seen to arise directly under the gynæcium, and are accordingly described as *hypogynous;* in the strawberry they arise in a circle at about the same level as the bases of the young carpels, and are consequently termed *perigynous;* while in the iris or the rose they seem perched upon the very top of the ovary, which is hence described as *inferior.* From the distinctness of the floral axis (then termed *thalamus*), the orders of hypogynous dicotyledons with separate parts became grouped as *Thalamiflorœ*, while those with perigynous or epigynous stamens and separate parts were termed *Calyciflorœ*, from the apparent origin of the stamens upon what was commonly regarded as a united calyx. All this, however, becomes intelligible when we combine the study of vertical sections of the adult flowers with the facts of their development. In the simplest hypogynous type we see the whorls of floral appendages standing in regular succession upon the conical floral axis just as they developed; the internodes having all developed equally. In the perigynous type, however, we see that the growth of the upper portion of the floral axis has been outstripped by that of its lower and as it were more vegetative region, which hence grows up around it; the epigynous type thus being only the extreme case of this, just as in inflorescences the spike becomes flattened into a capitulum, and this finally hollowed at the apex, or rather raised at the circumference into a cup, or even flask, as in the case of the fig. See INFLORESCENCE.

The large body of dicotyledonous orders in which the petals were united were grouped as Corolliflorœ, and finally the small and apparently degenerate types in which calyx, corolla, or both were absent were termed Incompletæ. The convenience of this system is so great that it is still retained in the *Genera Plantarum* of Bentham and Hooker. Its importance, but also its dangers may be well seen by comparing fig. 1, in which figures of types of as many well-marked Thalamifloral, Calycifloral, and Corollifloral orders are paralleled within the single order Liliaceæ (fig. 2), when with these we reckon the closely allied Amaryllids. In the same way the wide contrast between the usually splendid Calycifloral or Corollifloral and the inconspicuous Incomplete type might be paralleled within the range of a single order, witness rose and lady's mantle, or lilac and ash (Oleaceæ).

Though thus losing an absolute principle of classification, we gain a conception of simplicity underlying floral differences. From the mere empirical description of flowers as we find them we begin to penetrate the rationale of their development, to comprehend something of what we may call the principles of flower-making. Starting again from a simple and tolerably central type like that of the lily, we find among its immediate allies types here of increasing floral magnificence, there of diminished splendour and size; witness tulip and lily of the valley. We see how the more magnificent types tend to be always few or single-flowered, while the smaller and more modest types bear flowers in abundance; how the former are more individualised examples of the ordinal type, while the latter seem more embryonic. The one type tends to be richly coloured, often

indeed complexly marked; the other tends to be paler, even white or positively greenish. When departures from regularity of form occur it is the more splendid forms which become bilaterally

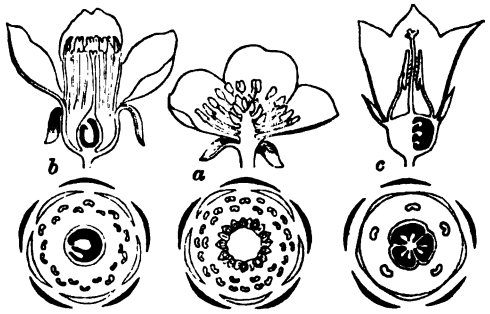


Fig. 1.

a, vertical section of buttercup (Ranunculaceæ), showing *hypogynous* arrangement (Thalamifloræ); *b*, cherry (Rosaceæ), showing *perigynous* arrangement (Calycifloræ); *c*, bell (Campanulaceæ), showing *epigynous* arrangement (here occurring along with the united petals of Corollifloræ). Each section is accompanied by its corresponding ground-plan or 'floral diagram.'

symmetrical; and conversely it is among the more embryonic types that the petals or other parts become united. The more vegetative habit of the lily of the valley as compared with that of the tulip is here of interest, since we can correlate this obvious constitutional difference with the facts already outlined, or with such an otherwise incomprehensible detail as the production of many ovules by the tulip, but of few by the more vegetative and consequently less reproductive blossom of the lily of the valley. Even were such facts comparatively isolated they would be suggestive; but a wider examination of the monocotyledons brings us face to face with the existence of the same contrast in groups of all extent. Those extreme types, as it would seem, at once of floral differentiation and of vegetative habit, which we know as grasses and orchids, are alike clearly referable to the simple liliaceous ground-plan of structure (see the floral diagrams in fig. 3), and the question hence arises—must we not regard these simply as extreme variations, greater in degree, but of no different kind than those which we have

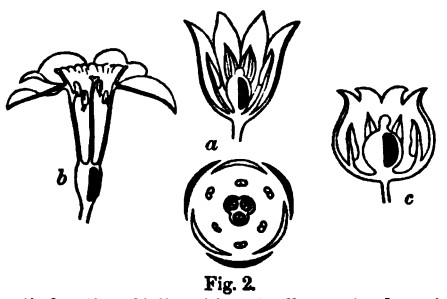


Fig. 2.

a, vertical section of tulip, with parts all separate; *b*, narcissus, with inferior ovary; *c*, lily of the valley (Convallaria), with united perianth and adherent stamens. The floral diagram of the tulip, however, applies to all.

recognised among the Liliaceæ proper? An examination of the orchids or the grasses themselves, still better of the arums, yields a similar result: the floral orchids have their degenerate vegetative types, small, many-flowered, few-seeded, it may be even green; while even the typically crowded and degenerate florets of the arums may recover, as we see by viewing the whole inflorescence, no small measure of floral magnificence. Passing to the dicotyledons we find the same result in reviewing them order by order, often indeed genus by genus (e.g. Clematis, Thalictrum, Delphinium, and Senecio). We thus comprehend the otherwise perplexing fact that of all supposed natural alliances it is that of the Incompletæ which has most broken down, their 'orders' having long been recognised as the degenerate (i.e. vegetative) representatives of many widely distinct orders. The bearing of these considerations upon our theory of variation and consequently upon our general conception of evolution cannot here be entered upon: it must suffice if the existence of order and simplicity amid the infinitude of floral detail has been rendered more apparent.

The problems just now raised will be found more fully discussed under VARIATION, &c.; while for the classification of plants see the articles referred to at VEGETABLE KINGDOM. The structure of the stamen, with the development of its pollen, are naturally described under STAMENS, and the process of fertilisation of the ovule under OVULE; while that deepest interpretation of the flower which compels us to view the phanerogam as not only the most evolved of the cryptogams, but really the most profoundly cryptogamic of them all, is necessarily given under GYMNOSPERMS, since a knowledge of these in relation to the higher

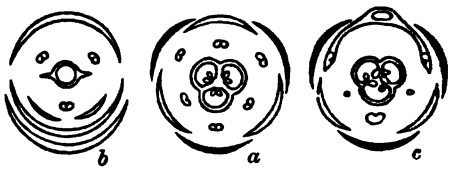


Fig. 3.

a, floral diagram of Liliaceæ; *b*, reduced modification of this usual in Grasses (q.v.); *c*, specialised modification usual in Orchids (q.v.).

cryptogams is indispensable. It remains, however, to glance briefly at the flower from the physiological side, in its adaptations to fertilisation.

Fertilisation of the Flower.—From the frequent separation of the sexes in flowers borne upon the same individual (*monœcism*—e.g. Begonia), or upon different individuals (*diœcism*—e.g. nettle, dog-mercury, red or white campion), it is evident that pollen must somehow be borne from male to female flowers. The artificial assistance of the wind-fertilised Date-palm (q.v.) has been already referred to as indicating some comprehension of the process from immemorial times. The hermaphroditism of most flowers, however, long misled botanists into thinking of the flower as normally fertilised by its own pollen; and so obstinate was this error that even the publication of Sprengel's *Secret of Nature Discovered*, with its wealth of careful observation even supported by accurate figures, failed to dispel it (see BOTANY); and this admirable book fell into oblivion until its rehabilitation by Darwin, followed by Delpino, Hildebrand, Fritz Müller, and many subsequent investigators.

Just as the familiar spores of ferns or horse-tail are scattered by the wind, so it is with the pollen of such primitive flowers as those of Conifers and Cycads (see GYMNOSPERMS). In the cryptogams, however, germination of the spores takes place upon the ground apart from the parent plant altogether; but in the flower, since the female spore or embryosac remains retained within its sporangium or ovule, and this in turn in monocotyledons and dicotyledons (angiosperms) within a carpellary leaf which usually does not even open until the maturation of the fruit (see FRUIT), it is manifest that only those male spores (pollen grains) can be effective which are conveyed to the receptive surface (stigma) of the carpellary leaf, and there

germinate until they succeed in penetrating as far as the ovule and embryosac. Hence the utility of wind or insects for the transport of pollen. In this regard it is evident that the help of spore-eating insects might early have been of service, since spores might readily thus be conveyed adhering to their bodies. It has been already noted (see CHLOROPHYLL) that the colouring matter of flowers, like that of vernal and autumnal leaves, must be associated with phases in the constructive or destructive changes of chlorophyll. Since the reproductive process especially checks those of vegetation, we have here an agency for the production of floral colour, which, by rendering the reproductive shoots more conspicuous to insects, would be constantly aided by natural selection. Upon the latter process, indeed, the customary explanation of the origin of floral colour and markings solely depends. An analogous advantage for the attraction of insects would be given by the overflow as 'nectar' of any excess of the sugary sap so largely used up by the flower itself, or similarly by the disengagement of perfume. A constant adaptation between flower and insect being in such ways established, further specialisations arise. Thus, while in many flowers—e.g. crucifers, the stamens and stigmas are ripe simultaneously, a 'want of time-keeping' is frequently observed, the stamens becoming *protandrous*—i.e. ripening before the stigmas, as typically in Geranium (q.v.), so that self-fertilisation is impossible, and a physiological separation of the sexes (*dichogamy*) is thus insured. Or where the ripening remains simultaneous, two or even three forms of flower (*dimorphism*, *trimorphism*) may occur in different individuals of the same species, so rendering cross-fertilisation by insects indispensable (see PRIMROSE, LOOSESTRIFE). The individual flower may also become peculiarly specialised: thus, the nectary may become so deep as to be accessible only to insects with long proboscis, as bees to the exclusion of flies, butterflies and moths to the exclusion even of bees, it may be even to some particular species only. Birds, too, may replace insects (see HUMMING-BIRD, HONEY-EATER). Mechanical adjustments are also to be found in many of the more specialised types, witness the stamens of the sage, which are rocked forward by the bee on entering the flower so as to dust his back with pollen just where it will be rubbed off upon the stigma of the next flower. The most extraordinary variety and complexity is, however, that presented among the Orchids (q.v.).

How some flowers (e.g. Stapelia, Rafflesia) attract the services of flesh-flies by the odour and even colour of carrion; how others like Arum and Aristolochia may entrap and detain the fertilising insect until well dusted with pollen, are examples which can but be mentioned. Nor can we describe the defences of flowers from rain or from ants, &c. (see, however, CATCHFLY, HEATH, &c.).

In wind-fertilised plants the flowers are usually comparatively small and inconspicuous, but numerous and closely aggregated, often in spikes, heads, or catkins; the floral envelopes are usually small and greenish; one or both whorls are indeed frequently absent (Incompletæ). The stamens are few but often versatile as in grasses, the ovary reduced, commonly only one-seeded, but with one or more styles and stigmas, the latter often exuberantly branched or feathery, so catching the small, smooth pollen. The stigmas are ready before the pollen is shed (*protogynous dichogamy*); and flowering often takes place as in many forest-trees before the development of the leaves. The pollen grains may be lightened with air-sacs as in the pine, may be helped by gravitation as in maize or bulrush, where the male inflorescence grows higher than the female, or may be scattered explosively as in the nettle or artillery plant. The utility of all these special characters of wind-fertilised flowers is thus no less obvious than that of the peculiarities of those dependent upon the visits of insects, and the natural selectionist is hence accustomed to draw from both of these remarkable sets of adaptations many of his strongest arguments for the development of even the most complex organic structures through the cumulative selection of minute spontaneous varieties (see DARWINIAN THEORY). Some facts, however, such as the repeated development of the characters of wind-fertilised flowers in quite unrelated types, seem rather to indicate the possibility of a constitutional interpretation similar to that indicated on the previous page (see VARIATION).

It is thus manifest that the flowers of every species in nature thus invite and reward an observant interest far other than that of the mere collector, systematist, or even morphologist. Further information will sometimes be found under individual headings—e.g. CAPRIFICATION, GERANIUM, VALLISNERIA, &c.; these cannot, however, exhaust the special works upon the subject.

See, for general reference and full bibliography, Müller's *Fertilisation of Flowers* (trans. by Thompson, Lond. 1882); also Kerner's *Pflanzenleben*, Bd. ii. (Leip. 1889); and Hooker's *Students' Flora* (1888). Among popular introductions to the subject those of Lubbock and Grant Allen ('Nature' series, &c.) are well known.

Flower, WILLIAM HENRY, zoologist, was born at Stratford-on-Avon in 1831, served as assistant-surgeon in the Crimea, and afterwards became demonstrator of anatomy at the Middlesex Hospital. He was appointed in 1861 conservator of the Hunterian Museum, in 1869 Hunterian professor of Comparative Anatomy and Physiology, and in 1884 director of the natural history departments of the British Museum. In 1889 he presided over the meeting of the British Association at Newcastle. He is a Fellow of the Royal Society, LL.D. of Edinburgh and Dublin, and has written numerous memoirs connected with anatomy, zoology, and anthropology, as well as a work on the osteology of mammalia.

Flower-de-luce, the old name for the common species of Iris (q.v.), or for the heraldic emblem conventionalised therefrom. See FLEUR-DE-LIS.

Flowering Rush (*Butomus umbellatus*), a monocotyledonous plant usually reckoned under the order Alismaceæ, easily recognised by its large linear three-edged leaves (which are said to cut the mouths of cattle, whence the Greek form of the generic name), and by its umbel of rose-coloured flowers, which Ovid tells us render the plant a special favourite of Flora. The bitter rootstock was formerly officinal, and was also used (as still in some parts of eastern Europe) as a source of starchy flour, and the leaves are sometimes plaited. It is not uncommon in ponds and wet places, and is well worth introduction where such conditions are present.

Flower of Jove (*Agrostemma flos-Jovis*), a pretty caryophyllaceous plant, with heads of purple or scarlet flowers, and leaves silky white with hairs. Other species are common in gardens—e.g. *A. cœli-rosa* (Rose of Heaven), and *A. coronaria*. The genus, also known as Rose campion, owes its technical name to the ancient use of the flowers in crowns and garlands.

Flower-pots are utensils of culture whereby plants are rendered portable at all seasons. They are used in one form or another in all countries where gardening as an art is practised. In Britain and on the Continent they are made in all sizes, from the *thumb-pot* of 2 inches in depth used for potting tiny seedlings and delicate cuttings, to extra large ones of 3 feet to accommodate

large palms, tree-like camellias, &c. Their diameter is usually equal to their depth. They are glazed or unglazed, it being immaterial to their utility whether they are so or not; and are plain or ornamental and artistic according to taste and the purpose for which they are intended. In order to be healthy receptacles for the roots of plants they must be provided with perforated bottoms to admit of the free egress of water from the soil. Saucers are made for all ordinary sizes of flower-pots for use in rooms and other places where drip would be inconvenient or undesirable. The sizes generally in use are made in the neighbourhood of most towns in Britain where suitable clay is to be had; but Weston-super-Mare is the most celebrated place for the manufacture of extra-sized flower-pots.

Flower Sermons are annual discourses founded on some subject connected with flowers. They were first instituted by the rector of the church of St Catharine Cree, London, in 1853. Generally the churches are decked with flowers, which are afterwards sent to hospitals.

Flowers, in Chemistry, is a term originally given by the alchemists to the sublimates which arose, or appeared to grow, from certain bodies capable of undergoing volatilisation when subjected to heat; thus, *flowers of antimony*, *flowers of arsenic*, *flowers of benjamin* or *benzoin*, *flowers of sulphur*, *flowers of zinc*, &c. See ANTIMONY, &c.

Flowers, ARTIFICIAL. Imitations, more or less exact, of natural flowers and foliage are extensively made for the ornamentation of ladies' bonnets, caps, and dresses, for head-wreaths, table and house decorations, and generally for employment where cut flowers and ornamental plants would otherwise be adopted. They possess certain advantages over natural flowers, chiefly from their toughness and durability, but in their use there is an absence of the sentiment which attaches to real flowers. The artificial flower industry is one of very considerable dimensions, but it is subject to great fluctuations owing to the caprice of fashion. It is almost exclusively a French trade, and the value of the exports from that country alone to the United Kingdom amounted in 1883 to £427,000, from which amount the total steadily declined till in 1887 it was less than £200,000.

The materials of which the artificial flowers commonly in use are made are cambric, jaconet, and other fine calico, with sometimes crape, gauze, velvet, and various yarns and threads with wire. Small feathers and portions of feathers, either natural colours or dyed, are also used effectively; and for cheap flowers to be used in public decorations, &c., coloured tissue-paper is employed. The Chinese make excellent artificial flowers from their so-called rice-paper (shola pith), and in the Bahama Islands pretty sprays imitative of flowers are made from small shells.

The petals and sepals of the flowers, as well as the leaves of the plant, are stamped out by punches, or 'irons,' as they are technically termed. A large stock of these irons is necessary, as special forms and sizes are required for each flower. The next process in shaping is that of 'goffering,' or 'gauffering,' by means of which the hollow form is given to petals, and the midrib and veins of leaves are imitated. For hollowing petals the goffering-iron is simply a polished iron ball mounted on an iron wire in a handle. It is slightly warmed, the petal is placed on a cushion, and the iron pressed against the petal. A variety of other forms of goffering-irons are used, such as prismatic rods, bent wires, &c. The venation of leaves is effected by dies made of iron or copper, which are nevertheless called goffering-irons.

The tinting of petals of the best flowers requires some amount of delicacy and skill. In nature, moreover, the tint of each petal of a flower is rarely uniform; and the best artificial flowers represent the natural variations with great accuracy. The petals of a rose, for example, are dyed by holding each separately by pincers, and then dipping it in a bath of carmine, and afterwards into pure water, to give delicacy of tint; but, as the colour is usually deepest in the centre, a little more dye is added there while the petal is still moist, and this diffuses itself outwards in diminishing intensity. The whiteness at the insertion of the petal is produced by touching that part with pure water after the rest is dyed.

Leaves are cut and stamped in like manner from green taffeta, cambric, calico, &c. The glossy upper surface is represented by coating the taffeta, &c., from which they are stamped, with gum-arabic; and the soft tone of the under side is obtained by means of starch coloured to the requisite shade, and brushed on when of the right consistency to dry with the proper effect. A velvety texture is given by dusting the powdered nap of cloth, which has been previously dyed of the required colour, over the gummed leaf, the gum having been allowed to partly dry till it has become 'taccy.' The superfluous portion of nap is then shaken off. Buds are made of taffeta, tinted, and stiffened, and stuffed with cotton. Stamens are made of short pieces of sewing silk stiffened with gelatin, and when dry the ends are moistened with gum and dipped in flour coloured yellow to represent the pollen. Fine wire is sometimes used for the filament of the stamen.

The flower is built up from the centre: the pistil and stamens are tied in a bunch to a piece of wire; the petals are arranged in order, and pasted; then the sepals of the calyx are pasted outside of these, and further secured by winding fine thread or silk round the lower parts. Other wires are enclosed with this thread, and form the stalk, which is bound round with green tissue-paper; and at proper intervals the leaves are inserted by means of fine wires to which they are bound, the ends of these wires being bound in and incorporated with the stalk, and concealed by the green paper.

Flowers suitable for mourning are prepared by coating leaves, flowers, &c. with strong gum, and then dusting upon them powdered galena, a natural sulphide of lead, which gives the surface over which it is spread a sombre, dark-gray, metallic lustre. Flower wreaths for memorials on tombs are now largely made of pottery ware, and to a smaller extent of enamelled or painted iron. Very delicate and graceful imitations of flowers for memorials and for decorations are also moulded in wax; but these industries do not come within the range of what is known as the artificial flower trades.

Flowers, FLORISTS', are those numerous forms of flowering plants which, having an inherent tendency to vary in the colour and size of their flowers and in habit when reared from seed, have received special attention in cultivation and in selection with the view of bringing their floral qualities up to ideal standards of excellence formed by the common consent of florists for each particular variety. Thus, for instance, the pansy, one of the most familiar of florists' flowers, is in all its wonderful variety the progeny of *Viola tricolor*, a widely distributed native of Britain. Its natural tendency to seminal variation rendered it a very facile subject in the hands of the florist, as may be seen by comparing the puny, unequal, and flabby flowers of the natural forms of the species with the large, circular, substantial, and brilliantly coloured blooms of the florists' varieties. This has been

achieved by the intelligent application of the principle of selection, the object being the attainment of a given ideal respecting the size, form, substance, and colour of the flowers. The petals are the only parts affected in this case; they are enlarged in breadth and length, their substance or thickness is increased, and their outline is rendered more symmetrical, but the other organs of the flower are not changed. As with the pansy, so it has been with every other kind of plant bearing single flowers in the florists' category. It is different with those kinds whose flowers are double, such as the carnation, anemone, hollyhock, ranunculus, rose, &c. In these the essential organs of the flowers have been wholly or partially metamorphosed into petals. But the so-called double flowers of dahlias, chrysanthemums, and other forms of the natural order Compositæ are not really double in this sense; the fertilising organs are not changed to petals in their case; but the tubular florets of the disc assume the strap-like shape of those of the ray, and hence the semblance of double flowers in such cases.

The Dutch were the first among European nations to cultivate systematically florists' flowers: to them is due the merit of having brought the Tulip (q.v.), the hyacinth, the anemone, the ranunculus, and the rose to the high degree of perfection their numerous varieties now present. The French florists have also had a large share in the improvement of the three last-named classes. British florists have distinguished themselves more particularly in the production of auriculas, polyanthus, the phlox, pentstemon, carnation, pink, hollyhock, dahlia, pansy, pelargonium, &c. But the Chinese and Japanese appear to have fostered the culture of many flowers in the same way as the European florists, long prior to the latter having done so. Camellias, azaleas, and tree-peonies were some of their favourite florists' flowers long before Europeans had much intercourse with the Chinese.

New varieties are obtained chiefly from seeds, but some also are obtained by *sports*, which, in the language of the florist, mean freaks of nature. Thus, the flowers on a certain shoot of a plant may perhaps exhibit features of a kind novel and distinct from those of the parent, and the variety, if worthy of being perpetuated, is propagated by cuttings or by grafting, according to the mode best adapted to the kind. If the variation becomes *fixed* or permanent a new sort is thereby obtained without direct seminal intervention; but this does not always follow, although a keen florist will never allow such an opportunity to escape without an attempt to improve it. Varieties of special merit in any class of florists' flowers can only be perpetuated by cuttings, layering, grafting, or division, because they cannot be relied upon to reproduce themselves from seed.

Flowers, LANGUAGE OF. Around many flowers a consistent and well-understood symbolism has gathered, but the Orientals have developed this into a perfect vehicle for communicating sentimental and amatory expressions of all degrees of warmth. Still further complexity is added by the habit of employing flowers the Turkish or Arabic names of which rhyme with the other really significant words. 'There is no colour,' says Lady Mary Wortley Montagu, 'no flower, no weed, no fruit, herb, pebble, or feather, that has not a verse belonging to it; and you may quarrel, reproach, or send letters of passion, friendship, or civility, or even of news, without even inking your fingers.' Our own floral symbolism is much more direct, simple, and really poetical, being nearer what is revealed to the inward eye of a Chaucer and a Wordsworth than all the whimsical and ingenious fancies of the East. Leaving aside all floral badges attached to particular families or clans; and all national heraldic associations, as of the rose with England, the thistle with Scotland, the shamrock with Ireland, the lily with the ancient crown of France; as well as all special historical signification arbitrarily attached to any flower, as the red and white roses of Lancaster and York, Napoleon's violet, or Lord Beaconsfield's primrose; we may say that everywhere the laurel is the symbol of glory: the olive, of peace: the rose, of love and beauty: the violet, of faithfulness: the daisy and white violet, of innocence: the rosemary, of remembrance: the amaranth, of immortality: the asphodel, of death and the unseen world: the weeping-willow, yew, and cypress, of mourning. So surely as the orange-blossom is proper to marriage does the finding of white heather betoken good-fortune to come, while the future chances of love may be revealed from the marguerite and poppy by a simple method of divination. Again, the almond expresses hope: the lily of the valley, unconscious sweetness: the white Julienne and the wallflower, love faithful in spite of adversity: the anemone, sickness: the primrose, early youth: the cyclamen, diffidence: and the arum or wake-robin, ardour. The turnip is strangely said to symbolise charity, while more naturally the young Persian offers his affection by the gift of a tulip. Neither the baneful properties attached to some plants, as the hemlock, belladonna, and mandrake; nor the magical qualities of the rue, the rowan, the elder, the thorn, the mistletoe, vervain, or valerian, fall to be discussed here; nor yet the old doctrine of Signature (q.v.), according to which plants bore certain marks indicating for what diseases they were medicinally useful. See John Ingram's *Flora Symbolica: Language and Sentiment of Flowers* (1882). For Flower-lore, see in the article Plants, PLANT-LORE.

Fludd, ROBERT, an English physician and mystic, born at Milgate in Kent in 1574. After studying at Oxford, he spent some years travelling on the Continent, where he became acquainted with the writings of Paracelsus. On his return to England he settled as a physician in London, where he died in 1637. Fludd (Lat. De Fluctibus) was the author of a theosophic system, the distinguishing features of which were the conception of man, the microcosm, as an analogy, in a physico-spiritual sense, of the universe or macrocosm, and the belief that the laws of the physical universe were dominated by two fantastic principles called the 'northern or condensing power,' and the 'southern or rarefying power.' His views called forth adverse criticisms from Gassendi, Kepler, and others.

Flue. See CHIMNEY, WARMING.

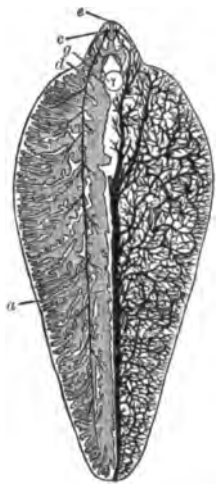
Flügel, JOHANN GOTTFRIED, German lexicographer, born at Barby in 1788, travelled as a merchant to North America, and in 1824 was appointed *lector* of the English language at Leipzig, where in 1838 he became United States consul, and in 1848 agent in Germany for the Smithsonian Institution. He died June 24, 1855. With J. Sporschil he edited a German-English dictionary (3d ed. 1848), and he assisted in the preparation of a *Praktisches Wörterbuch der englischen und deutschen Sprache* (11th ed. 1883). He also published a series of commercial letters in German and English (9th eds. 1873 and 1874), and other kindred works.

Fluid. In a solid body the constituent particles never move far from a certain position of equilibrium. In a fluid the particles can move about with greater or less freedom from one part of the body to another. All liquids, vapours, and gases are therefore known as fluids. All fluids are perfectly elastic; but liquids are highly incompressible, while gases can easily be compressed. In every actual

fluid there is more or less frictional resistance to the molecular motions; but it is often advantageous to consider theoretically the properties of frictionless, or, as they are called, 'perfect' fluids.

There is no sharp distinction between the solid state and the liquid state. Much depends upon external circumstances, such as temperature or the intensity of gravity. Some substances splinter under the action of sudden intense stress, while they flow like viscous liquids when exposed to long-continued gentle stress.

Fluke (*Fasciola* (or *Distomum*) *hepatica*), the parasitic worm which causes the 'liver-rot' of sheep. It belongs to the class of Trematodes (q.v.), and to a large genus of about three hundred species, if the two titles Fasciola and Distomum be regarded as identical. The adult fluke, which occurs in numbers in the bile duct of the sheep and other domestic animals, has a flat, oval, or leaf-like appearance, the broader end being anterior. It usually measures nearly an inch in length by half an inch across at its broadest part. The colour varies from reddish-brown or orange at the sides, to grayish-yellow, sometimes with dark spots, in the middle. There are two suckers, as the word Distomum suggests—one at the head end, perforated by the mouth; the other imperforate, on the ventral surface, also in the middle line, a little farther back. The internal structure is complex. There is a much branched blind alimentary canal penetrating the whole animal, which is without any distinct body-cavity; the nervous system consists of a ganglionated ring round the beginning of the gut, with nerves running fore and aft; there are no sense organs, though the larva has eye-spots to start with; the muscular system is well developed; the excretory system consists of two very much branched vessels opening at a posterior pore; the reproductive system is hermaphrodite, and exhibits a complex division of labour.



Fasciola hepatica, from the ventral surface (after Sommer):

The alimentary and nervous systems only are shown on the left of the figure; the excretory system alone on the right side; *a*, right main division of the alimentary canal; *c*, lateral ganglion; *d*, lateral nerve; *e*, mouth; *g*, ventral sucker.

Life-history.—The history of the fluke is happily an intricate one and full of hazards. The ova are probably fertilised by male elements from the same animal, a very unusual occurrence, all but exclusively restricted to certain parasitic flat-worms. The eggs are furnished with nutritive capital from a yolk gland, are surrounded by a shell, and begin to develop a little within the parent animal. After extrusion from the latter they may be found in the bile ducts in enormous numbers, each fluke being said to produce about half a million. Such prolific multiplication is a very frequent characteristic of parasitic animals, and is probably associated with the abundant and at the same time stimulating food. Its utility in securing the continuance of the species in face of the numerous risks of failure is obvious. From the bile duct of the sheep the segmented ovum enclosed in its shell passes to the exterior. The embryo develops for two or three weeks, and the successful result eventually becomes free in water. It swims for some hours by means of a covering of cilia, but its sole chance of life appears to lie in meeting and attaching itself to a small water-snail (*Limnæus truncatulus*), into which it bores its way. Having established itself, the embryo fluke loses its cilia, and is metamorphosed into what is called a *sporocyst*. This may divide transversely into two; but usually certain cells within the sporocyst behave like parthenogenetic ova, and develop into a fresh generation or several generations known as *rediæ*. The rediæ burst out of the sporocyst, and migrate into the liver or some other part of the snail, killing their host if they are very numerous. Like the sporocyst, they give rise internally to more embryos, of which some may be simply rediæ over again, while others develop into tailed embryos or *cercariæ*. These emerge from the rediæ, wriggle out of the snail, swim freely in the water, climb up grass stems or such like, swing their tails off, and encyst. If the encysted cercaria on the grass stem be eaten by a sheep it grows into the adult and sexual fluke. To recapitulate, the developing embryo becomes a free-swimming form; this bores into a snail and changes into a sporocyst; from certain cells of the latter asexual rediæ arise; these eventually give origin in a similar way to tailed cercariæ, which, eaten by a sheep, grow into flukes. There are thus several asexual generations interrupting the ordinary sexual process, illustrating what is known as 'alternation of generations.' The asexual process usually takes place by special cells, but there may be likewise transverse division of the sporocyst. The above history has been independently worked out by Leuckart and Thomas.

Practical Importance.—The disease of liver-rot in sheep is widespread and disastrous, killing, it is said, not less than a million per annum in the United Kingdom. It is especially common after wet seasons, and in low, damp districts. The external symptoms are described as 'emaciation, tenderness in the loins, harshness and dryness of the wool, and a scaly condition of the skin.' The preventives suggested are drainage of pastures and dressings of lime or salt; destruction of eggs, infected manure, and badly fluked sheep; giving the sheep salt and a little dry food. The same fluke occurs in other ruminants, and rarely in man. A related form, *Distomum lanceolatum*, has a similar distribution, and not a few other species have been reported as rare human parasites. The genus Bilharzia (q.v.) is not far removed. Other parasites, as of Fishes (q.v.), are likewise called flukes.—See also ANCHOR, FLOUNDER.

See PARASITIC ANIMALS, TREMATODES; also Leuckart, *Parasiten des Menschen* (1863; new ed. 1879 *et seq.*, trans. by Hoyle; Thomas, *Quart. Jour. Micr. Sci. XXIII.* (1883); W. E. Hoyle, *A General Sketch of Trematoda* (Edin. 1888).

Fluorescein. See DYEING, page 141.

Fluorescence is the term applied to a peculiar blue appearance exhibited by certain substances exposed to sunlight, and especially observable in a dilute solution of sulphate of quinine. See PHOSPHORESCENCE.

Fluorine (sym. F, eq. 19) is an elementary substance allied to chlorine. Its principal natural source is the mineral fluor spar, CaF, although it is also found in minute quantities in the igneous rocks, natural waters, plants, the bones and teeth of animals, as also in milk, blood, &c. All attempts to isolate fluorine in vessels of glass, gold, platinum, &c. have failed owing to its powerful action on these substances and the readiness with which it forms compounds with them. Recently, however, a vessel of an alloy of platinum and iridium has been used, and the pure substance obtained (1888). It is a gas having properties similar to those of chlorine, but differing in energy of action. The compounds

of fluorine are not numerous, but are important. *Hydrofluoric acid*, HF, is generally prepared by heating gently in a lead still a mixture of one part of fluor spar, CaF_2, with two parts of sulphuric acid, H_2SO_4, when the vapours of hydrofluoric acid, HF, are evolved, whilst sulphate of lime, $CaSO_4$, is left in the still. The dense acid vapours are conducted through a lead pipe into a lead receiver or bottle surrounded by a freezing mixture of ice and common salt. The acid is generally mixed with water when desired to be kept for some time. When the most concentrated hydrofluoric acid is required, the still and receiving vessel must be made of platinum. The other metals are not suitable for such apparatus, as they are rapidly corroded by the acid. When prepared in its strongest form, hydrofluoric acid has the density of 1·060, and is a colourless, fuming liquid of great volatility, which boils at 60° (15·5° C.). Not only does hydrofluoric acid corrode and dissolve the ordinary metals (excepting lead and platinum), but when placed on the skin it produces a severe burn owing to its caustic nature. The most important property which hydrofluoric acid possesses is its power of eating into and dissolving glass, which admits of its application in the etching of characters upon glass, as in thermometer tubes, and for eating away greater or less thicknesses of plates or sheets of coloured glass, so as to produce a variety of shades. See GLASS, and GLASS-(PAINTED).

Fluorotype, a photographic process in which salts of fluoric acid were employed for the purpose of producing images in the camera; but, as the impression was not very strong, the plate had to be afterwards steeped in a weak solution of protosulphate of iron. The process was first suggested by Robert Hunt in 1844.

Fluor Spar, or FLUORITE, a mineral which has been often described as chemically *fluate of lime*, a compound of fluoric (hydrofluoric) acid and lime, but which is in reality *calcium fluoride*, $CaFl_2$, consisting of 48·72 calcium, and 51·18 fluorine; occasionally it also contains some calcium chloride, and now and again organic matter, which is sometimes so abundant that when the mineral is struck with a hammer it emits a fetid odour—hence the name *fetid-spar* (Ger. *stink-fluss*). Fluor spar occurs both crystallised and massive, the massive varieties exhibiting a crystalline structure; the crystals appear usually in groups, sometimes of the primary form, which is a cube, but often of secondary forms, of which there is great variety, as the octahedron, rhombic dodecahedron, &c. Fluor spar is sometimes colourless, but often green, blue, yellow, or red, more rarely gray, or even black, different shades of colour frequently appearing in the same specimen, and in the massive varieties beautifully intermixed. Its colours often rival those of the most beautiful gems; but it is of very inferior hardness, being scratched even by quartz. Its specific gravity is 3·15 to 3·20. It generally becomes phosphorescent when heated, although this is more remarkably the case with some varieties than with others; it is decomposed by heated sulphuric acid, with evolution of hydrofluoric acid as a pungent gas; and, this having the property of acting upon and corroding glass, fluor spar is used with sulphuric acid for etching on glass. Fluor spar is also used for ornamental purposes, being wrought into vases, &c., for which it was in high esteem among the ancients. But the greater abundance in which it is now obtained has diminished the value of ornaments made of it. It is very commonly associated with ores of tin, silver, lead, and copper, occurring chiefly in veins, but is also found by itself in drusy cavities in granite and in veins in crystalline schists, slate, limestone, and sandstone. It has been met with also in volcanic tuff in Italy and in cannel coal in the United States, where it is limited to two districts in Illinois and Indiana. It is found only in a few places in Scotland, and in insignificant quantity, but is nowhere more abundant than in England, particularly in Derbyshire and in Cornwall. In Cornwall it is used as a flux for reducing copper ore. In Derbyshire the blue massive variety is known to the miners as *Blue John*. The manufacture of ornaments of fluor spar is carried on to some extent in Derbyshire; and fluor spar is often called Derbyshire spar.

Flushing (Dutch *Vlissingen*), a strong fortress and seaport of the Netherlands, in the province of Zealand, is situated on the south coast of the island of Walcheren, at the mouth of the Western Scheldt, which it commands. Formerly an important naval station, it was converted into a commercial harbour in 1865–73, and carries on an active trade with Java, England, and South America. A daily service of steamers connects Flushing with Queenborough (Kent) in England; the passage lasting eight hours. There is a royal dockyard here; and, since 1875, a large floating-dock. The inhabitants (12,565 in 1888) are occupied mainly in shipping pursuits. The town capitulated to the Earl of Chatham in 1809.

Flushing, a post-village of Long Island, on Flushing Bay, a branch of Long Island Sound, about 9 miles E. of New York city by rail. It has large nurseries and gardens, an academy, convent, seminary, and private asylum. Pop. (1890) 10,868.

Flustra, or SEA-MAT (q.v.), one of the commonest genera of marine Polyzoa (q.v.).

Flute (Fr. *flûte*, Ger. *flöte*, Ital. *flauto*), one of the oldest of wind-instruments, which originally had several varieties: one, in more modern times called *flûte à bec*, now developed into the Flageolet (q.v.); another, which was sounded by means of a hole in the side like the modern flute; and a third, used by the ancient Egyptians, in which the sound was produced by blowing into the open end of the tube. A modification of this last instrument is used still by the peasantry along the Nile.

The modern cone-bore flute consists of a tapered tube, in which the sound is produced by blowing with compressed lips into a large orifice near the top or wider end, which is stopped with a cork. Six holes in the lower end, to be covered by the first three fingers of both hands, serve to make the scale, supplemented by keys numbering from one to fourteen. The flute is what is called an octave-scaled instrument—i.e. by covering all the holes and lifting the fingers one by one in regular order, beginning at the bottom, the notes from D below the stave to C♯ are made; then, by repeating this process and blowing a little sharper into the mouth aperture, the same notes, *an octave higher*, are produced. Another octave can be produced by cross-fingering, the total compass being about three octaves. Two additional keys at the bottom of the tube, worked by means of levers by the little finger of the right hand, give the notes C♯ and C♮ below the stave.

The faults of this flute are that, as the holes must be placed where the fingers can reach them, they are not always in the exact places to be perfectly in tune, and the notes are not equal in quality. To meet these defects the flute has undergone more changes and improvements in modern times than any other musical instrument. The most important of these have been the cylinder bore and the system of fingering introduced by Theobald Bœhm in 1832, and patented in England by Rudall and Rose in 1847. The modern cylinder flute, from the head downwards, is cylindrical, or all one width of

bore, while the head-piece has a slight parabolic taper, and when combined with the Bœhm fingering it forms a nearly perfect instrument, with all the notes in tune and of practically equal quality of tone. The holes are placed where they make the correct notes, and to facilitate manipulation they are stopped by means of keys which can be worked conveniently by the fingers. The fingering of the scale on the Bœhm flute is quite different from the ordinary flute; and many other modified systems, more or less founded on the old, have been devised, among which may be mentioned those of Siccama, Clinton, and Carte. It would occupy too much space to describe their methods in detail. The general appearance of the Bœhm cylinder flute may be seen in the figure.

Flutes are usually made in cocoa-wood, ebonite, silver, and gold, and vary in price from a shilling or two to about £180 for one made in 18-carat gold. The Bœhm flute is very often made in silver, which is easily sounded and gives a fine liquid tone; it costs about 30 guineas. The ordinary cocoa or ebonite Bœhm flute costs from 18 to 30 guineas, according as it is mounted in German silver or silver. Except for military flutes, which are still made conical, the cylinder has almost completely superseded the cone bore.

The flute described above is what is known as the concert flute; but flutes are also made in a variety of smaller sizes for various purposes in E♭, F, B♭, and C; there are also D, E♭, and F piccolos or octave flutes, which are much used in modern orchestral music. In construction, however, they are all much alike, and need not be further described. A bass flute, too, is sometimes used, the Bœhm variety being simply a large flute, 32 inches long and 1 inch in diameter, and having a compass from the upper G of the bass stave upwards. Also, see FIFE.

The concert flute, from the sweetness of its tone and the comparative simplicity of its execution, is extremely popular as an amateur instrument, and a great variety of music is published arranged for flute and pianoforte; and, as it plays the same notes as the voice and piano, it can be made useful in all kinds of music. The flute is made great use of in classical music; Bach, Haydn, Handel, Mozart, Beethoven, Mendelssohn, and all the later writers giving it a leading part in their works; while Quantz, Kuhlan, and many others devoted themselves almost specially to writing for it. See T. Bœhm's *Essay on the Construction of Flutes*, and C. Welsh's *History of the Bœhm Flute* (Rudall, Carte, & Co.).—For the 'flute' stop, see ORGAN.

Flute-mouths (*Fistularidæ*), a family of marine fishes, nearly allied to sticklebacks, remarkable for the elongation of the front bones of the head into a pipe bearing the small mouth at its apex. They live near the shore, and are widely distributed in the warm parts of the Atlantic and Indo-Pacific. There are but few species—e.g. *Fistularia tabaccaria*, and *Aulostoma chinense*. The Snipe-fish or Trumpet-fish (q.v., *Centriscus scolopax*) belongs to an allied family (Centriscidæ).

Fluting, the mouldings in the form of hollows or channels cut vertically on the surface of columns. The idea is supposed to have been originally derived from the bundles of reeds tied together which formed the early columns of the Egyptians. Flutes were adopted by the Greeks as ornaments to their Doric, Ionic, and Corinthian columns, and were retained by the Romans in their architecture. The Tuscan is the only style without flutes. In Doric (fig. 1) there are twenty flutes on the circumference, and the curves meet with a sharp edge.

Fig. 1.

Fig. 2.

These curves are supposed, in Greek Doric, to be elliptical, and they are carried up across the necking to the base of the cap. In the other styles there are twenty-four flutes on the circumference (fig. 2). These are semicircular and separated by a small fillet, and, before reaching the necking and the base, are terminated with semicircular top and bottom.

Flutes are said to be cabled when they are filled in to about one-third of their height from the base with a convex bead. This is done to strengthen the column and protect the flutes. In countries where Roman remains are abundant, as in the south of France, fluting was sometimes adopted by the early medieval architects, as at Arles and Autun. In Italy also traces of this decoration are visible during the middle ages; but the flutes are not limited to the vertical form—in Romanesque Architecture (q.v.) they assumed many varieties of forms, such as curves, zigzags, &c., twisting round the shafts.

Flux (Lat. *fluxus*, from *fluo*, 'I flow'), a discharge generally from a mucous membrane. The term is applied more or less frequently to all preternatural fluid evacuations from the body, but especially to those from the bowels and from the uterine organs. Dysentery (q.v.) was long termed the bloody flux to distinguish it from simple diarrhœa. See also CATARRH, DISEASE, MEDICINE.

Flux is the term given to the substances employed in the arts to assist the reduction of a metallic ore and the fusion of the metal. *White flux* is an intimate mixture of ten parts of dry carbonate of soda and thirteen parts of dry carbonate of potash, and is mainly instrumental in removing siliceous impurities by combining with the silica to form a fusible glass; *black flux* is prepared by heating in close vessels ordinary cream of tartar (bitartrate of potash), when an intimate mixture of finely-divided charcoal and carbonate of potash is obtained. The latter flux, when mixed with finely-divided metallic ores, and the whole raised to a high temperature in a furnace, not only is useful in removing the silica by the action of the carbonate of potash as above described, but the charcoal withdraws the oxygen from the metallic oxide and causes the separation of the pure metal. Limestone is employed as the flux in the smelting of iron ores. Its action is similar to that of soda and potash, and it is used because it is so much cheaper. Fluor spar, borax, protoxide of lead, and other basic substances are also used for fluxing. See IRON, COPPER, &c.

Fluxions. The method of fluxions and fluents was the name given after Newton to that branch of mathematics which with a different notation is known after Leibnitz as the differential and integral calculus. Newton, representing quantities in the

manner of Euclid and others by lines, looked upon them not with Leibnitz as made up of very small parts, but as described by a continuous motion. 'From considering,' says Newton in the introduction to his *Tractatus de Quadratura Curvarum* (1704—the first formal exposition of fluxions published), 'that quantities increasing in equal times and generated by this increasing become greater or less according as the velocity with which they increase and are generated is greater or less, I was in quest of a method of determining quantities from the velocities of the motions or increments with which they are generated; and naming the velocities of the motions or increments *fluxions*, and the quantities generated *fluents*, I came little by little in the years 1665 and 1666 upon the method of fluxions.' Instead of referring the rate of change of a dependent variable y directly to the independent variable x, as in the differential calculus, the method of fluxions refers each to time (t) considered as a uniformly flowing quantity. Thus, the fluxions of y and x, denoted by $\dot{y}$ and $\dot{x}$, correspond to $\frac{dy}{dt}$ and $\frac{dx}{dt}$ respectively. The fluent of any quantity, say y, was denoted sometimes by $|\overline{y\dot{x}}|$, sometimes by y'. The notation adopted by Newton was on the whole clumsy, and has been abandoned for that of the differential calculus. In the method of fluxions the notions of prime and ultimate ratios take the place that limits hold in the differential calculus. The most logical and complete, as well as the most bulky, treatise that has ever appeared on fluxions is that by Colin Maclaurin (Edin. 2 vols. 4to, 1742; 2d ed. 2 vols. 8vo, 1801). For other information, see the article CALCULUS.

Fly, a popular name best restricted in its simplicity to the insects forming the order Diptera, but often so widely used with a prefix—e.g. butterfly, dragon-fly, may-fly—as to be virtually equivalent to insect. The flies properly so called have two delicate, unfolded wings with predominant longitudinal veins, hind wings modified into balancers (*halteres*) or rarely absent, and mouth parts in general adapted for sucking. The larva is usually a legless maggot, or has secondary 'false' legs. Gnats, mosquitoes, midges, crane-flies, gall-midges, breeze-flies, blow-flies, bot-flies, forest-flies, and house-flies are common Diptera noticed separately.

Fly, a river of New Guinea, rising in the north-west corner of the British portion of the island; after making a curve westwards into Dutch New Guinea it flows south-east, and pours its waters into the west side of the Gulf of Papua, forming at its mouth a wide delta. First ascended by MacFarlane and D'Albertis in 1875 to a distance of about 90 miles, it was explored in 1885 by Captain Everill for 200 miles, to a point at which it is joined by a large tributary coming from the north-east, more than 300 miles long. The banks of the Fly are densely wooded.

Fly-catcher, a name applicable to any of the numerous birds which make up the Passerine family Muscicapidæ. The family includes a large number (over 40 genera and 280 species) of usually small-sized and often brightly coloured forms, very abundant in the warmer parts of the Old World and Australia, scarcer in temperate and colder regions, and wholly absent from North and South America, where they are represented by the Tyrant-shrikes or Tyrannidæ. The nature of the bill is a distinctive feature; it is strong, short, and somewhat swallow-like, laterally compressed towards the slightly hooked point, and with bristles on the broad and flat basal portion. The common British Fly-catcher (*Muscicapa grisola*) is a tiny brownish-gray bird, which reaches our shores from Africa in early spring, and leaves again with its brood in autumn. The upper surface is mouse-coloured, the under side is whitish, with brownish-gray longitudinal spots. Its cry is a monotonous chirp; its habit, like that of its neighbours, is jerkily active. It remains quietly seated till an insect is observed, makes a successful dart, and

Spotted and Pied Fly-catchers (*Muscicapa grisola* and *M. atricapilla*).

returns to its perch. In nesting it is nowise shy; a beam in an outhouse, the side of a timber-stack, the branch of a tree trained on a building, and even a lamp-post are among the sites recorded. The parents have been seen to visit their nest with food for the young not less than 537 times in a single day, which indicates a marvellous quickness of movement and adroitness in food catching. The Pied Fly-catcher (*M. atricapilla* or *luctuosa*), with different colour, is common in south Europe, and has been recorded in Britain. There are ten other species in Europe and Africa. Among the other fly-catchers outside the genus Muscicapa are the Fantails (Rhipidura), with spreading tails, in oriental and Australian regions; the beautiful long-tailed Paradise Fly-catcher—e.g. *Terpsiphone paradisi* of the East Indies; the important genus Myiagra of Australia and the Moluccas; the interesting Australian 'Grinder' (*Seisura inquieta*), which 'hovers' like a kestrel, descends rapidly to the ground upon insect prey, and emits a curious noise (comparable to that made by a grinder at work) just before alighting, or when poising a few feet from the earth.

Flying, or FLIGHT, is the locomotion of an animal in the air by means of *wings*, organs specially adapted to that purpose. By means of these organs the animal raises itself from the ground and sustains itself in the air, as well as moves forward in any direction it desires. Birds and bats are the only existing vertebrate animals possessing the power of true flight; the lateral membranes of flying squirrels, flying lemurs, flying phalangers, &c. sustaining those animals in the air after the manner of the paper dart familiar to schoolboys. This toy is a folded, pointed arrangement, having this section $\overline{\vee}$, which, when projected from the hand with some force, will travel through the air for several yards. Flying-fishes, which possess enormous pectoral fins, are also sustained in the air for short flights on the same principle—rising and falling over the waves by means of the upward air-currents induced by the curved surfaces presented by the waters below. Examination of a

bird's wing—so different from that of an insect—will at once show that the mechanism of its flight is also different. The wing exhibits various curves, from its inner part where it inclines downwards to its tip, which is horizontal and sometimes turned upwards. Dr Pettigrew has endeavoured to show that all natural wings are screws, and that when vibrating they twist in opposite directions during the up and down strokes. Professor Marey points out the fallacy of this theory, and urges that the alternating movement of the wing cannot fairly be compared to the action of a screw. For, although we may admit that the wing revolves on an axis, its rotation is only a fraction of a turn, and is followed by the reverse action. This reversal in a screw would destroy the effect of the previous movement, just as the reversal of the movement of a ship's propeller will cause it to go backward instead of forward. A bird's flight is dependent upon mechanical laws; but there has always been a difficulty found in explaining it by those laws on account of the great rapidity of movement exhibited by birds when flying. We are, also, in ignorance of the exact amount of supporting power offered by the air to swiftly moving bodies of particular form. But form, we know, must play an important part in this aspect of the matter, as we find in the extreme cases of the fall of a solid round bullet and that of the same amount of lead beaten out into the form of a sheet. Hence many theories have been put forward to explain the flight of a bird, including the absurd notion that the bones and quills are charged with a light gas, such as hydrogen. It is obvious that there are marked differences in the mode of flight of different birds; some, like the humming-birds, progressing through the air by short and rapid strokes of the wings; whilst others—including the larger birds—combine such movements alternately with a period of apparent rest, when, with outstretched wings, they seem to sail along without any movement of the pinions whatever. This question of the 'sailing' of birds has given rise to much discussion, some averring that they have seen birds rising and remaining in the air for long periods without any movement of the wings. It is certain, however, that such periods of rest cannot be possible without an initial impulse by means of wing action, or by means of the impetus which would result from an oblique downward movement. We must also remember that the alleged stillness of the bird may be only apparent, and that the wings may be subject to slight variations of position which will enable them to take advantage of helpful currents in the atmosphere. We may take it for granted that a bird cannot 'sail' in perfectly still air for any long period, for such a power would be contrary to the natural laws with respect to falling bodies.

It may be assumed that in all creatures possessing the power of true flight the same principles are involved, although the movements vary with differences of form and structure. These movements have been subjected to careful analysis; but it must be admitted that the earlier investigators formed their conclusions more upon conjecture than upon direct experiment. Professor Marey, the eminent French physiologist, seems to have been the first to cause these movements to make their own records, which he did by carefully constructed apparatus, the principle employed being the same as that adopted in the sphygmograph and other modern instruments, in which a point in direct connection with the moving part is made to trace a line on a blackened (smoked) surface. The same investigator was also the first to apply (in 1882) the photographic method to this field of inquiry. By means of a camera of special construction, which he called a photographic gun—for it was aimed at a flying bird like a fowling-piece—he was able to secure twelve different images of the bird on one plate in a single second of time; whilst by means of a chronographic attachment the duration of each movement was ascertained. He noticed in this way in the case of a flying gull four typical movements of the wings, which were repeated three times in one second. By placing the photographs thus obtained in a phenakistiscope attached to an optical lantern he was able to combine the successive images upon a screen and reproduce the movements of flight. These pictures were little more than outlines or silhouettes; but under the microscope sufficient details of the feathers could be detected to enable Professor Marey to draw from their appearance certain conclusions. He states that each feather has a proper and independent motion, and that whilst they are brought closely together during the downward motion of the wing, they are somewhat separated and placed on edge during the return movement, so as to offer to the air as little resistance as possible. But he was forced to admit that such experimental photographs must be greatly multiplied, and taken with birds of various kinds in different positions with regard to the camera, before the study of flight could be made thoroughly complete. In 1884 further advances in photographic methods, and more especially the perfection to which the manufacture of rapid dry plates attained, enabled Anschütz in Germany to obtain photographs of birds in flight of a far more perfect character. These were so complete from an artistic as well as a scientific standpoint that they exhibited plainly the details of every feather on the flying bird. This inquirer had a concealed camera above a pigeon-house, and later on had the opportunity of making constant photographs of a stork's nest from a similar point of vantage. The photographs taken showed the parent birds (1) in flight, (2) hovering above the nest, (3) departing from it, and (4) arriving at their home. They fully corroborated the observations previously made by Marey.

Flight of Crested Heron, 10 images per second (after Marey).

The common argument, that because man has obtained such complete mastery of the ocean he should also be able to navigate the air, is fallacious, and can only be advanced by those who fail to comprehend the vast difference which exists between the two media. Air is compressible to an extraordinary degree—is elastic, and will offer little resistance or recoil if struck. Water, on the other hand, is almost incompressible—is inelastic, and offers such recoil if struck that a swimmer in diving from a height will suffer serious injury from contact with its surface, unless he take proper

precautions. We must remember, moreover, that a ship on the water is supported thereon without any need of energy, except to provide means for its propulsion. A flying creature, on the other hand, must be endowed with power to counteract the effects of gravitation, as well as to propel it through the air. It has been well shown by Dr Pettigrew how nature varies the travelling apparatus of different animals according to the medium in which the creature is destined to move. And he gives as illustrative examples the bull with comparatively small feet adapted for land; the turtle, with far larger travelling extremities adapted for water; and the bat, with immense wings in proportion to its size, for flight in air.

It is natural that man should from the very earliest times have endeavoured to fly, and the history of many countries records the various attempts that have been made in this direction, which attempts have always ended in ignominious failure. The balloon is but a thing of yesterday compared with the numberless devices which have been suggested and contrived to enable men to imitate birds in their passage through the air; for the balloon can boast of little more than a hundred years of existence, while these attempts at flight have been going on for thousands of years. It must be admitted, however, that the problem is no nearer solution to-day than it was at its first inception. It is true that we understand the principles of flight better than our forefathers did, and that we have at command new materials and methods of construction which they knew not of. Yet with all these advantages we cannot master the art of flying, and the reason of our failure is not far to seek. If we were able to construct a perfect pair of wings, endowed with every property pertaining to the natural mechanism of flight, we should be no nearer our goal, for the simple reason that we should lack muscular power to move them. Birds are not only light in proportion to their size—the largest weighing little more than 28 lb.—but they possess enormous strength. The pectoral muscles of a swallow are said to exceed in weight all its other muscles combined; and it may be said generally that those muscles in a bird upon which the wing action depends are hundreds of times proportionately more powerful than the muscles which actuate the movements of a man's arm. We must observe, too, that most of the swiftly-flying birds are carnivorous, are able to assimilate their food in a concentrated state, and that the temperature of their bodies is higher than in the mammalia. In this respect they may be compared to a small engine working at high pressure, and developing an enormous amount of energy. We must come, therefore, to the inevitable conclusion that, although it may be possible for man to make an experimental flight from a height with artificial wings, as has been done in the past, he will never be capable of sustained action in the air by the same means. Whilst we cannot concede the possibility of a man flying by his own muscular exertions, we must admit that a flying-machine is theoretically possible, and we may now point out the many practical difficulties which stand in the way of its achievement, and which hitherto have baffled the labours of the enthusiasts who have devoted much time to the matter. It may at once be remarked that the balloon has in no way helped in the solution of the problem. It is a mere lifting-machine, which, like a cork in the water, has no movement of its own, but is the sport of every current in the medium by which it is supported. A true flying-machine is one which will rise from the ground by self-contained energy—such energy being applied to (1) screw-propellers or (2) wings. So long ago as 1796 Sir George Cayley designed a toy on the propeller principle, which was actuated by means of the energy stored in a bent bow. Of more recent years flying toys have been made, working propellers or wings by means of twisted strands of india-rubber. We may also mention that flying toys on the kite principle have been constructed with some success. But when we come to consider the construction of a machine on a large scale, we find that we are beset with many difficulties. The most serious of these is the want of a motor powerful enough for the purpose which shall not be held to earth by its own weight. After reviewing all those which are at present known—including those actuated by compressed air, gas, and electricity—we must award the palm to the steam-engine, as being by far the most convenient means which we have for affording a continuous supply of energy of definite amount in proportion to its weight. But this energy falls far short proportionably of the amount expended by a bird in flight; and we must conclude that, until a motor be found that will in this respect approximate to the living bird, a flying-machine will be an impossibility. But supposing that such a motor be discovered, there will still remain the difficulty of the perfect balancing of the machine. A child learning to walk will be safe enough on a flat floor, but will soon fall down if its first steps are taken over unequal ground. The air may be compared to a surface having such inequalities, for it is not homogeneous, but is subject to eddies and currents in both upward and downward directions. A bird soaring in the air will instinctively meet an unexpected eddy affecting one wing by an immediate compensating movement; but a mere machine made by the hands of man would not possess this instinct; and it is difficult to believe that any mechanism, however beautiful in design, can effectually take the place of that which is associated alone with the breath of life.

See Pettigrew's *Animal Locomotion* (1873; new ed. 1882); M. Marey's *Animal Mechanism* (International Science Series, 1874); Reports of the Aëronautical Society of Great Britain; also correspondence in *Knowledge*, *Nature*, *English Mechanic*, and other scientific periodicals.

Flying Animals, in the strict sense, include most insects, birds, and bats, and these only. In past times there were 'flying reptiles' (Pterodactylus, Rhamphorhynchus), in which the outer finger was enormously elongated, and supported a wing-like expansion of the skin. In several ways these extinct forms were prophetic of birds, and certainly must be said to have had wings; but to what degree they were able to progress like birds in the air we do not know. For the true fliers, and for their interesting contrasts—e.g. between the wing of an insect and that of higher forms, or between the 'arms' of bat and bird—the relevant articles must be consulted; the present is devoted to a quite different set of animals, which are popularly called 'flying animals,' though they do not beat the air with wings.

(1) Among fishes, two very distinct genera (Exocœtus and Dactylopterus) have the power of skimming for considerable distances above the surface of the water, their expanded pectoral fins forming a parachute (see FLYING-FISH). (2) Some species of lizards in the genus Draco—e.g. *D. volans*—take short swoops through the air, the skin being stretched on several much elongated ribs, so as to form a sort of half kite on either side (see DRAGON). In some Geckos (q.v.)—e.g. the Californian *Phyllodactylus tuberculatus*—there is not a little membranous fringing of body, tail, and limbs. The flying powers of Wallace's 'flying frog' (Rhacophorus) have not been certainly established. (3) It is, however, among mammals that

attempts at parachute flight are most frequent, and that not in one order but in three: Marsupials (Petaurus), Rodents (Pteromys and Sciuropterus), and Insectivores (Galeopithecus).

FLYING PHALANGER, or Flying Opossum (*Petaurus*), a genus of marsupials, natives of New Guinea and Australia, where they are called Flying Squirrels, Sugar-squirrels, &c. Nearly allied to the Phalangers, they are distinguished by a hairy membrane or fold of the skin extending along the flanks, and used as a parachute to enable them to leap to great distances. This membrane extends along both fore and hind legs almost to the toes, but does not appear behind the hind-legs, nor include the tail. They are capable of modifying their course in the air, although not of true flight; and their aërial evolutions are very graceful. They repose during the day, and become active in the evening, feeding on fruits, flowers, leaves, insects, &c. A New Guinea species is as large as a cat;

1, Flying Phalanger (*Petaurus taguanoides*); 2, Flying Mouse (*Petaurus pygmæus*).

one of the Australian species is scarcely larger than a mouse, and is called Flying Mouse. The genera Belideus and Acrobata have also parachutes. See PHALANGER.

FLYING SQUIRREL (*Pteromys* and *Sciuropterus*), two genera of squirrels (Sciuridæ), the members of which have a fold of skin extended from the flanks between the fore and hind legs, by means of which they are enabled to take extraordinary leaps, gliding for a great distance through the air. The tail may also aid to support them in the air, as well as to direct their motion, its hairs being often extended laterally in a sort of feathery expansion, as in some of the flying phalangers. The genus Pteromys is especially well represented in the Indian region; Sciuropterus predominates in the north. The commonest Old-World species, the Polatouche (*S. volans*), from north-eastern Europe and Siberia, is about the size of a rat, grayish-ash colour above, white below, the tail only half the length of the body. It lives solitarily in the forests where birches abound, is nocturnal in habit, vegetarian in diet. The most common North American species, the Assapan (*S. volucella*), abundant from the Gulf of Mexico to Upper Canada, is fully 5 inches long, with a tail of 5 inches additional, fur included. The general colour is brownish-gray, lighter beneath. In gliding from tree to tree it descends obliquely and with very rapid motion, perhaps for a distance of 20 yards, and always lands of course at a considerably lower level than that at which it started. The flying squirrels are all arboreal and nocturnal, and feed not only on nuts and young shoots of trees, but also on small birds. Some forms are readily

Flying Squirrel (*Sciuropterus volucella*).

domesticated; the fur is sometimes substituted for that of other squirrels. See SQUIRREL.

FLYING LEMUR, or Colugo (*Galeopithecus*), an aberrant Insectivore, with a parachute provided with special muscles, and even more efficient than in the preceding mammals. The hairy fold of skin begins behind the throat, includes fore and hind limbs as far as the claws, and extends along the tail to the tip. The animal has been observed to swoop over a distance of 70 yards. The claws are used in climbing; the lower front teeth are remarkably comb-like; the general colour is said to resemble mottled bark; the brain is very small.

Flying Lemur (*Galeopithecus volans*).

The flying lemurs are about 20 inches in length, are natives of the Indian Archipelago, inhabit lofty trees in dense forests, and feed chiefly on leaves and fruits, though said at times to eat insects, eggs, and even small birds. They are nocturnal in their habits, and very inoffensive, scarcely attempting to bite even when seized. Their voice resembles the low cackling of a goose. The female bears a single young one at a birth, and has a pair of teats on each side near the armpits. The Pelew islanders greatly esteem them as food, but they have a rank, unpleasant smell. The zoological position of Galeopithecus is difficult to determine; it has been referred to the lemurs, to the bats, and with most justice to the Insectivores, while Wallace regards it as 'a lateral offshoot of some low form, which has survived during

the process of development of the Insectivora, the Lemuroidea, and the Marsupials, from an ancestral type.' Two species (*G. volans* and *G. philippinensis*) are usually distinguished. The flying foxes (Pteropidæ) are true bats and true fliers. See BAT, BIRD, DRAGON, FLYING, FLYING-FISH, INSECTS, PHALANGER, PTERODACTYL, SQUIRREL, WINGS.

Flying Bridge. See FERRY.

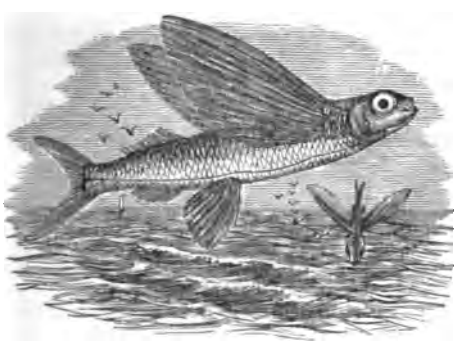
Flying Buttress. See BUTTRESS.

Flying Column. See under ARMY, page 433.

Flying Dutchman, a Dutch captain, Van Straaten, who was condemned, as a penalty for his sins, to sweep the seas around the Cape of Storms (the Cape of Good Hope) unceasingly, without ever being able to reach a haven. Seamen who saw his black spectral ship on the horizon quickly changed their course, and hastened to flee from his fatal influence. The notion that gave foundation to this legend is widespread in German mythology. The dead crossed the water in boats, and northern heroes were sometimes buried on land within their ships, sometimes placed in a ship which was taken out to sea and allowed to drift with the waves; while the same story is localised in the German Ocean, where Herr von Falkenberg is condemned to beat about the ocean until the day of judgment, on board a ship without helm or steersman, playing at dice with the devil for his soul. In the form of the legend chiefly current in England, the impious seaman's name is Vanderdecken, while his ship, which continually scours the seas, is, in all respects but reality, the image of a real ship. The legend gave Wagner the subject for his well-known opera, *Der fliegende Holländer*.

Flying-fish, species of Exocœtus and Dactylopterus, bony fishes which, though not indeed true fliers like birds or bats, are able to progress for some distance in the air, quite above the surface of the water. The genus Exocœtus is included in the family Scombresocidæ not far from the Pikes; while the genus Dactylopterus is referred to the Cataphracti, nearly allied to the Gurnards.

(1) *Exocœtus* (Flying Herrings).—There are over forty known species of this genus, mostly in the warmer seas. Two have occasionally been seen near British shores, one of which (*E. evolans*) ranges from Australia through the Indian Ocean,



Flying-fish (*Exocœtus volitans*).

while the other (*E. volitans*) is common in the Mediterranean. The long pectoral fins, which extend to the anals or even to the tail, form the most characteristic feature. The usual length of the body is about a foot. Their 'flight' has been much discussed, with the following general results. The fins are kept distended like a parachute, and are not moved like the corresponding appendages of birds or bats; deviation from a straight course, whether lateral or vertical, is due to air-currents, except when the animals in their progress dip their tail into the water and give a stroke; 'their flight is rapid, but gradually decreasing in velocity, greatly exceeding that of a ship going 10 miles an hour, for a distance of 500 feet;' they 'fly' most in rough weather, and farthest when more or less against the wind; in a calm their course is parabolic like that of a projectile, and close to the water, but they are liable to be lifted by the air-pressure over high waves, or by the wind on to the decks of ships; they leave the water when frightened, but also apparently from the mere exuberance of their constitutional activity. They swim and often 'fly' in shoals, and are chased by coryphenes (so-called 'dolphins') and other fishes, as well as by sea-birds. They are good for eating, and are often netted by the natives of the South Sea islands and elsewhere.

(2) *Dactylopterus* (Flying Gurnards).—Of this genus three species are known, abundant in the

Flying Gurnard (*Dactylopterus volitans*).

Mediterranean, the tropical Atlantic, and Indo-Pacific. The young have comparatively short pectoral fins, and cannot lift themselves, but the adults 'fly' after the above-described fashion. They are larger and heavier than the Exocœti, often measuring a foot and a half in length.

See Günther, *Introduction to the Study of Fishes* (Edin. 1880); K. Möbius, *Die Bewegungen der Fliegenden Fische durch die Luft* (Leip. 1878).

Flying Squid (*Ommastrephes*), a genus of decapod Cuttle-fishes (q.v.), widely distributed, especially in the warmer seas. The body is long, cylindrical, and pointed posteriorly, with two triangular fins, by help of which the animal can jerk itself out of the water, sometimes so high as to fall as a 'sea arrow' upon a ship's deck. Like other cuttle-fish, they swim rapidly by forcibly ejecting water from their mantle or gill cavity. They are included among those Cephalopods which have the cornea of the eye open, so that the sea-water reaches the lens. Their internal shell or 'pen' is furnished with three diverging rays, and a hollow conical appendage. The species vary in length from 1 to 4 feet. Gregarious in their habits, they prey upon shoals of mackerel and other fishes, and are themselves devoured by dolphins and other cetaceans, as well as by sea-birds. One species (*O. sagittatus*) is used very abundantly for bait in the Newfoundland cod-fisheries.

Fly Poison. This term includes the various preparations which are sold for the purpose of killing flies. Formerly powders on papers containing arsenic, and sweetened so as to attract the flies, were in general use. Since it has been found that paper dipped into a sweetened solution of quassia is equally efficacious, the poisonous article has been partly superseded. Under this heading may be included various viscid substances which, when smeared on threads or on boards, attract flies by their sweetness, and retain them by their stickiness.

For this purpose treacle and birdlime are fairly effective.

Fly-trap. See DIONÆA.

Fly-wheel, a large wheel with a heavy rim fitted to steam-engines, or other machinery, in order to equalise the effect of the driving effort. Its action depends on the principle that matter in motion possesses kinetic energy—e.g. a body in having its velocity reduced is capable of doing work. The amount of work it can do depends directly on the mass of the body, and on the difference of the squares of its initial and final velocities, and is numerically equal to $\frac{m(v_1^2 - v_2^2)}{2}$. A heavy wheel thus becomes a reservoir of work when set in motion.

There are two principal cases in which the fly-wheel is commonly applied: (1) where the driving effort is intermittent or irregular, while the resistance to be overcome is for the time practically constant; and (2) where the resistance or work to be done is intermittent or irregular. The crank in a foot-lathe is a good example of the first case; the driving effort of the foot is only applied to the treadle on the down stroke, and the crank must rise independently of the effort. A fly-wheel attached to the crank-shaft effects this, the motion it acquires while the foot is acting gives it energy, and in virtue of this it is able to bring the crank up again into the proper position for the foot to act on the treadle. In single-crank engines the fly-wheel carries the crank over the dead centres (see CRANK), and whenever used in engines its function is to keep the speed steady during each revolution of the crank—i.e. to prevent unsteadiness during each turn; this it does by storing up energy during parts of the revolution when the effort is greater than the mean resistance, and giving it up again during those parts of the revolution when the effort falls below the resistance. In the gas-engine, where the effort (explosion) is often only applied during part of every second or third revolution, it does very important work. Its action must be clearly separated from that of the governor, whose function is to determine the mean speed or number of turns the engine shall make per minute; this the fly-wheel cannot in any way do—it can only keep the speed steady during each turn.

The second case is illustrated by a punching-machine. The engine need not be of sufficient power to directly force the punch through the metal, but with the aid of a fly-wheel it easily does it. The machine is so arranged that the actual part of each revolution spent in punching is very small; all the rest of the revolution the fly-wheel is storing up energy, nearly all the effort going in this. Then at the proper moment the work stored up is added to the direct work of the engine, and the punch forced through, the speed of the fly-wheel being proportionately reduced.

The principle of the fly-wheel is sometimes applied in other forms than that of a wheel—e.g. in fly-presses for stamping or coining metals, in which two heavy balls are fixed at the ends of a long lever, which is made to swing round with considerable velocity. The accumulated energy is given up at the moment of impact of the die upon the metal, and a force of great intensity called into play to compress the latter. Fly-wheels are not required in locomotives or marine engines (see STEAM-ENGINE).

Fochabers, a village of Elginshire, on the Spey, 7 miles ESE. of Elgin. Milne's Free School (1846) is the chief edifice. A mile north is Gordon Castle, the old 'Bog of Gight,' and the seat, since 1449, of six earls and four marquises of Huntly, five dukes of Gordon (the fourth of whom almost rebuilt it towards the close of the 18th century), and now of the Duke of Richmond and Gordon. Pop. 1189.

Focus, in Optics, is a point in which several rays meet and are collected after being reflected or refracted, while a *virtual* focus is a point from which rays tend after reflection or refraction. The principal focus is the focus of parallel rays after reflection or refraction. See LENS, MIRROR, OPTICS, PHOTOGRAPHY. For the focus of geometry, see ELLIPSE, HYPERBOLA, PARABOLA.—The *Focimeter* is an instrument for assisting in focusing an object in or before a photographic camera; it is usually a lens of small magnifying power.

Fodder (A.S. *fódor*, cog. with Ger. *futter*), the food collected by man for the use of the domestic herbivorous quadrupeds. In English the term is commonly restricted to dried herbage, as hay and straw; but in other languages it is more comprehensive, and includes all the food of cattle, except what they gather for themselves in the field.

The principal part of the food of the domestic herbivora is furnished by grasses, most of which are eaten by them when fresh and green. Besides the supplies which they receive of the surplus of corn cultivated for human food, they are also, to a considerable extent, dependent on the *straw* or dried herbage of the corn-plants for their winter provender; and that of many other grasses, cultivated on this account alone, is converted into *hay* for their use. Hay, being cut and rapidly dried whilst the plant is still full of sap, contains more nutritious matter than the ripened straw of the cereals. The most important perennial fodder grasses of Britain are Timothy, Foxtail, Cocksfoot, Tall Fescue, Meadow Fescue, and Hard Fescue. Perennial ryegrass, under certain conditions, may be added to the number. They should be all represented in ordinary mixtures for seeding land, down to permanent grass. Italian ryegrass surpasses the perennial in its power of yielding a large crop under favourable circumstances in a rotation. In the United States the best grasses are Timothy, Red Top or Rhode Island Bent, White Top, Orchard Grass, and June Grass or Kentucky Blue Grass.

Next to the grasses are ranked the Leguminosæ, affording food for cattle in their seeds—as beans, peas, lentils, lupines, &c.—and in their herbage, on account of which many of them are cultivated, as clover, lucerne, vetch, tares, sainfoin, &c. When consumed green, the produce of these crops is usually termed forage or green forage. Some of them enter also largely into the composition of hay, being cut and dried with the grasses along with which they have been sown. Some of the Cruciferæ are cultivated to a considerable extent as forage-plants, cattle being fed on their green herbage, although they are not suitable for drying as fodder. Among these are kale and cabbage, rape, &c.

In some parts of the world cattle are not unfrequently fed on the leaves of trees, as in the Himalayas, where the leaves of different species of Aralia, Grewia, elm, and oak are chiefly employed for this purpose, and are collected, dried, and stacked for winter fodder. In seasons of drought in India cattle are kept alive on the green leaves and pods of Acacia and *Inga dulcis*. See CLOVER, GRASSES, PASTURE, &c.

Fœtus, the term applied in Medicine to the mammalian embryo, especially in its more advanced stages. In the human subject we usually speak of the embryo at and after the end of the fourth month as a fœtus.

The weight and length of the fœtus at full term—nine months—varies within considerable limits. Observations on a very large number of cases have

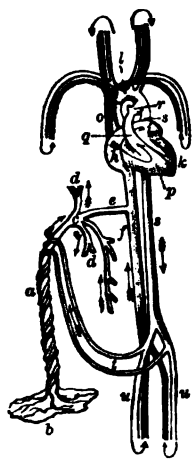
shown that this variety is related to several conditions—e.g. sex, race, number of previous pregnancies of the mother, &c. Male children are from 8 to 12 oz. heavier than female; children born in Britain are heavier by 3 or 4 oz. than those born in France, and first-born children are 4 to 6 oz. lighter than subsequent ones.

On an average the fœtus at birth weighs from 6½ to 9 lb. But a healthy child may weigh as little as 5 or 5½ lb., and cases are on record where the child has weighed 17½ and 18 lb. Children under 5 lb. weight at birth rarely live, and when they do are puny. The length of the fœtus is 17 to 21 inches, occasionally being as much as 24 inches.

There are certain points in which the fœtus at the full period differs anatomically from the child shortly after birth. The bony skeleton is very incomplete, cartilage occurring in the place of many bones. Indeed, complete ossification (viz. of the vertebræ) is not finished until about the twenty-fifth year, and the only bones completely ossified at birth are the minute ossicles of the ear. The difference between the fœtus and the child in this respect is, however, only one of degree.

During pregnancy a temporary organ, termed the placenta (popularly known as the after-birth, from its being thrown off shortly after the birth of the child), is developed on the inner wall of the uterus (see *b* in the figure). This organ is mainly composed of vessels, and there proceeds from it the structure known as the umbilical cord, *a*, in which lie the umbilical vein, which conveys arterial blood to the fœtus, and the two umbilical arteries, which return the blood to the placenta. This umbilical cord conveys these vessels to the umbilicus or navel. Before tracing the course of the blood through the fœtus, we must notice the chief anatomical peculiarities presented by the vascular or circulating system before birth.

(1) In the heart we find a communication between the two auricles by means of an opening termed the *foramen ovale*. (2) In the arterial system we have to notice first the *ductus arteriosus* (see *r* in the figure), which is a large communicating trunk between the pulmonary artery, *q*, and the descending aorta, *s*, *s*; and, secondly, the branches given off by the internal iliac arteries, which go under the name of hypogastric as long as they are within the body of the fœtus, and of umbilical when they enter into the structure of the cord, are continued from the fœtus to the placenta, to which they return the blood which has circulated in the fœtal system. (3) In the venous system there is a communication between the umbilical vein, *c*, and the inferior vena cava, *f*, called the *ductus venosus*, *e*.



The Fœtal Circulation.

Pure blood is brought from the placenta by the umbilical vein, which passes through the umbilicus, and enters the liver, where it divides into several branches, *d*, *d*, which are distributed to that viscus, the main trunk or *ductus venosus*, *e*, passing directly backwards, and entering the inferior vena cava, *f*. The pure blood here becomes mixed with the impure blood which is returned from the lower extremities and abdominal viscera, and is carried into the right auricle, *h*, and from thence, guided by the Eustachian valve (which is situated between the anterior margin of the inferior vena cava and the auriculo-ventricular orifice, and is of relatively large size in the fœtus), passes through the *foramen ovale*, into the left auricle, *i*. From the left auricle it passes into the left ventricle, *k*, and into the aorta, *l*, whence it is distributed by the carotid and subclavian arteries principally to the head and upper extremities, which thus receive comparatively pure blood. From the head and arms the impure blood is returned by the superior vena cava, *o*, to the right auricle; from the right auricle it is propelled, as in the adult, into the right ventricle, *p*; and from the right ventricle into the pulmonary artery. In the adult it would now pass through the lungs, and be oxygenised; but in the fœtus it passes through the *ductus arteriosus* into the commencement of the descending aorta, where it mixes with that portion of the pure blood which is not sent through the carotid and subclavian arteries. Some of this mixed blood is distributed by the external iliac arteries, *u*, *u*, to the lower extremities, while the remainder (probably the larger portion) is conveyed by the hypogastric or umbilical arteries, *t*, to the placenta.

From the above description we perceive: (1) That a considerable quantity of the pure blood from the placenta is at once distributed to the liver, which accounts for its large size at birth as compared with the other viscera. (2) That a double current meets in the right auricle, one stream, guided by the Eustachian valve, passing through the *foramen ovale* into the left auricle, the other through the auriculo-ventricular opening into the right ventricle. (3) That the comparatively pure blood sent to the head and arms, as contrasted with the impure blood sent to the lower extremities, causes the relatively greater development of the former organs, and prepares them for the functions they are called upon to perform; the development of the legs at birth being slight as compared with that of the head or arms.

Almost immediately after birth the *foramen ovale* becomes closed by a membranous layer, and the *ductus arteriosus* and *ductus venosus* degenerate into impervious fibrous cords. The lungs, previously to the act of inspiration, are dense and solid in structure, and of a deep-red colour, and lie far back in the chest. Their specific gravity is greater than water, in which they (or portions of them) consequently sink, whereas lungs (or portions of lungs) that have respired float in that fluid.

Although nine months is the normal period of fœtal development *in utero*, it is possible for a fœtus to survive though born much within this period. When a child is born in a state of development sufficient to enable it to survive, it is said to be *viable*. A fœtus born at 4½ months may give evidence of life, such as movement of limbs, attempts at respiration, &c., but of course cannot survive, and hence is not viable. Several instances have been recorded in which the fœtus survived after birth at 6½ months. At seven months viability is established, and with reasonable care a very large proportion of children born at this time survive. Such children may become perfectly healthy and strong, both mentally and physically. It is said that Sir Isaac Newton was born at the seventh month. The French code fixes the longest limit of gestation at 300 days—a limit rarely reached, if ever.

This article would be imperfect without a notice of the question—What constitutes live-birth? This is a point on which the most distinguished obstetric authorities have differed: some holding that where there is muscular movement there is life; while others maintain that where respiration has not been proved to have taken place the child was still-born. Amongst the most celebrated lawsuits bearing on this point we may mention that of

Brook *v.* Kellock, tried in 1861, in which it was decided that a child may live for some time after birth and not breathe, the absence of signs of breathing being held to be no proof of its being born dead. It was given in evidence that there was pulsation of the funis after separation of the cord, and the beating of the heart was regarded as proof of live-birth. Hence we may regard it as established in English law that respiration is not required to establish live-birth. Nor do the laws of France or the United States require that the child shall have breathed. In Scotland the law requires not only that the child shall have breathed, but that it shall have cried; and in conformity with this law a child which lived, breathed, and died in convulsions at the end of half an hour was declared to have been born dead. See EMBRYOLOGY, and other articles cited there; GESTATION, PREGNANCY.

Fog, or MIST. Water vapour is always present in the atmosphere, and it condenses either as rain, mist, or fog when the state of saturation is reached. In some cases dust-particles condense moisture from non-saturated air, and this produces what is known as a *dry* fog. Condensation of moisture takes place on a drop more readily the larger it is (see CAPILLARITY), and experimental proof has recently been given by Aitken in support of the theory that no condensation can occur without the presence of a nucleus. Such a nucleus is furnished by the visible or invisible dust-particles in the atmosphere. The amount of vapour present and the number and size of the dust-particles in part determine whether fog, mist, or rain will be formed, under given conditions of temperature and pressure; but the gathering of moisture into drops sufficiently large to fall as rain seems not to depend merely on the number and size of the particles on which condensation occurs. When a stratum of warm, dusty air gets cooled, a fog may be produced. The great amount of smoke-particles and dust-particles present in the air of large towns furnishes the conditions, in certain states of weather, that give rise to the intense fogs often prevalent in large cities. A morning fog disappears as the temperature rises, because of evaporation of the moisture from the nuclei. A fog is often produced in the evening over the surface of water or moist ground, because the air is sufficiently cold for condensation of vapour to occur. The fogs on the coasts of Nova Scotia and other places are caused by currents of warm air moving over cold water; so also the fogs caused on the coasts of Oregon and California by west and north-west winds. On the outskirts of an anti-cyclone fogs of immense breadth sometimes stretch for hundreds of miles lengthwise. Aitken has pointed out that dust-particles are probably efficient in the production of fog or rain in another way besides acting as nuclei. He believes that dust is a good absorber, and therefore a good radiator, of heat; for he has shown that, on equally clear days, the sun's heat is strong if the number of particles per unit volume of the atmosphere is small, but is weak if the number is large. Hence, when the sun's rays are withdrawn, the air surrounding the particles is rapidly cooled, and its moisture condenses.

Clouds, whether of fog, mist, or rain, though apparently suspended in the air, are in reality falling with extreme slowness. The force which causes drops to fall is their own weight, which is proportional to the cube of their diameter. The force acting upwards is the resistance of the air, which is proportional to the diameter. Hence, if the diameter of a drop becomes $\frac{1}{10}$ of its original value, the resistance is reduced to $\frac{1}{10}$ only of its value, while the weight becomes $\frac{1}{1000}$ of what it was before, and so the drop falls far more slowly.

One of the worst fogs on record, alike for its density and protractedness, occurred in London from the beginning of November 1879 to the following February. The deaths for the six weeks ending February 21st were 1730, 1900, 2200, 3376, 2495, and 2016, the deaths in the fourth week being thus nearly double those of the first. Of all diseases the deaths from asthma were most directly influenced in fatality by the fog In the first three weeks of 1880, when London was largely cleared of fog, the deaths fell 30 per cent. below the average; but in the end of January, when the fog again became severe, the deaths rose to 43 per cent. above the average. Bronchitis, pneumonia, pleurisy, other lung diseases, and whooping-cough, though not showing so strict an obedience to the varying density and persistence of the fog, rose to a much greater fatality, the death-rate from bronchitis rising to 331 per cent. and whooping-cough to 231 per cent. respectively above the averages of these diseases. Fogs are worst in the low-lying districts which are on the lee-side of the city, with respect to the direction of the light drift of the wind at the time, and least felt in the higher districts on the windward-side, the amount of suffering and number of deaths being proportioned to the density and persistence of the fog.

Foggia, capital of the Italian province so named (formerly Capitanata), is situated in a district abounding in olives, vines, and other fruit-trees, 76 miles NW. of Bari by rail. It is a handsome, well-built town, with a cathedral, commenced in the Norman style in 1172, but partially destroyed by an earthquake in 1731, and afterwards rebuilt in a different style. It is the most important mart in Apulia, and a celebrated fair is held here annually in May. Pop. (1891) 40,648. Foggia, supposed to have been built from the ruins of the ancient *Arpi*, was a favourite residence of the Emperor Frederick II., and here died his wife, Isabella, daughter of the English king, John.

Fog-signals, audible warnings used on board ships, on the sea-coast, or on railways, during fogs and mists, or at any other time when lights or ordinary daylight-signals are not available.

The commonest fog-signal on shipboard is the ringing of the ordinary time-bell at frequent intervals, or striking the anchor with a hammer, together with the occasional discharge of musketry and heavy guns. These are adopted, to prevent collisions, when ships are overtaken by a fog in the British Channel, or other places where shipping is abundant. The blowing of a horn, the beating of a drum, an empty cask, or a gong, and various other unusual sounds are also adopted. Steamers and sailing-vessels at anchor sound bells at intervals not exceeding two minutes; sailing-vessels under weigh sound a fog-horn, and steamers sailing their whistle. These sounds, however, only indicate rudely the position of the ship, and not the direction in which she is sailing. Many plans have been devised for a code of signals, by which the directions north, south, &c. might be indicated by the varying length of each sound, or the intervals between the sounds of a fog-horn or whistle.

British ships of war, when under steam, sound a prolonged whistle, at intervals of not less than two minutes. When under sail, one blast with the fog-horn indicates that the vessel is on starboard tack; two blasts in succession, that she is on the port tack; these are to be repeated at intervals of not less than two minutes. When at anchor the bell is sounded instead of horn or whistle. It is very desirable that some general code of signals of this kind should be adopted for the merchant service as well as the navy, and that its recognition by the marine of all other nations should

be procured. The admiralty have such a code for the direction of a fleet of ships of war in thick weather, but its application is limited to the navy. See SIGNALLING.

Fog-signals from the shore are very desirable, especially on a dangerous coast. Bells and guns have both been used for the purpose, but when a strong wind is blowing in towards the shore their sound is heard only at a very short distance out to sea. Consequently steam-whistles, and fog-horns sounded by compressed air, are being employed in their stead. Fog-sirens, producing a sound after the manner described in the article Siren (see SIREN, Vol. IX., pages 475–6), are now largely in use, and are audible at a distance of from two to ten miles.

The fog-signals used on railways are small cases charged with detonating powder, and laid upon the rails. They explode loudly when the wheel of an advancing train comes upon them. They are used not merely in fogs, but in all cases of danger from obstruction of the line, or in other cases of urgency when a train has to be stopped without delay. Station-masters and railway police are furnished with them.

Föhr, a fertile island in the North Sea, off the west coast of Sleswick, to which it belongs. Area, 28 sq. m.; pop. 4150, Frisians by race, and principally engaged in fishing and fowling. The chief town is Wyk (pop. 1063).

Foil (Lat. *folium*, 'a leaf') consists of metal reduced to very thin sheets, intermediate between the extremely thin leaf metal, such as gold and silver leaf, and sheet metal. There are two distinct classes of foil in common use—the foil which in tenuity approaches leaf metal, and the much stouter tinsel foil used by jewellers, and for theatrical ornaments, &c.

Tinfoil is made by rolling bars of tin down to fine sheets, which are further attenuated by being laid in piles and beaten with a wooden mallet. Formerly tinfoil was very largely used for the 'silvering' of mirrors, by amalgamation with mercury; but that process is now little employed (see MIRROR). The chief consumption of tinfoil is now in connection with the wrapping up of chocolate and other confectionery, and of tobacco and other products which must be kept from drying in the air. It is also largely used for lining small boxes and cases, and in the preparation of Leyden jars and other electrical apparatus.

The bright foil used by jewellers and for theatrical and other ornaments, under the name of 'tinsel,' is made of copper, tin, tinned copper, or silvered copper. The last is now chiefly used by jewellers. The metal is rolled in a flatting mill, and the requisite brilliancy of surface is produced by finishing between burnished rollers and polishing. The various colours are produced by coating the white metal with transparent colours mixed in isinglass size. A similar varnish without colour is laid over the white foil, to prevent tarnishing. The socket or setting in which a stone or paste is mounted is lined with the foil, which, by reflecting from the internal facets the light that passes through the stone, adds considerably to its brilliancy. The natural colours of real stones are sometimes heightened or modified by coloured foil, and factitious colours are thus given to the glass or 'paste,' as it is called, of which spurious precious stones are made.

Foil. See FENCING.

Foix, capital of the French department of Ariège, lies in a Pyrenean valley, 44 miles S. of Toulouse by rail. Of the ancient castle of the counts of Foix (1362) there remain only three towers, all dating anterior to the 15th century. The town has iron and steel works. Pop. 5860.

Foix, an old French family, which took the title of count from the district of Foix (now the department of Ariège), in the south of France. The first who bore the title was Roger, who died in 1064. Roger Raymond accompanied King Philip Augustus to Palestine and distinguished himself at the taking of Acre. Afterwards, on his becoming an adherent of the Albigenses, his estates were confiscated by Simon de Montfort. He was a patron of the Provençal poets, and died in 1223. The next succeeding counts held their lands of the king of France; they were principally engaged in waging a feud against the House of Armagnac, and in fighting for the French king in the English wars. Gaston III. (1331–91), called, on account of the beauty of his person, Phœbus, was noted for his knightly love of splendour and military prowess. For his assistance to the king against the English in 1345, he was made governor of Languedoc and Gascony. In 1356 he took part in a crusade against the heathen Letts of Prussia, and in 1358 rescued certain members of the royal family out of the hands of the Jacquerie insurgents. On being supplanted in the governorship of Languedoc by the Duc de Berri, Gaston maintained his position by force of arms, and defeated the duke at Revel. He left a work on hunting, *Miroir de Phébus*, whose bombastic style became a byword (*faire du Phébus*). After his death without children, in 1391, the estates and title went to a collateral branch of the family. Gaston IV. rendered good service to Charles VII. in his wars against England. In 1455 his father-in-law, John II., king of Navarre, named him his successor, and the French king invested him with the seigniory of Carcassonne and the countships of Roussillon and Cerdagne. He died in 1472, when the family possessions were again divided. His grandson, Gaston (1489–1512), whose mother was Marie d'Orléans, sister of Louis XII. of France, received from his uncle the title of Duc de Nemours in 1505. In the Italian wars Gaston displayed such brilliant genius and bravery as to earn the title of 'Thunderbolt of Italy.' He twice overthrew the Swiss, at Como and Milan (1511); chased the papal troops from Bologna; seized Brescia from the Venetians; and won the battle of Ravenna over the Spaniards, 11th April 1512, in which, however, he fell, at the early age of twenty-three. On his death the estates and title went to the king of Navarre. Finally Henry IV. of Navarre attached the county of Foix to the French crown.

Fokshani, a town of Roumania, near the border-line between Moldavia and Wallachia, is situated in the former province, on the Milkoff, a tributary of the Sereth, 123 miles by rail NE. of Bucharest. There is a considerable river trade with Galatz, especially in grain. Near Fokshani the Turks were defeated by the allied Austrians and Russians on 1st August 1789. Pop. 25,290.

Földvar, or DUNA-FÖLDVAR, a town of Hungary, and a steamboat station on the Danube, 48 miles S. of Pesth, with sturgeon-fishery, vineyards, and manufacture of matches. Pop. (1890) 12,364.

Foley, JOHN HENRY, R.A., sculptor, was born in Dublin, 24th May 1818, became a student of the Royal Academy in 1835, and first exhibited in 1839. His 'Ino and Bacchus' (1840) attracted much notice, and was followed by a succession of admirable classical and ideal works, including 'A Youth at a Stream,' 'Caractacus,' and several excellent subjects from Shakespeare. The most noteworthy feature of his work, however, was his careful and artistic execution of his statues and busts, which included the Hampden and Selden figures in St Stephen's Hall, Westminster; Goldsmith, Burke, and O'Connell, in Dublin; and the equestrian statues of Lord Hardinge and Sir James

Outram, for India, which rank among the finest equestrian sculptures of modern times. The statue of the Prince Consort for the Albert Memorial is also Foley's work. He died August 27, 1874, and was buried in St Paul's Cathedral.

Fol'goré, an Italian poet who flourished at the end of the 13th century, the dates of whose birth and death and the incidents of whose life are unknown. He wrote a number of sonnets, all of which have been translated into English by Dante Rossetti and Mr J. A. Symonds. Their poetic merit is far from contemptible, and they are particularly interesting from the vivid light which they throw on Italian society. Their prevailing tone is one of refined epicureanism, and their style is mainly remarkable for affluence of imagery. 'Every line,' says Mr Symonds, 'presents a picture, and each picture has the charm of a miniature fancifully drawn and brightly coloured on a missal marge.' See Rossetti's *Dante and his Circle* (1874), and Navone's *Le Rime di Folgore* (Bologna, 1880).

Foliation, a term restricted by Darwin, and subsequently by geologists, to the alternating and more or less parallel layers or folia of different mineralogical nature, of which the crystalline schists are composed. It differs from Cleavage (q.v.), which is applied to certain superinduced divisional planes that render a rock fissile; and from lamination, in which the planes of separation in a rock are the result of deposition in successive layers. The folia of a schistose rock may be composed of only one mineral, but most commonly they consist of two or more; they are conspicuously lenticular, thickening and thinning out, and reappearing after an interval on the same or a different plane. These alternately lenticular folia are usually more or less closely welded or felted into each other, so that they are not readily separable; and they frequently present the appearance of being puckered or crumpled. The crystalline texture and the foliated character of the schists distinguish them at once from any ordinary bedded 'fragmental rock.'

Foligno, a town of Central Italy, on the Topino, 25 miles SE. of Perugia. The town has a modern appearance, and possesses a cathedral and several churches. Tanning, paper-making, the manufacture of sugar confectionery, and the cultivation of the vine and of silk are carried on. The town was destroyed by the people of Perugia in 1281, and in 1833 it suffered severely from an earthquake. In 1439 it became subject to the pope. Pop. 8753.

Folkes, MARTIN, English antiquary, born in London on 29th October 1690, died on 28th June 1754, is known by two books on English coins—*A Table of English Gold Coins* (1736), and *A Table of English Silver Coins* (1745). He was a member of the Royal Society (president in 1741), of the Society of Antiquaries (president in 1750), and of the Paris Academy of Sciences.

Folkestone, a municipal borough, seaport, and bathing-place of England, on the coast of Kent, 7 miles WSW. of Dover, stands on uneven ground at the foot of a range of hills and up their slopes, the oldest part lying in a narrow valley, crossed by a fine railway viaduct. The town has rapidly extended and improved since the opening of the South-Eastern Railway, and of a daily service of steam-packets to Boulogne. Pop. (1871) 12,694; (1891) 23,700. Folkestone unites with Hythe in returning one member to parliament. The harbour is much used by boats employed in the herring and mackerel fisheries. In the vicinity are the remains of Roman entrenchments. Here Harvey, the discoverer of the circulation of the blood, was born in 1578.

Folkland, the public land of the nation in old English times, what remained to the nation over and above what was possessed by individuals, families, or townships. It was under the control of the king and witan, and, after England was consolidated into one kingdom, was very large. But it was always diminishing, portions being granted to individuals for services rendered, and to the church, &c.; the land so alienated from the public became Bocland (q.v.). Portions were also granted temporarily to individuals for fixed services, and became practically hereditary. Under the Normans the king became supreme in the disposition of the public lands, which became merged in the private property of the kings. The distinction has been recently restored, and what are now called Crown-lands (see under CROWN, Vol. III., page 590) still represent the old Folkland of England. See Stubbs's *Constitutional History*.

Folklore, a term first suggested by W. J. Thoms in 1846 (*Athenæum*, August 22, under his well-known signature 'Ambrose Merton') to designate what was then for the first time becoming a subject of wide popular interest, considered as a department of the study of antiquities or archæology, and embracing everything that related to ancient observances and customs, to the notions, beliefs, traditions, superstitions, and prejudices of the common people. Folklore, as understood by Mr Thoms, had indeed been observed and noted by countless writers from the Father of History downwards; the *Gentleman's Magazine* in the 18th century, and, in the 19th, his own well-known journal *Notes and Queries* (instituted 1851) being invaluable repositories of such observed facts; but it was not till after the beginning of the 19th century that the value of folklore for the elucidation of the social history of mankind had become apparent to thinkers, and its systematic study been seriously begun. Nor had there been wanting special collections of detached facts, very varied in quality but all of precious value now, by curious antiquaries, as John Aubrey in his *Miscellanies* (1696), or by speculative original thinkers, as Sir Thomas Browne in his *Pseudodoxia Epidemica* (1646). The former discussed in a gossiping manner such matters as omens, dreams, corpse candles, and second-sight; and another work by the same credulous author, *Remaines of Gentilisme and Judaisme* (ed. by James Britten, 1881), 'did not disdain to quote' a multitude of ancient customs which would otherwise have been forgotten, and which have proved to be a precious mine for later and more scientific students. The Rev. Henry Bourne published at Newcastle in 1725 his *Antiquitates Vulgares, or the Antiquities of the Common People*, valuable chiefly for its record of old popular customs connected with the feasts of the church; and at the same city John Brand published in 1777 the first edition of his famous *Observations on the Popular Antiquities of Great Britain*. This work, as subsequently enlarged by himself, partly from the stores of miscellaneous facts of folklore collected in Sinclair's *Statistical Account of Scotland* (1791–95), and thoroughly revised by Sir Henry Ellis in 1813, ill arranged as it is, remains the richest of such storehouses of folklore as formerly—of materials for folklore as now—understood. Of other books containing similar records more or less valuable of detached facts, it may be enough here to name Strutt's *Sports and Pastimes of the People of England* (1801); Hone's *Every Day Book* (1826–27), *Table Book* (1827–28), and *Year Book* (1829); and Chambers's *Book of Days* (1863).

Meantime the reawakening to natural poetry, and to the beauty of free emotional expression in literature, which lay at the foundation of what it is usual to call Romanticism, had already begun even in the 18th century, and the publication of Percy's *Reliques of Ancient English Poetry* (1765)

had given a powerful impulse to Scott and others in England, to Herder, and to Arnim and Brentano in Germany, who found lying to hand a rich wealth of traditional poetry, the poetic value of which they fortunately had the eyes to see. But the study of folk-songs really began with Scott's *Minstrelsy of the Scottish Border* (1802–3). It was perhaps an advantage rather than a disadvantage that the first worker in this new field was but the folklorist unawares and mere great poet and romancer of genius that he was; for our folk-poetry would never have enriched and permanently influenced all later English literature but for its own intrinsic and genuine poetic quality, any more than our detached folklore facts would ever have risen above the dignity of the whimsical pastime of an idle hour but for their inherent though unsuspected faculty for throwing light backwards upon the history of human civilisation. And it is fortunate for us that we have had before us a succession of antiquarian students with curiosity enough to note and preserve things strange for their own sakes—facts merely half-understood or entirely misunderstood, but yet to be co-ordinated and systematised by later ages after a really scientific spirit had been born. The spread of book-learning and the inevitable diffusion of rationalistic ideas, the levelling of the ancient social distinctions, and the creation of totally new industrial conditions transplanting the people from the customs and ancient habitations of their fathers have stopped short the current of popular belief which has flowed traditionally down in undisturbed but ever-widening stream from the mists of obscure antiquity, and turned its waters, rich with the fertilising faculty of imagination, to overflow new fields within the vast vistas of science. Popular traditions began to be valued duly just as they began to decline and disappear; but fortunately a plentiful crop had been gathered and put into writing beyond the risk of oblivion before the growing disfavour for everything supernatural but religion itself, and the impatience of anything beyond the range of the practical and the profitable, had stripped our people of everything they had received from their fathers.

Yet the task of the folklore-collector even in England is not at an end, though the conditions under which he has to work are materially altered; for countless ancient notions still survive, although in strangely altered form, and although our citizens fondly imagine in all the pride natural to a little learning that all old things have been put away, and that all things have become new. The most consciously rational mind is ever unconsciously swayed by impulses and habitudes, the origins of which are so obscure as to be entirely unknown and even unsuspected, but which weigh irresistibly though imperceptibly upon it. Yet these are the real springs of thought and the ultimate motives of character and conduct, so powerful is the effect of hereditary impressions upon man, so weak compared with it is even the influence upon the individual of the immediate environment in which he breathes. At no stage in human history is there ever a violent disruption from the preceding: society, like time itself, innovateth greatly but quietly, and by degrees scarce to be perceived. And, just as the biologist reasons back step by step from ascertained and verifiable facts to the most obscure and mysterious phenomena of life, so the scientific student of folklore co-ordinates the results of observation and experience, and builds them into a unity in a system that transcends the sphere of archæology and even anthropology itself, and forms an integral part of the living structure of human sociology. But, while the laborious student may be permitted to indulge the dream that his studies will supply some of the stones with which this stupendous temple may yet be built, he must not forget that to his generation belongs only the task of accumulating these materials, and that the building itself must be left to the larger generalisations of future ages. Meantime such works as Mr E. B. Tylor's *Primitive Culture* (1871), from a wide comparison of the essential identities and analogies between European and savage customs and superstitions, and Mr G. L. Gomme's *Folklore Relics of Early Village Life* (1883), from a close observation of the affinities between our own village and homestead customs with those of other lands, have shown us what large and significant constructive results may already be attained with the evidence we possess. It is the peculiar merit of Mr Tylor to have demonstrated the evidential value of such *survivals* of more or less savage earlier states of society as still exist among us to reflect light upon the past. 'Survival in culture, placing all along the course of advancing civilisation waymarks full of meaning to those who can decipher their signs, even now sets up in our midst primeval monuments of barbaric thought and life. Its investigation tells strongly in favour of the view that the European may find among the Greenlanders or Maoris many a trait for reconstructing the picture of his own primitive ancestors.'

Just as the science of archæology has been laboriously built up out of the relics of old races that have been brought to light, so the task of the folklorist is to construct the philosophy of primitive man from its still-surviving relics. These linger longest among the least progressive peoples, and it is in their superstitions and stories, whether in their native irrationality or as rationalised by a shallow philosophy, that the student will find the richest and most plentiful materials. He must not confine his pursuit of analogies to the experiences of merely Aryan or yet Old-World races, for in the survivals to be seen in the religious rituals and ceremonial traditions of the most civilised peoples he will find things absolutely identical with the beliefs and customs of present-day savages in Africa or the South Sea Islands. He will find in the most advanced a basis of absolute irrationality, or things believed in just because they are irrational—a process that gives a singular strength even to minds within the range of the highest religions; and this he will find it impossible to explain satisfactorily by other principles than those he applies to parallel and analogous irrationalities in Samoa or Zululand—there, however, neither irrational nor anomalous, but perfectly explicable in harmony with the universally accepted philosophy of life. Indeed, the wider the study applied to the social history of man, the more absolute becomes the certainty of the substantial uniformity in the working of the human mind under the same physical conditions everywhere. The civilised man preserves the fact, or the shadow of the fact, from the conservatism natural to man; the savage is more philosophical in his unconscious irrationality, and preserves the reasons for it also. Neither identity of race, nor community of origin, nor conscious borrowing need be postulated here; this theory is firmly based upon the elemental law of human nature—that the minds of men at parallel levels of culture are everywhere substantially the same, and develop naturally along the same lines in that gradual progress upwards, which is ever in movement, though ever differing in degree. The fundamental bases of popular beliefs then are everywhere the same: what is due to the particular race is the particular development of the belief. Gods, who are mere magnified men, capable like them of being

influenced by magical powers, and not more superior than men themselves to transformation into human and bestial forms; spiritual existences which pervade all nature, animate and inanimate alike, adding the human attribute of personality to all visible objects; ghost-souls surviving in shadowy form beyond the grave—these are the fundamental assumptions of all mythologies, and the essential foundations of the religion of all men. What race adds is the particular poetical form and colour with which the human imagination clothes its shadows. It is the peculiar merit of Mr Andrew Lang's contribution to the science to have elucidated this explanation with such felicitous wealth of illustration as to have made it the accepted working hypothesis of most modern mythologists, who are often grouped together as forming the anthropological school. It may be said that to him more than to any other scholar is due the widespread belief in the substantial identity between the most irrational and rudimentary mythologies and those of the Greeks, Scandinavians, and Hindus, however disguised or adorned these may be in the poetical accretions of successive generations of culture. His brilliant polemic has brought over most of the waverers into his camp.

Here, before going further, the reader has a right to demand that the relations between folklore and mythology should be set forth. The former will shortly be defined at more length; here it may be enough to say that mythology is properly the special science which treats of myths or legends of cosmogony, of gods and heroes. 'A myth embodies in human form primitive man's conception of a non-human action.' It, again, is sharply differentiated from religion, which, at its lowest, involves the conception of visible or invisible supernatural powers ascending into the range of the divine, whether beneficent or maleficent to man, and early concerned in establishing moral relations with humanity, the maintenance of which it regulates by a postulated system of rewards and punishments, distributed here or hereafter. With its beginnings, whether due to an original divine tradition, or to the innate *sensus numinis*—a necessity of man's complex nature—or to man projecting subjectively his own shadow upon the mists of the unknown, and receiving it again unconsciously as an objective efficient cause, neither mythology nor folklore has to deal. Nor may the last two be confounded as synonymous. 'At the most it can be urged,' says Mr Alfred Nutt (*Folklore Journal*, vol. ii. 1884, p. 313), 'that folk-belief and comparative mythology touch each other at a great many points, a fact which by no means necessitates the confounding together of the two studies. The relation between them may be stated thus: All, or nearly all, the facts of comparative mythology are to be found in folk-belief *in solution*; a great many facts of folk-belief are to be found in comparative mythology *crystallised*. The facts are essentially the same in both cases, but the one study deals with them at one, the other at another stage. It is when they have become at once rigid and systematised by passing through the hands of an hierarchical class, yet capable of development by falling under the artistic influence of the craftsman and the philosophic influence of the thinker, that comparative mythology has to do with them; before then they are but a portion of folk-belief. The two studies thus go hand in hand, and cannot be carried on at all without perpetual reference from one to the other.'

Before the rise of the anthropological school the prevailing method of explaining mythology was based upon the results gained by comparative philology. But long before this attempts of various kinds at its explanation had been made, as allegorisations of physical or ethical truths, and even of biblical narratives; or as rationalisations of historical facts, culminating in the elaborate theory of Euhemerus—to be strangely and ingeniously revived under a new form in our own day by Herbert Spencer. The philological method is now usually associated with the venerated name of Professor Max Müller, but is substantially the same as that taught by the great fathers of modern folklore and almost of modern philology alike, Jacob and Wilhelm Grimm, and carried further by Adalbert Kuhn, Bréal, and many other scholars. The modern science of language early in the present century established the unity and homogeneity of the Aryan speeches, and from this Grimm, Kuhn, Max Müller, De Gubernatis, Dasent, and Cox, finding a vast similarity in the mythologies and popular beliefs of the peoples within this range, passed on to an assertion of an equal unity and homogeneity in their traditional lore. Myths were explained as due to a disease of language—to an assumed excessive figurativeness of phraseology practised by the common ancestors of the Aryan family, the proper meaning of which was lost by later generations, who yet went on using the phrases after the real meaning had been forgotten. Still more, the old terminations expressive of gender became confounded with significations of sex and personality. From what has been said before it will be understood that this explanation is not maintained in the present article, but its further discussion falls to the article MYTHOLOGY.

The modern folklorist, while gratefully accepting the results of the philological school so far as these go, insists on carrying his inquiries infinitely further than they did, and claims that savages and savage customs should be interpreted by themselves, and not by the traditions of peoples with whom they have neither linguistic nor ethnological affinities. The first two generations of folklorists have made a vast contribution to the science from the evidence offered within the Indo-European family; the third has extended its borders to embrace the native Australians, the Zulus, Hottentots, Maoris, South Sea Islanders, Red Indians, and Eskimo; and already the library of folklore and folk-tales actually extends to thousands of volumes.

First in importance of these is still the earliest, the *Kinder- und Haus-Märchen* (1812–14) of the brothers Grimm. The stories in the first two volumes of this wonderful work were collected during thirteen years from the lips of people living in Hesse and Hanau, many from a cowherd's wife with a special gift of story-telling. The Grimms' method of editing may still be taken as his canon by the collector: 'Our first aim in collecting these stories has been exactness and truth. We have added nothing of our own, have embellished no incident or feature of the story, but have given its substance just as we ourselves received it. It will, of course, be understood that the mode of telling and carrying out of particular details is principally due to us, but we have striven to retain everything that we knew to be characteristic, that in this respect also we might leave the collection the many-sidedness of nature. For the rest, every one engaged on a work of this kind will know that this cannot be looked on as a careless or indifferent method of collection, but that, on the contrary, a care and skill which can only be gained by time are required to distinguish the version of the story which is simpler, purer, and yet more complete in itself, from the falsified one. Whenever we found that varying stories completed each other, and that no contradictory parts had to be cut out before they could be joined together, we have given them as one; but when they differed, we have given the

preference to that which was the better, and have kept the other for the notes.' Wilhelm Grimm, writing in 1850, says: 'How unique was our collection when it first appeared, and what a rich harvest has sprung up since! At that time people smiled indulgently when we asserted that thoughts and intuitions were preserved in these stories, the origin of which was to be sought for in the darkness of antiquity. Now this is hardly ever denied. Stories of this kind are sought for with full recognition of their scientific value, and with a dread of altering any part of their contents, whereas formerly they were only regarded as worthless amusements of fancy which might be manipulated at will.' Grimm's *Deutsche Mythologie* (1835) is still unequalled in the range of its erudition and in the systematic thoroughness with which the mythology and superstitions of the ancient Teutons are traced back to the dawn of direct evidence and downwards in decay and diminution to the popular tales, traditions, and phrases in which they still unconsciously survive. These two works of Grimm created a school, whose abundant labours later folklorists have entered into, while they have enlarged the horizon of the science, because the stamp of soundness and sufficiency so far as it goes is impressed on all the work of Grimm and his successors, of whom, in Germany, the most eminent were Kuhn, Mannhardt, J. W. Wolf, and W. Schwartz.

Elsewhere, Castrén and Lönnrot devoted themselves to Finnish mythology; Asbjörnsen and Moe collected the Norse popular tales; Schiefner and Jülg, those of the Mongolians and Tartars; Hyltén-Cavallius and George Stephens, those of Sweden; Afanasief, those of Russia; Haltrich, of Transylvania; Kreuzwald, of Esthonia; Von Hahn and B. Schmidt, of Greece and Albania; Arnason, of Iceland; Rink, of the Eskimo; Bleek, of the Hottentots; Calloway, of the Zulus; J. F. Campbell, of the west Highlands of Scotland. The study of these tales involved the study of the customs imbedded in them, and ere long a plentiful crop of books appeared devoted to the preservation of popular proverbs, customs, rhymed riddles, and the like, among which a place of distinction is due to the *Fairy Legends and Traditions of the South of Ireland* (1825), by T. Crofton Croker; the *Popular Rhymes of Scotland* (1826) of Robert Chambers; *The Nursery Rhymes of England* (1842) and the *Popular Rhymes and Nursery Tales* (1849) of Halliwell; and that not merely for the early date of their issue, but for their own intrinsic merits also. The great development of oriental studies that has marked the 19th century has opened up to the West through literary channels those vast treasuries of eastern story from which many believe, as will be seen, that all our own traditional folk-tales were originally drawn in ancient ages. Max Müller's essays revealed to Englishmen a new world of undreamt-of affinities, and the combined charm of their literary grace, wide learning, and rare powers of exposition converted every reader to a theory which, as has been seen, is only now being displaced by another with a sounder basis of real philosophy and fact. Since then the study of folklore has become fashionable, indeed almost an article of patriotism, and societies have been formed in most countries to further its study. Of these the most important is still the Folklore Society of England, established in 1878, with a sufficiently wide programme, 'having for its object the preservation and publication of popular traditions, legendary ballads, local proverbial sayings, superstitions and old customs (British and foreign), and all subjects relating to them.' It numbers within its ranks most of the working folklorists of England, and has through its official organ, the *Folklore Record*, monthly until its fifth volume, thenceforward quarterly under the new title of the *Folklore Journal*, made numberless contributions of the first importance to the science; while it has also distributed special treatises to its members so valuable as Professor Comparetti's *Researches respecting the Book of Sindibad*, Calloway's *Zulu Nursery Tales* and *Religious System of the Amazulu*, and an enlarged re-issue of Henderson's *Notes on the Folklore of the Northern Counties of England and the Borders*. The last and Miss Charlotte S. Burne's *Shropshire Folklore* (1886) are still the best books we have devoted to a particular district of our country. The *South African Folklore Journal* (1879–80) died untimely in its second volume. There is stronger promise of life in the American Folklore Society, instituted at Cambridge, Mass., early in 1888: (1) For the collection of the fast-vanishing remains of folklore in America, viz.: (*a*) Relics of old English folklore (ballads, tales, superstitions, dialect, &c.); (*b*) lore of negroes in the southern states of the Union; (*c*) lore of the Indian tribes of North America (myths, tales, &c.); (*d*) lore of French Canada, Mexico, &c. (2) For the study of the general subject, and publication of the results of special studies in this department. Already its journal has amply justified its existence by a series of articles of striking originality and value. In 1878 was founded in France by H. Gaidoz and E. Rolland a folklore journal of the very highest class, the well-known monthly paper *Mélusine*, which was interrupted after a year, and not resumed till 1884. In the year 1885 was formed the Société des Traditions Populaires, whose organ, the *Revue des Traditions Populaires*, has appeared monthly since the beginning of 1886. Yet a third French monthly is *La Tradition*, commenced in 1887. Meantime many special books have been published in France upon departments of folklore, and especially noteworthy are two admirable series of books: (1) *Les Littératures Populaires de toutes les Nations: Traditions, légendes, contes, chansons, proverbes, devinettes, superstitions* (29 vols. up to 1889), embracing books devoted to Upper and Lower Brittany, to ancient Egypt, Gascony, Normandy, Picardy, the Basque country, Corsica, Alsace, North-west Canada, Mauritius, Asia Minor, and the Vosges district; (2) *Collection de Contes et Chansons Populaires* (14 vols. up to 1889), including the stories of the Greeks, Portuguese, Albanians, Kabyles, Slavs, Indians, Arabs, French, Senegambians, Corsicans, ancient Provençals, Berbers, and Egyptian Christians. So widely popular have folklore studies become in France that a special congress of its students was held at Paris during the great Exposition of 1889. Of the more eminent folklorists of France may merely be named Gaidoz, Sébillot, Luzel, Bladé, Vinson, Cosquin, Puymaigre, Carnoy, Leger, and Rolland. In Germany again, since the time of Grimm, the continuity of the study has been unbroken, some of the more illustrious in the chain of names being Benfey, Steinthal, Müllenhoff, Rochholz, Simrock, Zingerle, Felix Liebrecht, Reinhold Köhler, Bastian, Veckenstedt, &c. The last founded in 1889 the monthly *Zeitschrift für Volkskunde*. Benfey's *Orient und Occident* lived only from 1862 to 1866. *Volkskunde*, an organ for Dutch folklore, was founded in 1888; *Wisla*, for Polish, in the same year.

In Italy among the chief names are G. Pitrè and S. Salomone-Marino, joint-directors of the well-known quarterly, *Archivio per lo studio delle Tradizioni Popolari* (commenced in 1885); the former the author of more than forty folklore books and papers, and the indefatigable editor of the *Curiosita Popolari Tradizionali* (6 vols. up to 1889), as well as the *Biblioteca delle Tradizioni Popolari Siciliane*

(18 vols. 1870–89), covering with splendid fullness every department of the folklore of Sicily. Two other journals are *Giambattista Basile* (estab. 1883) and *Calabria* (1888). Other scholars who have made solid contributions are F. Sabatini (editor of *Folklore*, a monthly started at Rome, May 1889), Comparetti, Imbriani, Visentini, Bernoni, Laura Gonzenbach, Finamore, Nigra, Prato, Graf, Miss Busk, and Professor Crane. The *Canti e Racconti del Popolo Italiano*, edited by Comparetti and D'Ancona, already fill eight volumes (1871–89).

In Spain we have the *Biblioteca de las Tradiciones Populares Españolas* (11 vols. 1884–86), under the intelligent directorship of Antonio Machado y Alvarez. Other publications are the already extinct *Boletin Folklorico Español* (1885), and *El Folklore Andaluz* (1883), the *Biblioteca Popular de la Associacio d'Excursions Catalana* (3 vols. 1884–86), and the collections of folk-songs or studies on these of R. Marin, Demofilo, Mila y Fontanals, &c. For Portugal the guiding names are Coelho, Braga, Leite de Vasconcellos, and Pedroso; for Belgium and Holland, Von Reinsberg-Düringsfeld, Gittée, Pol de Mont, and Wilken; for Russia, Afanasief, Khudyakof, Rudchenko, Wesselefsky, Dragomanoff, Buslajev, and Ralston; for the Basques, Cerquand, Vinson, and Wentworth Webster; for the Gypsies, Miklosisch, Constantinescu, Paspati, Kopernicki, Wlislocki, C. G. Leland, and F. H. Groome; for Hungary, Hermann (*Ethnologische Mittheilungen*, first vol. 1887–89); for Finland, Krohn; for Roumania, Gaster; for Egypt, ancient and modern, Maspero and Spitta Bey; for the Welsh, Wirt Sikes and Professor Rhys; for India and Persia, the ancient literary collections of stories known as the *Hitopadesa*, the *Panchatantra*, the *Kalilah wa Dimnah*, and the *Kathá Sarit Ságara* of Somadeva (*Ocean of the Streams of Story*, Tawney, 1880), with the special books by Benfey, Rhys Davids, and W. A. Clouston, as well as, for modern and oral stories, the works of Miss Frere, Maive Stokes, Lal Behari Day, Captain Temple (*Legends of the Punjab*, and in collaboration with Miss Steel, in *Wide-awake Stories*), Natêsa Sâstrî, and J. H. Knowles. Few general books devoted to a particular country are so satisfactory to the scientific folklorist as Mr Turner's on Samoa, Mr Im Thurn's on British Guiana, and Mr Romilly's on New Guinea. Again, general books which no scientific folklorist can go far without consulting are those of Waitz, Gerland, Bastian, M'Lennan, Bachofen, Morgan, Hearne, Sayce, and Maine, and last, though far from least, Tylor, Lubbock, and Lang.

The Folklore Society's Definition and New Programme.—The vagueness and looseness in signification of the terminology of folklore had become so inconsistent with the enormous advance of knowledge in all its departments that a general desire arose for an exact definition of its scope and functions. With this view a discussion was opened in the pages of the *Folklore Journal*, to which important contributions were made by Miss Burne, and Messrs Gomme, Sydney Hartland, Machado y Alvarez, Nutt, Wake, and Wheatley, and afterwards by Captain Temple and Mr J. S. Stuart-Glennie. Mr Gomme's definition may now be taken as the working definition of the subject, both as upon the whole the simplest and most convenient offered, and from the fact of its possessing a kind of official sanction as the basis on which the society's *Handbook of Folklore*, which its author has long been preparing, is to be constructed. A code of questions on its lines has been prepared, similar to that drawn up by Sébillot in 1880, for the purpose of drawing forth such facts as are most helpful to the progress of real science and the formation of sound generalisations. Mr Gomme's definition is—the science which treats of the survivals of archaic beliefs and customs in modern ages. His divisions are: (1) *Traditional Narratives:* (*a*) Folk-tales, (*b*) Hero Tales, (*c*) Ballads and Songs, (*d*) Place Legends; (2) *Traditional Customs:* (*a*) Local Customs, (*b*) Festival Customs, (*c*) Ceremonial Customs, (*d*) Games; (3) *Superstitions and Beliefs:* (*a*) Witchcraft, (*b*) Astrology, (*c*) Superstitious Practices and Fancies; (4) *Folk-speech:* (*a*) Popular Sayings, (*b*) Popular Nomenclature, (*c*) Proverbs, (*d*) Jingle Rhymes, Riddles, &c.

Folk-songs, Ballads, Counting-out Rhymes, &c.—The reader has already seen the important part that belongs to popular folk-songs or Volkslieder in the scheme of folklore, and he will find this department already treated with some fullness in this encyclopædia under the head of BALLAD. These belong also to literature proper, from their intrinsic poetic content, and from the important influence they have exerted upon more cultured poetry. The patriot whose survey ends with his own shores and the mere man-of-letters alike claim them as falling within their province, in so far as they are national history and literature as well as tradition. Yet these may be correlated with the traditional folk-poetry of other races no less than folk-tales, and we have a splendid example of this in Professor Child's treatment of our *English and Scottish Popular Ballads* (5 parts, 1882–88)—the best edition of a body of popular poetry available to the student.

Much attention has been paid in recent years to children's rhymes and formulas of play, which have been found to be handed down from immemorial antiquity, and to reflect with strange persistency the life and even the religion of long past times. An admirable book devoted to this subject, *The Games and Songs of American Children* (New York, 1884), by Mr W. W. Newell, has demonstrated the identity of the games and rhymes of American children of to-day not only with those of Old England, but with those of Germany, France, Italy, and Sweden. Those doggerel rhymes of unmeaning jingling words for 'counting out' live with startling persistence, and some idea of their venerable antiquity may be gathered from the history of the so-called 'Anglo-Cymric score,' a corrupted form of the Welsh numerals up to twenty, still used in Cumberland for counting sheep, but used by children in many parts of Great Britain, and more strangely still, even in America, where it has often been supposed to be of Indian origin. Of these jingles as many as 800 specimens have been collected by a single editor (H. Carrington Bolton, 1888). Though they have been preserved and transmitted with such persistent conservatism, the genesis of these jingles and counting-out rhymes is so natural that it is quite superfluous to explain them as survivals of ancient superstitious practices of divination by lot.

Folk-tales, their Content, Origin, and Diffusion.—These, the *Volks-märchen* of the Germans, the *Contes populaires* of the French, are properly popular tales handed down by oral tradition from remote antiquity. Besides this continuous life they have at various times been lifted into literature, and again reacted in new forms upon purely traditional lore, thereby complicating enormously the problems to be solved. Thus, in the *Odyssey* and *Rig-veda* we find distinct traces of veiled and degraded folk-tales; while in the *Panchatantra*, *Hitopadesa*, *Kalilah wa Dimnah*, and Somadeva's *Kathá Sarit Ságara*, the *Thousand and One Nights*, the *Gesta Romanorum*, the *Disciplina Clericalis*, the *Tredeci piacevoli notti* (1550) of Straparola, Basile's *Pentamerone* (1637), the old French fabliaux, and the *Decameron* of Boccaccio we find

many actual folk-tales, more or less disguised by artistic processes of elaboration and refinement. These stories, from whatever sources originally derived, exercised a profound influence upon both eastern and western literature. In 1697 Perrault published his famous *Histoires ou Contes du Temps Passé*, seven stories undoubtedly written down substantially in their traditional shape. They created a fashion, and in imitation of them literary fairy tales were steadily produced throughout the 18th century, as may be seen in the voluminous *Cabinet de Fées*. But the beginning of real science was, as has been seen, the *Kinder- und Haus-Märchen* of the brothers Grimm. Since their time thousands of stories have been printed from all quarters of the globe, including Hottentot, Zulu, Swahili, Maori, Annamese, Brazilian, Samoan, Basque, Finnish, Eskimo, and Red Indian examples, as well as others from every province of every country of Europe. It is impossible here to enumerate these more fully; it may be enough to say that the most really valuable collections are still those connected with the names of Asbjörnsen and Moe, Von Hahn, J. F. Campbell, Calloway, Afanasief, Ralston, Pitré, Crane, Krauss, Sébillot, Luzel, Temple, and Cosquin. Many editors would have given greater value to their collections had they possessed an adequate grasp of the real conditions of the problem, and not hampered themselves by the perpetual necessity of finding facts to bolster up some preconceived theory.

The Grimms early found a startling similarity in the substance of these stories, and it only remained for later workers to discover the same identities when the comparison was extended far beyond the range of Aryan affinities. It was found that certain incidents, plots, and characteristics occurred everywhere—as the ill-treatment of the youngest son or daughter, who is eventually successful, and is often the heir; the substitution of a false bride for the true; the abduction of a bride by a youthful hero, and the pursuit by her giant (or supernatural) father, who is outwitted by cunning; a supernatural husband or wife, who is for some cause obliged to abandon a human mate; forbidden chambers, and the disasters that follow from their being opened; descents into the world of gloom, and the danger of eating there; husband and wife forbidden to see each other or name each other's names; the souls of the dead entering animal forms; and the interchange of kindly offices, as if on equal terms, between men and beasts. Again, the incidents are usually unnatural and irrational, completely traversing ordinary human experiences: thus, magical transformations, cannibalism, incest, beasts and men intermarrying, women bringing forth beasts and *vice versâ*, and inanimate things obeying incantations and speaking like men are perfectly familiar occurrences. An attempt was made by Von Hahn, in the introduction to his *Griechische und Albanesische Märchen* (1864), to construct a scheme for classifying folk-tales so as to facilitate comparison, and this idea was developed by Baring-Gould, Alfred Nutt, and other folklorists, until at length it was adopted by the Folklore Society (Fourth Report, June 1882). A series of schedules was prepared for systematic tabulation, the following points being especially observed: (1) The fixing of a generic title for each story, and the abolition of the variant titles of the same story which now obtain in different collections; (2) the determination of a common terminology for the study of stories and for each description of story; (3) the determination of a common terminology for each story-incident; (4) the compilation of an index of story-incidents; (5) the tabulation of all stories in printed collections upon a common recognised plan. An admirable example of work on these lines is Captain Temple's Analysis and Survey of Incidents in *Wide-awake Stories* (1884). The Society has also originated a similar analysis of customs, which promises to be no less fruitful in scientific results.

The time is not yet ripe for any satisfactory answer to the sphinx-like riddle of the origin and manner of diffusion of folk-tales; here it must suffice to state briefly the chief attempts at an answer hitherto offered. The first theory, sanctioned by the august authority of the Grimms, and maintained by Max Müller, Von Hahn, Dasent, and, with more zeal than discretion, by Cox and De Gubernatis, is that popular tales form a part of the mythology of the Aryan peoples, and were carried by them westwards at the primeval dispersion. Some consider them the *detritus* of the saga and the epic, others again as the original elements by a reconstruction and artistic elaboration of which the epics and sagas were formed. The next contribution of first importance was made by Benfey, in the masterly introduction to his translation of the *Panchatantra* (1859). His contention was that the popular tales were carried to Europe from India, within historical times, and diffused chiefly through literary channels, such as translations of Eastern story-books and the like. A few special sources were the fables connected with the names of Æsop or of Bidpai; the *Panchatantra*, especially the parent of tales; and *Syntipas*—in other versions called the *Book of the Seven Wise Masters*, more closely connected with novel literature. Among the more important media of communication may be named the wandering and trading Jews, the Moors in Spain, and the Crusaders in their intercourse with the Moslems in the East and with the orientalised Greeks of Byzantium. Dr Gaster (*Ilchester Lectures*, 1887) makes the old Slavonian religious literature the parent of the medieval and imaginative apocryphal literature, the romances and epics, and the didactic fables; and argues that oral folklore arose out of this written literature, the traces of which may be found in saga and romance, in religious and epic poems, in riddles and tales, and even in popular beliefs, customs, and habits. The ultimate common origin of all these was the East, of which not only the religion but the profane literature reached the Slavonic peoples through the medium of Byzantium —the open gateway of the East. He postulates a previous literary period, and affirms that not the legends alone, as now known to us, but also the fairy-tales, and even amulets and spells were almost unknown in Europe before the 10th century. Mr Clouston and M. Cosquin follow Benfey with greater or less modifications; and Mr F. Hindes Groome has made the striking suggestion (*The National Review*, July 1888) that one main channel of communication may well have been that ubiquitous, wandering, and specially gifted oriental race, the Gypsies. M. Cosquin argues that if the Aryan race before its dispersion preserved the myths only in their earliest germinal form, after the separate branches had lost touch of one another it would have been impossible that the final form of the myths—the household tales as we have them now—would have so closely resembled each other as they do. While admitting that the same ideas and situations are afloat wherever men exist at the same stage of culture, he refuses to allow that independent parallel or identical combinations are possible without conscious borrowing. What makes a story, properly speaking, is not the ideas which enter into it, such as speaking beasts, transformations, objects of magic, and the like, but rather the combination of the same, which is usually a thing entirely arbitrary; and it is impossible to believe, according

to M. Cosquin, that identical successions and combinations of incidents can occur without transmission by some means or other. He urges that the combinations in European folk-tales are Indian, nay, Buddhistic; consequently they must have been transmitted within the historical period from India.

The answer to this theory is to point to the vast accumulation of equally startling identities discovered among races far removed geographically from contact with India. It contradicts that homogeneity of human inventiveness which is found paralleled in the similar development of the arts of life everywhere. We are not told why stories can only be produced in India, and how Indian stories could possibly have penetrated within the period to the Zulus and the Iroquois. No doubt there has been some such borrowing as M. Cosquin's theory demands; and, indeed, we know of diverse currents which have carried in all directions several written collections; but the negation on which the theory rests will not support the weight it has to bear. Besides, the flank of M. Cosquin's position has been turned by the discovery that popular tales resembling those of India and Europe are found on papyri of ancient Egypt, dating 1400 years before our era. Sir Richard Burton and others attribute the origin of all human culture to Egypt, but of course it might here be said that ideas and combinations of ideas may have been carried from Egypt to India, which there ripened into fruit, and were scores of generations afterwards carried back again to the west. Mr Stuart Glennie makes 'the Arkhaian White Races,' represented by the ancient Egyptians and Akkadians of Chaldea, the originators of human civilisation. They possessed common traditions, as of a Paradise and a Deluge, and were succeeded about 3000 B.C. by the Semites and about 500 B.C. by the Aryans. The grosser myths found among the white races are not survivals of their own primitive culture, but rather of the superstitions of the lower races with whom the white races came into contact; while myths found among the lower races are merely rude misconstructions of the symbolisms of the higher races that subdued them. This theory is ingenious and interesting, but unfortunately its large postulates rest on much too feeble a basis of fact.

The most satisfactory theory hitherto offered—that of Mr Lang and the anthropological school—has already been stated substantially in the foregoing pages. It makes the spontaneous generation of similar ideas, incidents, and arrangements of these, under the same physical conditions, and at parallel levels in culture, the most important element in the manufacture of folk-tales. Popular tales are thus 'kaleidoscopic arrangements of comparatively few situations and incidents, which again are naturally devised by the early fancy.' At the same time it admits that the process of borrowing has also gone on, and that stories once invented may have been carried from people to people by daring merchants, captured alien wives, and slaves bought or carried off by violence. As a theory it confirms rather than contradicts the known facts of human psychology, and it traverses no hopeless difficulties of geography or history.

See the articles ANIMISM, BALLAD, BEAST-FABLES, CHAP-BOOKS, DEMONOLOGY, DIVINATION, FABLE, FABLIAUX, FAMILY, MYTHOLOGY, WITCHCRAFT, as well as on the names of the more important writers. Some of the more important books have been already mentioned; among general books may be named Bastian, *Der Mensch in der Geschichte* (1860); W. K. Kelly, *Curiosities of Indo-European Tradition and Folklore* (1863), antiquated, but still suggestive; Liebrecht, *Zur Volkskunde* (1879); Lang, *Custom and Myth* (1884), his preface to Mrs Hunt's trans. of Grimm (1884) and to his edition of Perrault (1888); W. A. Clouston, *Popular Tales and Fictions* (1887); Gustav Meyer's *Essays und Studien* (1885); and Puymaigre, *Folklore* (1885).

Folkmoot, or FOLKMOTE ('folk-meeting;' A.S. *mót, gemót,* 'assembly'), was the old name in England for the public assembly of the nation for political and judicial purposes, or for collective deliberation. The old Germans had similar assemblies, as also the Scandinavians (the latter being called *Ting, Althing*). There were numerous local moots, such as the *shiremoot*, or County Court (q.v.). It cannot be said that there was in the old days a national folkmoot for all England, to which every freeman had a right to come; even the *Witenagemót* (q.v.) was not fully representative, but was rather a royal council of magnates.—The *Moot-hall* was the hall of meeting; the *moot-hill*, the eminence or mound on which the open-air assemblies used to be held. See VILLAGE-COMMUNITIES; and Gomme, *Primitive Folkmoots or Open-air Assemblies* (1880).

Follicle. See HAIR, SKIN.

Fomentation (Lat. *fomentatio, fomentum;* from *foveo,* 'I warm'), an application of warmth and moisture to a part, by means of cloths wrung out of hot water, sometimes medicated with vegetable infusions of substances calculated to relieve pain or stimulate the surface. Thus, opium, belladonna, camomile, turpentine, &c. are used in various forms in connection with fomentations, which are employed in almost all painful local disorders. A fomentation can generally best be made by laying a strong towel across an empty basin, placing upon it a piece of flannel, folded to the proper size, pouring over this sufficient boiling water to wet it, and wringing it out inside the towel. It can thus be applied at once hotter and less wet than if it is wrung out by the hands alone. A sheet of waterproof material should be placed over it, to prevent wetting of the clothes, &c.; and another flannel substituted as soon as the first becomes cool.

Fonblanque, ALBANY WILLIAM, English journalist, was born in London in 1793, and when only nineteen exchanged the law for journalism. As editor of the *Examiner*, a leading Liberal weekly journal, he exhibited a singular keenness both of wit and intellect, and exercised no inconsiderable influence on public opinion between the years 1830 and 1836. The characteristics of his political writings may be gathered from his *England under Seven Administrations* (1837), a reprint of articles published in the *Examiner* from the period of the Canning and Goderich ministries to the return of the Melbourne ministry. Fonblanque's services to the Whigs were rewarded by his appointment to the uncongenial office of secretary to the Statistical Department of the Board of Trade in 1847. He died on 14th October 1872. A further collection of his writings from 1837 to 1860 was published by his nephew, together with a biographical memoir, in 1874.

Fond du Lac (Fr., 'end of the lake'), the capital of a county of the same name in Wisconsin, stands at the southern end of Lake Winnebago, 63 miles NNW. of Milwaukee by rail. It is connected by steamers with Lake Michigan, through Winnebago and the Fox River, and carries on a large trade in lumber, its principal manufactories being the sawmills. The city is supplied with water by nearly a thousand artesian wells. Pop. (1870) 12,764; (1880) 13,094; (1885) 12,726; (1890) 12,024.

Fondi, a town of Italy, situated in the province of Caserta, NW. of Gaeta, and 6 miles from the sea, in a fertile but unhealthy plain, where grew the Cæcuban wine of classic times. The town, through which passed the Appian Way, is still

partly surrounded by its ancient walls, and contains an old castle and a cathedral. Pop. 6773.

Fonse'ca, a bay on the Pacific coast of Central America, the proposed terminus of a projected interoceanic railway through Honduras.

Fonseca, ELEONORA PIMENTEL DE, MARCHIONESS, was born in Naples in 1758, and was lady-in-waiting to Queen Caroline until she forfeited her mistress' favour by remarking on her intimacy with Acton (q.v.). In 1798 she was an active partisan of the French; but on the fall of the Parthenopean republic in 1799 she was sent to the gallows at the instigation of the queen.

Font (*fons baptismalis*), the vessel used in churches as the repository of the baptismal water. In the early period, while immersion continued to be the ordinary rite in the administration of the sacrament of baptism, the Baptistery (q.v.) was furnished with a basin in the floor sufficiently capacious to admit of the immersion of a certain number of converts at one time. When infant baptism became general, fonts of an oblong form were employed, of suitable size for the immersion of a child. When it became customary to baptise by affusion—i.e. by pouring the water on the head of the person to be baptised—the size of the basin was naturally diminished, and eventually it assumed the dimensions and the form which are now familiar to us in most of the medieval churches in Great Britain and upon the Continent. The baptismal font, in its normal form, consists of a basin or cup, more or less capacious, but usually about 2 feet 6 inches in diameter, hollowed out of a solid block, and supported upon a stem or pedestal. It is ordinarily of stone, but some ancient examples of leaden fonts also occur, and a few of copper or of bronze. In general it may be said that the font, in its external design and character, followed the prevailing style of ecclesiastical architecture and ornamentation. There is some doubt as to whether any existing specimen in England really belongs to the Saxon period; but examples are found of all the later styles, from the Early Norman down to the latest revival of Gothic architecture in our own day; the Early English;

Font.

the Decorated, of which a beautiful example exists in the church of All Saints, Norwich; and the Perpendicular, which is seen in its highest perfection at East Dereham in the same county of Norfolk. The annexed illustration exhibits a highly characteristic specimen of the fonts of the beginning of the 14th century, which stands in the church of Swaton, Lincolnshire, erected about 1310.

The external figure of the basin was often octagonal, sometimes circular, sometimes square, more rarely hexagonal. Ancient sarcophagi were sometimes employed. The basin was commonly supported on a single pillar or stem. Many cases, however, occur in which it rests on three, four, or five pillars, or, as in the engraving, on a group of pillars or pilasters united into a solid stem. In the square font the central basin rested on a solid central stem, and four shafts supported the four corners. The angles of the frame were used for carrying the salt, the oil, and the candles employed (see V. le Duc, *Dictionnaire*, vol. v. p. 539, for illustration). The exterior, as well of the basin as of the pedestal, was often highly decorated, ordinarily with sculpture, but occasionally also in gold and colours; the designs on the basin commonly representing subjects connected with baptism, or its types and symbols. We frequently meet around the pedestal figures of the apostles, sometimes only eleven in number, Judas being omitted.

In the Catholic Church the 'chrism,' or consecrated oil blessed by the bishop, and also the so-called 'oil of catechumens' are mingled with the baptismal water, which is reserved for subsequent use. With a view to the preservation of the water thus reserved, the font, especially when it is of porous stone, is sometimes lined with lead; and from an early date it has been furnished with a lid, which is secured by a lock. The lid was originally a flat wooden cover, but in later times it is carried up like a spiral canopy, and is often of a highly ornamental character.

The ordinary place of the font is at the western end of the nave, near the entrance of the church; but in some cases, especially on the Continent, it stands in a separate chapel or baptistery, or at least in a compartment screened off for the purpose. Even when it stands in the open nave, it is properly enclosed by a rail.

The baptismal font is not to be confounded with the 'holy-water fount,' which usually stands near the entrance of Catholic churches, and from which persons entering sprinkle their forehead, in recognition of the inward purity with which we ought to enter the house of God; nor with the *piscina* or *cuvette*, which is found in the chancel or the sacristy of ancient churches, and which was intended to receive and carry away the water used in cleansing the sacred vessels and the other furniture used in the administration of the eucharist, though the font itself is also sometimes called piscina.

Fontaine. See LAFONTAINE.

Fontainebleau, a town in France, in the department of Seine-et-Marne, is beautifully situated in the midst of a forest, near the left bank of the Seine, 37 miles SE. of Paris, with which it is connected both by steamers on the Seine and by railway. It furnishes a great deal of wine and fruit for the capital, and has manufactures of porcelain, and a sandstone quarry. Pop. (1891) 10,923.

Fontainebleau is chiefly famous for its chateau, or pleasure-palace of the kings of France, and the forest that surrounds it. The forest covers an extent of 65 sq. miles, and presents much fine scenery. The château is said to have been originally founded by Robert the Good toward the end of the 10th century. It was rebuilt in 1169 by Louis VII., of whom and of Philip Augustus it was a favourite residence, and was enlarged by Louis XI. and his successors. After being allowed to fall into decay, it was repaired and embellished by Francis I., by Henry IV., and by Napoleon I. Almost every king has added something in the way of enlargement or embellishment, so that it bears the character

and style of almost every century. Louis-Philippe had all the paintings renovated, and the apartments restored in the taste of the 16th century. It was the residence of Christina of Sweden after her abdication, and here in 1657 she caused her secretary Monaldeschi to be executed. Under Louis XIV. it was occupied by Madame de Montespan, and under Louis XV. by Madame du Barry. Here Charles V. was entertained in 1539; here the decree for the revocation of the Edict of Nantes was signed in 1685; and here in the following year Condé died. In the château, too, Pope Pius VII. was detained a prisoner for nearly two years by Napoleon, and here this emperor signed the act of his abdication in 1814. In the forest Millet and other artists have lived and found their subjects.

Fontaines, MADAME DE, a French novelist, the date of whose birth is unknown. Her maiden name was Marie Louise Charlotte de Givri. She was a friend of Voltaire's in his youth, and died in 1730. She wrote *Amenophis* (a short story), and *La Comtesse de Savoie*, a tale of the 11th century.

Fontana, DOMENICO, an eminent engineer and architect, born in 1543 at Mili, on Lake Como. He became the papal architect in Rome, and was employed on many important public works, including the Lateran Palace and the Vatican Library. After the death of Sixtus V. he was royal architect and engineer in Naples, where he died in 1607.

Fontanes, LOUIS, MARQUIS DE, was born 6th March 1757, at Niort, in Poitou. After the completion of his studies he went in 1777 to Paris, where he acquired a reputation by his poems, *Le Cri de mon Cœur* (1778), *Le Verger* (1788), *L'Essai sur l'Astronomie* (1789), and *L'Épître sur l'Édit en Faveur des Non-Catholiques* (1789). He also wrote a metrical translation of Pope's *Essay on Man* (1783), with an elegant introduction, and an imitation of Gray's *Elegy*. During the Revolution Fontanes conducted a couple of journals in the popular interest, was appointed professor of Literature at the College of the Four Nations, and admitted a member of the Institute. In 1802 he was made a member, and in 1804 president, of the legislative body. His admiration of Napoleon was great; and his oratorical talents were often employed in eulogising the emperor's acts. In 1810 he entered the senate, and, passing on the fall of Napoleon into the service of the Bourbons, was raised to the peerage by Louis XVIII. He died at Paris, 17th March 1821. His writings, prose and poetic, which are regarded as models of elegance and correctness, were edited by Sainte-Beuve in 2 vols. in 1837, with a critical and biographical memoir.

Fontarabia, or FUENTERRABÍA, a picturesque old frontier town of Spain, at the mouth of the river Bidassoa, opposite to the French town of Hendaye, below the west extremity of the Pyrenees. It was long an important fortress, and the frequent object of contention between French and Spaniards, especially in 1638, when Condé was defeated, and in 1794, when its fortifications were demolished by the French. Battles were fought near by between Wellington and Soult in 1813, and during the Carlist war in 1837. In 1888 a strong redoubt was completed on the heights above. Pop. 3713.

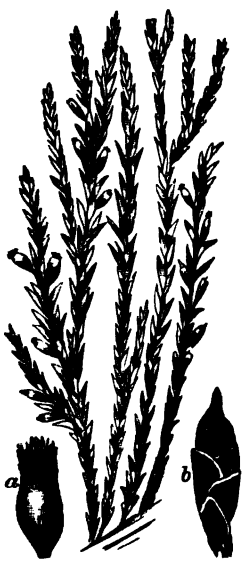
Fontenay-le-Comte, or FONTENAY-VENDÉE, a town of France, in the department of Vendée, is situated at the head of navigation on the river Vendée, 27 miles NE. of La Rochelle. Its most remarkable buildings are the beautiful Romanesque church of Notre Dame, with a Gothic spire 311 feet high, and the fountain from which the town is said to have derived its name. The town has manufactures of hats, woollens and linen, tanneries, and a trade in grain, &c. Pop. (1886) 9282; (1891) 8050.

Fontenelle, BERNARD LE BOVIER DE, was born at Rouen, February 11, 1657. His mother was a sister of Corneille. He was educated by the Jesuits and studied for the bar, but entered early in life upon a purely literary career in Paris. In the great quarrel of Moderns *versus* Ancients, which was then raging in France, he took part with La Motte and the other champions of the Moderns, assailing the Greek writers and their French imitators, and receiving in return the satiric shafts of Boileau, Racine, J. B. Rousseau, and La Bruyère. La Bruyère ridiculed him pitilessly in the *Caractères*, where he figures as Cydias, the pedant who ranks himself above Plato and Theocritus, and confidently awaits the hour when men will recognise his superiority to Homer. After the failure on the stage of his *Aspar*—a play to which Racine ascribed the origin of the practice of hissing in theatres—Fontenelle produced an imitation of Lucian, entitled *Dialogues des Morts*, and the *Lettres du Chevalier d'Her...*, a work of fiction written in the 'precious' style afterwards adopted by Marivaux. Thenceforth he devoted himself mainly to literary criticism and to the task of popularising science. His prose works brought him a remarkable reputation, which was to some extent merited by the elegance of the style and the perspicuity of the exposition. In 1697 he was made secretary to the Académie des Sciences, of which he afterwards became president. His *Éloges des Académiciens* added greatly to his fame, and after the death of Boileau in 1711 he enjoyed a well-nigh absolute rule in the Academy. He died in his hundredth year at Paris, on January 9, 1757, and is thus a link between the age of Molière and Boileau and the age of Diderot and Voltaire. He was a man of remarkable vigour and versatility of intellect. The best writers of his day endeavoured in vain to crush him. Had he not possessed rare strength of character he must have succumbed to the attacks of the brilliant men whose enmity he incurred. He attempted well-nigh every form of literature, he wrote idyls, and satires, and dialogues, and critical essays, histories, and verses of society, tragedies (*Aspar* and *Idalie*), scientific treatises, and operas (*Endymion*, *Thétis et Pélée*, &c.). He has left no book of outstanding merit; he was not a strong original thinker, and he seems to have cared less for truth than for paradoxes and piquant phrases. But his learning was far from contemptible, his style was graceful, and his wit was keen. His best works, the *Entretiens sur la Pluralité des Mondes*, and the *Histoire des Oracles*, the latter based on the treatise of the Dutchman, Van Dale, are still worth reading for the felicity of the expression and the frequent acuteness and ingenuity of the thought. Mr Lang has discovered the germ of his explanation of myths in Fontenelle's dissertation on Fables.

Fontenoy, a village (pop. 857) of Belgium, 5 miles SE. of Tournay, was the scene of a battle (11th May 1745) in the war of the Austrian Succession, between the French, 60,000 strong, under Marshal Saxe, and the allies (English, Dutch, and Austrians), in nearly equal force, under the Duke of Cumberland. After a hard-fought fight the allies were forced to retreat, the loss on each side being about 7000 men. The victory was in great measure due to the courage of the 'Irish Brigade' in the French army, as much be-sung by Irish poets.

Fontevrault (*Fons Ebraldi*), a town in the French department of Maine-et-Loire, 8 miles SE. of Saumur, with a population (1891) of 1513. The place owes its origin to a celebrated abbey founded by Robert d'Arbrissel, a Breton monk, in 1099, as the residence of a monastic society composed of both nuns and monks. The society followed the

rule of Benedict, but was governed by an abbess, not by an abbot. The order of Fontevrault, which received the papal sanction in 1106 and 1113, soon spread through France and into Spain, and acquired great riches. The abbesses belonged for the most part to illustrious families, and were subject only to the pope. At the outbreak of the French Revolution there were fifty-seven priories of the order in France, which, however, were then abolished. The 12th-century church contains sepulchral monuments to several English sovereigns and princes, including Henry II., his queen, Eleanor of Guienne, Richard Cœur-de-Lion, and Isabella, the queen of John. Since 1804 the old monastic buildings and courtyards have been used as one of the central prisons of France, accommodating about 2000 convicts. See *Fontevrault et ses Monuments*, by Edouard (2 vols. Marseilles, 1874).



Greater Water-Moss (*Fontinalis antipyretica*): *a*, spore-case or capsule, divested of calyptra and lid, showing the peristome; *b*, spore-case, with its involucre of leaf-like scales.

Fonthill Abbey. See BECKFORD.

Fontinalis, a genus of Mosses, allied to Hypnum, but having the capsule in the bosom of the leaves, almost without stalk. Several species are British; one of which, the Greater Water-moss (*F. antipyretica*), growing upon rocks and roots of trees in brooks and ponds, is remarkable for the difficulty with which it burns, even when completely dried; on which account it is used in some parts of the north of Europe for lining chimneys to protect the adjacent woodwork from fire. Its shoots are a foot or more in length, and branched; they float in the water. The fruit is on the sides of the stems.

Foochow (*Fû-Châu*), capital of the Chinese province of Fû-chien, with suburbs extending to the river Min, 25 miles above its mouth. The town proper is surrounded with walls nearly 30 feet high, and 10 feet wide at the top. The river is thronged with floating houses, and is crossed by a great bridge, 329 yards long, built of huge slabs of stone, some of them 42 feet in length, resting on forty piers. The Min provides an easy communication with the interior, with which a large trade is carried on in timber, paper, and cotton and woollen goods; and the port, opened to foreign commerce in 1842, is one of the principal tea-markets and mission stations in China. The trade has declined owing to the competition of Indian teas; but the export in the season of 1887–88 still amounted to 99,087,467 lb., of which 45 per cent. was shipped to London. The imports are chiefly opium, cotton goods, and lead. There are manufactories of silk and cotton fabrics and paper, and some shipyards; and on an island some three miles down the stream there is a large government arsenal managed by Europeans. Pop. about 630,000.

Food. Although the word 'food' is generally taken to indicate those solid matters, such as bread, meat, &c., which are consumed by a person for the nourishment of his body, yet it is convenient to use the term with a much wider significance. Under the term food we are forced to speak of all matters ingested for nutritive purposes, irrespective of their physical conditions, and to include beverages of various kinds, and even the air we breathe. There is the following very simple reason for this somewhat extended definition of the word. Water is the basis of all beverages, and no ordinary solid food is without some water, while on the other hand most beverages, wine, beer, tea, &c., contain solid matter dissolved in water. Air, as every one knows, is a vital and ever-pressing necessity, and its action within the body is eminently nutritive. The tissues of the body consume its oxygen as well as the nutritive parts of beef and mutton; and air we must therefore include within our extended definition.

The classification of food into solid food, beverages, and air would, however, be an unsatisfactory one. The chemist has been able to divide the food-stuffs, as we may call them, into classes, by sorting into groups substances which have similar chemical and physical properties. This arrangement has the advantage that members of the same class have nearly always similar properties as regards their nutritive functions.

THE VARIOUS KINDS OF FOOD-STUFFS.

NITROGENOUS	Proteids.
	Nitrogenous extractives.
NON-NITROGENOUS	Carbohydrates.
	Fats.
	Vegetable acids.
	Inorganic salts.
	Water.
	Air (oxygen).

The Nitrogenous Foods.—These all contain nitrogen, and, inasmuch as during life nitrogen is invariably, and under all circumstances, excreted by the body, it must be replenished by nitrogenous food-stuffs. The proteids (albuminoid substances) are found both in the animal and vegetable world. Among animal proteids are the white of egg, the vitellin of the yolk, myosin from muscle (flesh of meat), fibrin and albumen from blood, and gelatin from bones. In the vegetable world vegetable albumens and globulins are present, and in the grains and seeds of plants they are found in quantity. Nitrogenous extractives are found in the muscles (flesh) of animals, and are probably of great value, chiefly as stimulants. Beef-tea is an extract of these from the muscle of the ox, and they are found in rich animal soups.

The Carbohydrates.—These are food-stuffs containing carbon, oxygen, and hydrogen, but no nitrogen. Moreover, the oxygen and hydrogen are present in the proportions which form water. The vegetable world furnishes us with the most important carbohydrates. These are the various starches and dextrines. Then we have the sugars—cane-sugar, grape-sugar, sugar of milk or lactose, &c. The flesh and other eatable parts of animals are poor in carbohydrates; nevertheless the latter are found there. Glycogen or animal starch is widely distributed, although, except in the liver, it is present in small quantity.

Fats and Oils.—These substances, of a very high nutritive value, are found in both the animal and vegetable world. In vegetables they are especially abundant in seeds and fruits. In the animal world we find them in the tissues under the skin, and in many animals, such as whales, seals, &c., the blubber, as it is called, is present in enormous amount. The liver is generally found to contain a great deal of fat, as is also the tissue round the kidneys, and round other abdominal organs. The chief fatty matters present are olein, stearin, and palmitin.

Vegetable Acids.—The action of these substances

as food-stuffs, though important, is not altogether understood; but their withdrawal from the food may lead to serious inconvenience. The most important vegetable acids are tartaric, oxalic, citric, acetic, and malic.

Inorganic Salts.—Of these the most important is common salt, or sodium chloride. It is present in small quantities in all foods, but in addition man requires as a rule a still larger quantity. It greatly assists digestion, and probably is necessary for the formation of the gastric juice. Whereas it can pass through the system if taken in large quantities, yet a certain amount is required by the body to establish within it those conditions under which alone life is possible. Thus, many of the proteids would suffer complete alteration were it possible to abstract all the salt from the body, and the blood would become at once a turbid fluid which would rapidly cease to flow. In addition to sodium chloride there are many other salts required, such as potassium chloride and the phosphates of calcium and magnesium, the latter for the formation of bone. Iron salts are required for the formation of the colouring matter of the blood.

Water.—This all-important substance is taken in its natural form as spring, river, well, or rain water. In all cases certain inorganic salts are held in solution, which vary in their nature and quantity with the soil with which the water has come in contact. Organic (both animal and vegetable) matter may be present, especially in river and shallow well water. In addition, water is present in almost every kind of solid food, as well as in liquid foods and beverages. Bread, meat, cheese, potatoes, all contain a large quantity of water, and such substances as flour and biscuits are rarely free from a trace of it. Its importance for the needs of the economy are at once apparent when we recollect the large amount daily excreted by the lungs, the kidneys, and the skin, all of which require replenishing.

Air.—From the atmosphere we breathe oxygen is obtained, without which the other classes of food-stuffs would avail us little. Their destination is, in fact, to meet with this oxygen, and suffer changes called 'oxidation changes' within the tissues of the body.

SOURCES OF THE FOOD-STUFFS.—*The Carcasses of Animals.*—From the carcasses of animals we obtain meat and bones and fat, all of which have an important nutritive value. Cartilage, gristle, and yellow elastic tissue (pax-wax) are of almost no utility. Meat consists of from 70 to 80 per cent. of water, and the rest of proteids, extractives, fats, salts, and indigestible substances. The proteids of meat form about 20 per cent. of the whole; they are easily digestible, more so perhaps than are the vegetable proteids. Amongst the proteid fibres of the meat a certain amount of fat is generally lodged, and here and there it is collected in larger masses. The percentage quantity varies immensely, but even in lean meat there is on an average 2 per cent. of fat present. The extractives of meat are valuable stimulants of digestion, and the salts, chiefly chlorides and phosphates, are very abundant. The flesh of domesticated animals, such as oxen, sheep, and pigs, is especially rich in fat. The same may be said of fowls, ducks, and geese. The flesh of wild animals and birds contains less fat, and very little is ever present in the flesh of fish. The flesh of animals is almost invariably eaten after cooking. In this case the proteids are coagulated, the fibrous tissue of the meat is softened and rendered more digestible, and the savoury qualities of the meat are developed.

Meat may be cooked directly after killing, and in this case it is tender and very palatable. If the animal be kept for even a few hours the meat becomes hard owing to death coagulation; cooked at this stage it is tough and indigestible; it requires to be kept until it softens again. If kept for some time meat putrefies and becomes high. Game is generally eaten in this condition, and it is readily digested, and admirable in flavour. It is, however, apt to disagree with many people, and even fatal consequences may follow its consumption. High meat is putrid meat; the proteids have in part decomposed, but the remainder is partly in the very digestible form of a peptone proteid. The meat contains microscopic organisms termed Bacteria (q.v.), and is full of their excretions (*ptomaines*). These ptomaines are in all probability the cause of both the intestinal troubles and the actual poisoning which may follow the consumption of high meat, although at present we are not in a position to say why, under ordinary circumstances, it may be as a rule consumed with such impunity. Their poisonous action seems not to be destroyed by thorough cooking. The same may be said of the fatal consequences which sometimes follow eating fish, lobsters, crabs, and shell-fish which are not as fresh as they should be. In other cases, from as yet unknown causes, mussels, oysters, and other shell-fish produce bad dyspepsia, nettle-rash, and even graver symptoms, although they are eaten perfectly fresh. Many fish, especially during the breeding season, are quite unpalatable or even poisonous, apart from putrefactive changes. These fish are for the most part inhabitants of the tropical seas.

Idiosyncrasy plays a very important part in our selection of animal foods. Many are unable to eat veal, pork, high game, and certain kinds of fish. One medical man known to the writer can eat eggs *à la coque*, but vomited at the smell of a poached egg. Another can only eat freshly killed meat; if it has been hung a day or two, although he cannot distinguish the difference by means of the palate, yet he suffers afterwards from violent diarrhœa.

Diseased meat is always to be avoided, and it is probable that many affections as yet unrecognised are derived from eating the flesh of animals not in perfect health. There is, however, a great difference of opinion on this subject: many authorities at the present day trace even cases of poisoning to the eating of the flesh of animals suffering from black-quarter, smallpox, foot-and-mouth disease, cattle-plague, and anthrax; while it is certain on the other hand that the flesh is frequently eaten without any traceable ill consequences. No ill effects have been proved to follow the consumption of the flesh of pigs suffering from typhus and scarlet fevers. Nevertheless it cannot but be a sound principle to follow, that the flesh of healthy animals should alone be eaten; it is well to err on the safe side. Moreover, no one questions the fact that the flesh of the pig affected with *trichina spiralis* must be avoided. The parasites are not at all readily killed by cooking, and very dangerous febrile symptoms are produced by the action of the young trichinæ which wander into the tissues. Tapeworm is also produced by the consumption of the flesh of the pig and ox, although if the flesh be thoroughly cooked the danger is greatly diminished.

Bones of animals are very important articles of food. In the interior of the shafts one finds the yellow marrow, consisting of fat of a very savoury taste. At the ends of the bones is situated the red marrow, which is practically devoid of fat, but is rich in nitrogenous extractives. The whole bone, too, is porous, and boiling is able to extract from its interior a rich supply of nitrogenous extractives. Hence bones are useful for making soups, which we may look upon as hot decoctions of salts and extractives, having a useful stimulating

action, but not of any great nutritive value, unless thickened by the addition of pieces of meat or vegetables, which should be served up with the soup. The bone itself consists of a gelatin-yielding substance termed *collagen*, which is chemically united with earthy inorganic salts. This gelatin may be removed by prolonged boiling, and is used for making jellies, and for various other purposes.

Cereal Grains.—These are very important articles of food, and are largely used by mankind in nearly all parts of the globe. The most important cereal grains are those of wheat, oats, rye, barley, rice, and maize. They form very condensed articles of food, containing little water, and consisting of highly nutritive solid matter. They all contain an abundance of starch, together with smaller quantities of dextrine and sugar. Proteid matters are also present in no inconsiderable amount, consisting chiefly of insoluble substances, such as gluten-casein, gluten-fibrin, gliadin, together with some soluble albumen. The cereals are as a rule deficient in fat and salts.

Wheat-flour and Bread.—Wheat is rich in albuminous matter, containing about 12 per cent. It contains about 70 per cent. of starch, and very little fat. The grain is crushed and separated into flour and bran. With the loss of the bran the flour loses some fat, salts, and nitrogenous matter; on the other hand, bran is irritating to the digestive mucous membrane. Whole-meal bread is therefore more nourishing, but is apt to disagree.

If flour be mixed with water it forms a sticky dough or paste. This consists of gluten, a nitrogenous substance of a sticky nature, by which the granules of starch are held together. On heating this dough, with or without admixture of eggs, milk, &c., pastry, biscuits, &c. are made. Macaroni is made by forcing dough through small apertures during the application of heat. Bread is dough inflated with carbon dioxide, which gas may be generated in the dough itself, or may be driven into it by pressure. Yeast has the property of converting sugar into alcohol and carbon dioxide. If therefore yeast be mixed with dough which contains a little sugar, this ferments, and the carbon dioxide causes the dough to swell up. Baking powders are used for the same purpose; they consist of substances which yield carbon dioxide during the baking process. In Dauglish's process carbon dioxide is forced into the bread under pressure, and bread so prepared is termed 'aerated.' When flour is converted into bread much of the starch is converted into the more easily digested dextrine, and the albumens are coagulated and otherwise changed. It is rendered soft and open, readily permeable by the digestive juices. One hundred pounds of flour yield about 135 lb. of bread.

Oats and Oatmeal.—Oats have this advantage over wheat, that they contain more fat and more saline matter. They may be looked upon on this account as more valuable food, when the diet is limited to a few articles only. They are ground into oatmeal, from which porridge may be made. Oatmeal boiled with a large quantity of water, so as to form a drink, is highly spoken of by Parkes. It is capable of forming a much more sustaining drink than perhaps any other, and is much advocated for the use of labourers, especially for those engaged in harvesting or in other labour, where great exertion has to be made in a short space of time.

Barley, Maize, and Rye.—These are very nutritious, the maize containing about 6 per cent. of fat, in addition to albuminous and starchy matter. Rye and barley are apt to produce intestinal irritation.

Rice.—This grain is poor in nitrogen, and contains little fatty matter; so that those who subsist almost entirely upon it are obliged to supplement its deficiencies by admixture with fat, and with proteid matter either in the form of milk or legumes. It should not be cooked by any boiling process, inasmuch as during the process it loses much of its nutritive value, the albumens being in part dissolved away. It should be steamed in preference.

The Legumes or Pulses.—These include the peas, beans, and lentils. They are distinguished by containing large quantities of nitrogenous matter, and accordingly their chief utility is to supplement the deficiencies of starchy and fatty food. They are eaten with rice in India, and in England they form a favourite dish—'beans and bacon'—equivalent to the 'baked beans' of New England. The Mexicans, however, are the greatest consumers of beans (*frijoles*) in the world, although this vegetable is nearly equally popular throughout Central America; and the *garbanzo*, or chick-pea, fills the place of the potato in Spain. Lentil soup is a valuable food. The pulses are not readily boiled, and are not digested very easily.

Vegetable Roots.—Vegetable roots and tubers yield abundant food to man, of a highly nutritive quality, and containing as a rule a large quantity of starchy matter. The potato is one of the most important tubers. As it contains little nitrogenous and fatty matters, these must be added when the diet consists largely of potatoes. This tuber should be steamed rather than boiled; it is very digestible, especially when not too young. Since 1845, the year of the great potato disease, the plant has deteriorated, and, some maintain, is a less nutritive food than it had previously been. Arrow-root, which consists almost entirely of starch, and is largely adulterated with other forms of starch, cannot be considered in any other light than that of a single food-stuff, and in consequence it must always be used as an addition to other foods. The same remark applies to Tapioca (q.v.), and to sago, although this latter is obtained not from a root, but is cut away from the centre of the stems of several kinds of palm-trees. Other roots are the Jerusalem artichoke, containing sugar and nitrogenous matter, and turnips, carrots, and parsnips, containing starch, sugar, and a small quantity of nitrogenous matter. Beet-roots, mangold-wurzels, and radishes are all succulent roots, containing both starch and sugar.

Vegetables.—The most important vegetables are members of the cabbage tribe, amongst which may be mentioned the common cabbage, the red cabbage, cauliflower, Brussels sprouts, various kales, and broccolis. These have not a very high nutritive value, but they supply the economy with useful salts, and are in consequence very highly antiscorbutic. Much the same may be said for the lettuce, onion, mustard, cress, endive, &c.

Fruits.—These are of value chiefly on account of the sugar and vegetable acids they contain. The sugar is in a form which is readily absorbed; and, on account of the large quantity of vegetable acids, they have a very important antiscorbutic action.

Nuts, such as cocoa-nuts, walnuts, Brazil-nuts, are rich in oily and nitrogenous matter. They are not easily digested, however.

Beverages.—Water is the main constituent of every beverage. Most beverages contain solid matter, either in solution or in a state of suspension. We may divide beverages into nutritive and stimulating, the most useful ones combining both these properties. Perhaps the most important nutritive beverage is milk. It contains all the necessary food-stuffs, as is shown by the fact that the newly-born child can thrive on it alone. Its percentage composition is nitrogenous matter, 4 per cent.; fat, 4; milk-sugar, 5·2; salts, ·8; water, 86

per cent. The composition varies in different breeds of cows. The Alderney cow yields a milk that is very rich in fat, while the milk of the long-horned cow is rich in casein. It varies too with the pasturage, and may even acquire poisonous properties. The peculiar taste of the milk from cows fed on turnips is well known to every one. The milk of the ass may frequently be taken by persons who are unable to digest cow's milk. Cream consists of the fat of milk, and is obtained by allowing freshly drawn milk to stand for some hours. The lighter cream floats to the surface, and may be removed. The name 'skimmed milk' is applied to the residue after removal of the cream. Buttermilk contains less fat than does skimmed milk. It is, however, of important nutritive value, as it contains much nitrogenous matter, salts, and sugar.

Tea, Coffee, and Cocoa are restorative beverages having a stimulating action. They have little nutritive value unless taken with milk and sugar. Tea contains an astringent substance—tannin, which causes the rough taste experienced when it is drunk without milk. The addition of a few drops of the latter substance prevents its astringency, by precipitating the tannin as an insoluble albuminous tannate. It should be made by pouring boiling water over the leaves; if the leaves are boiled in water they lose their aroma, and much astringency is developed. On account of its astringency tea slightly impedes digestion and lessens the action of the bowels. Theine is the active principle. Coffee has, roughly speaking, the same composition as tea. Its active principle is *caffeine*, and it contains a tannic compound and a characteristic volatile oil. As a beverage it is stimulating; but it retards digestion and the action of the bowels. Like tea, it is said to prevent tissue waste, and it increases the action of the skin. Cocoa is much more nutritive than either tea or coffee, as it contains starch and a large quantity of fat and proteid matter. Chocolate is prepared by adding sugar and flavouring matter to the cocoa. See also KOLA NUTS.

Alcoholic Beverages.—Alcohol is an article of food of some nutritive value, though perfect health is compatible with total abstinence (see ALCOHOL). Alcohol is undoubtedly oxidised within the body, although if taken in any quantity the excess is eliminated. Taken in reasonable quantity it stimulates the action of the heart, and probably raises slightly the temperature of the body; but it retards to some slight extent the action of the gastric juice. It is also a mental stimulant, producing exhilaration. In many alcoholic beverages a large quantity of saccharine matter is present, and these may in consequence hold a place as possessing high nutritive qualities. Such are beer and porter. Bitter principles, when present, as in beer, are gastric stimulants, and probably assist digestion by increasing the secretion of the gastric juice.

The Economics of Food.—In temperate climates when a pastoral people turn their attention to agriculture they become to a great extent vegetable feeders. Their diet no longer consists chiefly of the flesh and milk of animals, but in addition includes the use of a large proportion of grains, pulses, and other vegetable food-stuffs. The agricultural race in time displaces the pastoral one, for several reasons. In the first place, the very fact that the art of agriculture has been acquired indicates a greater mental development, certain to exercise its full weight in the struggle for existence. In addition, however, there is another and an equally potent reason. Vegetable matter is, and must always be, more economical as a food-stuff than animal matter. A given area of soil must always yield food-stuffs of a more nutritive value if that soil has been used to cultivate vegetables such as corn, oats, &c., to be eaten directly by man, than if it be used for the maintenance of any animal kept for the subsequent nutrition of man. The reason is very simple. A vegetable has a certain nutritive value—i.e. it will yield when eaten so much muscular energy, &c. If eaten by man it will directly administer to the energy of his body, and his muscles and brain will be nourished by it. If it be given to an ox part will no doubt go to the nourishment of the ox, and then, if the ox be eaten, to the nourishment of the man. The greater part, however, will be consumed by the ox to obtain materials for *its own energy*. Every step it takes, the perpetual movement of its jaws in chewing, the whisking of its tail to chase away a fly, these are all deductions to be made out of the nutritive value of its food, and the residuum alone, and that a comparatively small one, is what is obtained when the ox is consumed. So truly is this understood by practical men that they try to minimise these deductions to the greatest possible extent. They prevent as much movement as possible on the part of the animals to be used as food, penning up the poultry, and placing the pig, naturally an active and intelligent animal, within the confines of a sty. In order that the animal may be compelled by a process of exclusion to devote itself entirely to feeding and to furthering the development of fat, it is rendered asexual by an operation which is in a high degree painful. Nevertheless, these deductions are only minimised in some degree, and it will ever be impossible to get rid of them altogether. It follows, therefore, from what we have said that, at anyrate in a thickly populated country, it is an economy to go straight to the vegetable world for food rather than to consume the flesh of animals. The high price of meat is an indication of what has just been alluded to. There is a loss in converting vegetable into animal produce, and the value of the latter rises in proportion to that loss. Life may be very cheaply sustained on vegetable produce, such as bread, oatmeal, peameal, &c. The cost of animal food is two or three times as great in the case of milk, cheese, and butter, and about twelve times as much in the case of beef, veal, ham, &c. According to Frankland, if an average man were to confine himself to one article of diet he would require, to support life from day to day, 5·068 lb. of potatoes; 1·156 lb. of Cheshire cheese; 1·335 lb. of peameal; 1·341 lb. of ground rice; 2·345 lb. of bread; 3·532 lb. of lean beef; 4·300 lb. of lean veal; 6·369 lb. of whiting; 8·745 lb. of white of egg; 2·209 lb. of hard-boiled egg; 9·865 lb. of carrots; 12·020 lb. of cabbage; ·693 lb. of butter; ·555 lb. of beef fat; 6¾ bottles of stout. It is not, of course, supposed that healthy existence can be maintained on one or two food-stuffs alone; the diet should be varied as well as plentiful, and in order to be economical it must be drawn largely from the vegetable world.

The various countries of the world differ very widely in regard to their power of producing within their own borders food and to spare for all their inhabitants. The United States is the most conspicuous example of a country which raises in superabundance the essential food-stuffs required by its own people, and has of many kinds a large surplus available for export. Few European countries save Russia are self-sufficing in this way. Great Britain is the most notable example of a country which is very largely dependent on foreign countries for the food of its people, and to an ever-increasing extent. At the beginning of the 19th century, according to Mulhall, the grain imports into the United Kingdom did not exceed 4 million bushels annually; in 1851–60 they had risen to 78 millions; in 1871–80, to 229 millions. Mean-

while the home production of grain had fallen, being in the decade 1871–80 about 345 million bushels. In the years 1880 to 1888 the imports of wheat alone varied from 90 million to 112 million bushels, while the production in 1888 was only 72 million bushels. The total food imports, including wheat, meat, butter, cheese, sugar, tea, coffee, rice, and eggs, increased from 2271 thousand tons to 5506 thousand. Great Britain imports about 37 per cent. of the meat consumed, 58 per cent. of the cheese and butter, and 61 per cent. of the wheat required. It may be said that Great Britain obtains nearly one-half of its food-supplies from abroad. These food imports are mainly from the United States, Russia, Germany (Denmark); after these, from Canada, India, and Australia. The imports of Indian wheat have greatly increased of late. In 1867 the total value of imports of live animals, meat, butter, cheese, eggs, wheat, flour, grain, hops, sugar, fruits, nuts, and vegetables was £78,611,416, or £2, 11s. 9d. per head of population; in 1883 it was £157,520,797, or £4, 8s. 6d. per head. In some of the years 1883–88, the average per head fell again as low as £3, 1s. 6d. or £3, 4s. 1d.

While Britain has been becoming more and more dependent on foreign countries, the United States has largely increased its surplus available for export. In 1821 to 1840 the United States exported on an average 6 million bushels yearly; in 1851 to 1860, 29 millions; in 1871 to 1880, 147 millions; and since then as much as 285 millions in one year. The grain exports from the United States to Great Britain alone in the years 1883 to 1887 varied from 43 millions of cwts. to 60 millions, with a value of from £20,000,000 to £29,000,000.

A circumstance that has enormously affected the imports from the United States into Britain is the extraordinary reduction in the cost of ocean transit between New York and Liverpool. Thus, while in 1880 each bushel of grain had to pay 9½d. for the transit, in 1886 one penny carried it all the way; and the cost of carrying a ton of flour fell in these years from 25s. to 7s. 6d.

However great be the advantage to Great Britain in having access thus freely to the best markets of the world, there is one aspect of the consequent dependence upon foreign countries which tends to cause misgivings. What could a country dependent for nearly one-half of its food-supplies on foreign countries do in time of a war with a great state, even if it were not one of those on which it was directly dependent? Assuming that the navy could prevent anything in the way of a complete blockade of the shores of Great Britain, still privateers might seriously hinder the access of necessary food: food cargoes might have to be transferred from British to foreign bottoms, and the consequence might be a swift rise to famine prices. The issues of a great war are, of course, incalculable; but it has been pointed out that it would be well for Britain to minimise the disadvantage, in view of such possibilities, by developing as far as possible the food-raising and food-exporting resources of her own colonies, while diligently striving by improved agricultural methods to make every acre at home raise as much more food for man and beast as is possible.

See the articles DIET, DIGESTION, BLOOD, COOKERY, and the books there quoted, as also the separate articles in this work on ALCOHOL, BEER, BREAD, CHOCOLATE, COCOA, COFFEE, WINE, &c.; for the subject of adulteration of food, see ADULTERATION; and on food generally such works as Pavy, *Food and Dietetics* (1875); Thompson, *Food and Feeding* (1886); Blyth, *Foods: their Analysis and Composition* (1881); and works on Food by Hassall (1876) and Letheby (1882).

Fools (COURT). See JESTERS.

Fools, FEAST OF. The Romans kept the festival of Saturn, in December, as a time of general license and revelry. During the brief season of the Saturnalia (see SATURN) the slave reclined on his master's seat at table, the master waited upon his slave, and society for the moment seemed to be turned upside down. The grotesque masquerade survived the pagan creed which gave it birth, and not only kept its place among the Christians, but, in the face of solemn anathemas from fathers and councils, found its way into the ceremonial of the Christian church. It was called, at different times and places, by many different names, but latterly came to be best known as the Feast of Fools (*Festum Fatuorum*, *Festum Stultorum*). The rites practised varied greatly, but were everywhere marked by the same spirit of broad, boisterous drollery, and coarse but not ill-natured caricature. The donkey played such a frequent part in it that the pageant was often called the Feast of Asses (*Festum Asinorum*). In some places the ass of Balaam was figured; in others, the ass which stood beside the manger in which the infant Saviour was laid; elsewhere, the ass on which the Virgin and Child fled to Egypt, or the ass on which Jesus rode into Jerusalem. In every instance there was more or less attempt at dramatic representation, the theatre being generally the chief church of the place, and the words and action of the drama being often ordered by its book of ceremonies. Several rituals of this sort are still preserved: that which was in use at Beauvais, in France, has a rubric ordering the priest when he dismisses the congregation to bray three times, and ordering the people to bray three times in answer. As the ass was led towards the altar he was greeted with a hymn. Where the ass did not come upon the stage the chief point of the farce lay in the election of a mock pope, patriarch, cardinal, archbishop, bishop, or abbot. These mimic dignitaries took such titles as 'Pope of Fools,' 'Archbishop of Dolts,' 'Cardinal of Numskulls,' 'Boy Bishop' (q.v.), 'Patriarch of Sots,' 'Abbot of Unreason,' and the like. On the day of their election they often took possession of the churches, and even occasionally travestied the performance of the church's highest office, the mass, in the church's holiest place, the altar. In some convents the nuns disguised themselves in men's clothes, chanted mock services, and elected a 'little abbess,' who for that day took the place of the real abbess.

The Feast of Fools maintained itself in many places till the Reformation in the 16th century. At Antibes, in the south of France, it survived till the year 1644, when we have it described by an eye-witness in a letter to the philosopher Gassendi. The scene was, as usual, a church; and the actors, dressing themselves in priests' robes turned inside out, read prayers from books turned upside down, through spectacles of orange-peel, using coal or flour for incense, amid a babblement of confused cries, and the mimic bellowings of cattle, and grunting of pigs. See Tilliot, *Mémoires pour servir à l'Histoire de la Fête des Fous* (Lausanne, 1741), and Schneegans in Müller's *Zeitschrift fur Deutsche Kulturgeschichte* (1858).

Fool's Parsley (*Æthusa Cynapium*), an umbelliferous plant, common as a weed in gardens and fields in Britain, and in most parts of Europe, somewhat resembling parsley in its foliage and general appearance, so that serious accidents have occurred from its being mistaken for that herb; for it is a poisonous plant, somewhat resembling hemlock in its properties. With the curled variety of parsley it cannot easily be confounded; the leaves are smaller and glossy, and have a disagreeable garlic-like odour when rubbed. The growth is annual, but at first more rapid than that of true

parsley. When in flower it is readily known from every other plant in British gardens by its umbels wanting general involucres, but having upon the secondary umbels partial involucels of three slender leaves hanging down on one side.

Fool's Parsley (*Æthusa Cynapium*): *a*, umbel.

Foot. In man the bones of the foot are twenty-six in number, and are arranged in three natural groups—viz. the tarsal bones, which are the hindermost; the metatarsal bones, which occupy the middle portion; and the phalanges of the toes anteriorly. The tarsal bones, seven in number, are short and somewhat cubical, and form the heel and the hinder part of the instep. The uppermost (see fig. 1) is called the *astragalus*, from its supposed resemblance to the dice used by the Romans. Above, it articulates with the two bones of the leg, the *tibia* and *fibula*, and through these bones the whole weight of the body is thrown upon the two *astragali*. Below, it is connected with and rests upon the *os calcis*, or heel-bone, which is the largest bone of the foot. Immediately in front of the astragalus, and supporting it in this direction, is the *scaphoid* or boat-like bone.

Fig. 1.—Bones of the Foot and Ankle:
a, tibia; *b*, fibula; *c*, astragalus; *d*, os calcis, or heel-bone; *e*, scaphoid bone; *f*, *g*, *h*, the internal, middle, and external cuneiform bones; *i*, cuboid bone.

In front of the scaphoid bone are the three *cuneiform* or wedge-shaped bones; and on the outer side of the cuneiform bones, and in front of the os calcis, is the *cuboid* bone. We see from fig. 1 that the front row of tarsal bones is composed of the three cuneiform bones on the inner side of the foot, and of the cuboid bone externally. There are five metatarsal bones passing forward, one for each toe. Each cuneiform bone is connected with one, and the cuboid bone with two, of these metatarsal bones. Behind, they are close together, but as they run forward they diverge slightly from one another, and their anterior ends rest upon the ground and form the *balls* of the toes. They constitute the forepart of the instep. The remaining bones are those of the toes, and are named the *phalanges*, each toe having three of these bones, excepting the great toe, which has only two. (A similar law holds for the bones of the hand, each finger having three phalanges, but the thumb only two.)

The instep is composed of the seven tarsal and the five metatarsal bones, which are so arranged and connected (see fig. 2) as to form the *plantar* arch from the extremity of the heel-bone to the balls of the toes. The astragalus forms the summit or keystone of this arch, and transmits the weight which it receives back to the heel, and forward to the balls of the toes.

The bones where they articulate with one another are covered with a tolerably thick layer of smooth cartilage, and by this means, together with the very slight movements of which each bone is

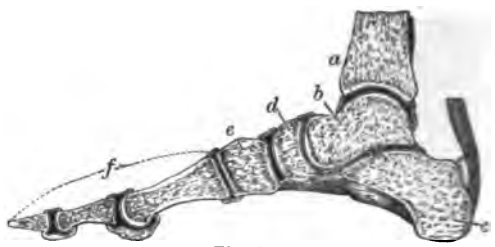


Fig. 2.
Section through the lower end of the tibia *a*, and through the astragalus *b*, the heel-bone *c*, the scaphoid bone *d*, the internal cuneiform bone *e*, and the bones of the great toe *f*.

capable, a degree of elasticity is given to the foot, and consequently to the step, which would be altogether wanting if the plantar arch were composed of one single mass of bone. This elasticity is far greater in the anterior pillar of the arch, which is composed of five comparatively long bones sloping gradually to the ground, than in the posterior pillar, which is short, narrow, and composed of a single bone, which descends almost vertically from the ankle to the ground. Hence, in jumping from a height, we always endeavour to alight upon the balls of the toes, and thus break the shock which we should feel if by accident we descended upon the heels.

The bones of the foot are held together by short ligamentous bands of great strength. These are attached to the non-articular surfaces of the bones, and are arranged mostly on their *plantar* and *dorsal*—i.e. upper—surfaces, while others are situated between bones, and are hence named *interosseous*. So resistant are these ligaments that it is almost impossible to dislocate the bones which they hold together.

The spot over which the inferior calcaneo-scaphoid ligament extends is the weakest in the foot, the astragalus being there unsupported by any bones; additional support is, however, afforded where it is more required by the tendon of a strong muscle, the *posterior tibial* (fig. 3, B), which passes from the back of the tibia (the chief bone of the leg) round the inner ankle, to be inserted into the lower part of the inner surface of the scaphoid bone. It not unfrequently happens that the astragalus, being either insufficiently supported, or from

its being overweighted, descends slightly below its proper level, causing a lowering of the arch and a flattening of the sole of the foot. The defect when slight is known as 'weak ankle;' when more decided it is termed 'flat-foot;' and in extreme cases the bone may descend to such an extent as even to render the inner side of the foot convex when it naturally should be concave.

In the movements of the foot upon the leg we see a striking combination of variety of movement with general security. This combination is effected by the harmonious action of three joints, each of which acts in a direction different from the others. The first of these joints is the ankle-joint, which is formed by the bones of the leg—the tibia and fibula—above, and the astragalus below. At this joint the movements of *flexion*—i.e. approximation of the toes to the knee, and *extension*—i.e. pointing the toes to the ground, take place. The second joint is between the astragalus and the heel-bone, and it permits the foot to be rolled inwards or outwards; while the third joint is between the first and second row of tarsal bones—viz. between the astragalus and os calcis behind, and the scaphoid and cuboid bones in front—and allows the degree of curvature of the plantar arch to be increased or diminished within certain limits. The following is the order in which the movements of these three joints occur: the raising of the *heel* (by the first joint) is accompanied by a rolling of the foot *in*wards (by the second joint), and by an increased *flexure* of the plantar arch (by the third joint); and the raising of the *toes* is accompanied by a rolling of the foot *out*wards, and a *straightening* of the sole.

The joints, however, merely allow of movements; they do not effect them: this is the special function of the muscles; and each of the three movements we have indicated is effected by special groups of muscles. The principal of these muscles are shown diagramatically in figs. 3 and 4, representing the inner and outer sides respectively. The first series of movements is mainly effected by three muscles: viz. (1) *muscles of the calf* (fig. 3, A), attached above to the bones of the thigh and leg, and below by the *Tendo Achillis* to the heel-bone; (2) the *posterior tibial* (fig. 3, B), attached above to the tibia, and below by its tendon to the scaphoid bone; and (3) the *short fibular* (fig. 4, C), attached above to the fibula, and below by its tendon to the outer metatarsal bone. The calf-muscles, whose tendon is inserted into the heel-bone, are large and very powerful, for in raising the heel they have to raise the weight of the body. The other two muscles, the posterior tibial and the short fibular, turn round the inner and the outer ankle respectively, and are inserted into the inner and the outer edges of the instep; the former being attached to the scaphoid, and the latter to the outer metatarsal bone. They not only assist in raising the ankle, but support it laterally. The muscle whose tendon is on the inner side of the foot (the posterior tibial) effects the two movements which are associated with the raising of the heel-bone—viz. the turning of the foot inwards and the increased flexure of the arch.

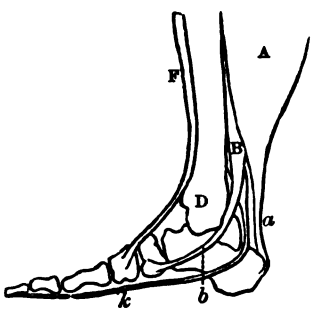


Fig. 3.

A, the gastrocnemius and soleus muscles, forming the muscles of the calf; *a*, the Tendo Achillis; B, the posterior tibial muscle; *b*, its tendon; D, the inner ankle; F, the anterior tibial muscle, attached above to the front of the tibia, below to the internal cuneiform bone; *k*, the flexor tendon of the great toe.

The second series of movements—the raising of the toes, the turning of the foot outwards, and the straightening of the sole—are effected by two muscles, the *anterior tibial* (fig. 3, F) and the *third fibular* (fig. 4, G), whose tendons pass, one in front of the inner ankle, and the other in front of the outer ankle, to the corresponding edges of the instep, and are inserted into the internal cuneiform and the outer metatarsal bones. These muscles are direct flexors of the tarsus upon the leg; the former raising the inner, and the latter the outer border of the foot.

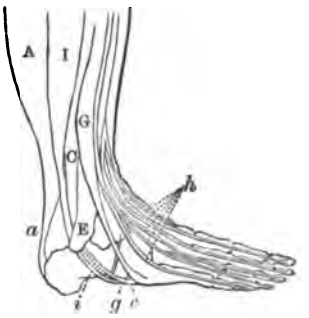


Fig. 4.

E, lower end of fibula, forming the outer ankle; C, the short fibular muscle, attached above to the fibula, and below by its tendon, *c*, to the outer metatarsal bone; I, the long fibular muscle, its tendon, *i*, running behind the outer ankle and under the instep to the metatarsal bone of the great toe; G, the anterior or third fibular muscle, attached above to the fibula and below by its tendon, *g*, to the outer metatarsal bone; *h*, the extensor tendons of the toes.

Another point in the anatomy of the foot that requires notice is the mode of union of the metatarsal with the tarsal bones. In these joints in the fourth and fifth toes a slight revolving motion can take place, which probably enables the outer metatarsals to adapt themselves to inequalities of the ground, and to equalise the distribution of the weight which is thrown upon the foot; while, in the corresponding joints of the three inner toes, scarcely any motion can occur—a provision by which additional strength is given to the inner side of the foot, upon which the weight of the body most directly falls.

The skin of the sole is very tough and strong; and intervening between it and the bones and the strong fascia of the sole of the foot is a thick pad of fat, which acts the part of an air or water cushion in defending the adjacent parts from injurious pressure, and in deadening the jars and shocks that would otherwise be felt in leaping, &c.

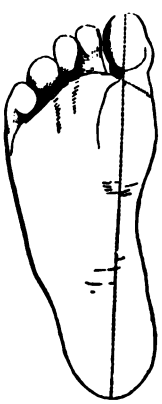


Fig. 5.

Fig. 6.

A few remarks on the subject of shoes may here be added. The shape of the sole of the natural foot is shown in fig. 5, while the shape after the prolonged use of a badly-made shoe is given in fig. 6. In the foot in its normal state the great toe is seen to be free from the others, and the line of its axis prolonged backwards passes through the centre of the heel; while in the foot distorted by the use of the shoe the line of the great toe is quite altered, and the toes generally—not being able to find room side by side—overlap each other

and lose their separate and individual actions; corns, bunions, and ingrowing toe-nails being the natural consequence of this maltreatment. Meyer of Zurich drew attention to the bad treatment which the foot receives from ordinary shoemakers, and pointed out that the great toe should be allowed to have its normal position, and this can be done by making the inner edge of the sole incline *in*wards, instead of *out*wards, from the balls of the toes. The accompanying figure (7) gives the outline of a shoe designed under Meyer's superintendence, and shows the difference between it and the usual shape; the latter being indicated by the dotted outline. High heel-pieces tend to make the step less steady and secure, to break down the arch of the foot, to shorten it, and to impair the action of the calf-muscles. A high heel-piece, moreover, places the forepart of the foot at a lower level than the heel; the weight is thus thrown too much in the direction of the toes, and they are thrust forward and cramped against the upper leather of the shoe.

Fig. 7. Shoe designed by Dr Meyer, the dotted outline being the usual shape.

If we compare the human foot with the feet of other mammals we find that it presents certain peculiarities, all of which have reference to man's erect posture. The chief peculiarities are (1) the greater relative size of the tarsal bones as compared with the other bones of the foot, and the more perfect formation of the plantar arch, which is higher and stronger than in any of the lower animals. Strength and elasticity are thus combined in the human foot in the highest degree. (2) The great toe is remarkable in man for its size and strength, and for the firm manner in which its metatarsal bone is joined to the other bones so as to render it the main support to the foot. (3) If we compare the human foot with that of the gorilla (fig. 8) or any other Anthropoid Ape (q.v.) we see that the toes are short and small in man in relation to the other parts of the foot, while in the gorilla the toes form the greater part of the foot. Indeed, a reference to fig. 8 shows that the organ in question is rather a *hand* than a *foot*, and hence the term *quadrumanous* as applied to this class of animals. There is scarcely any plantar arch, and the weight of the body bears chiefly on the outer edge of the foot; the digits are long and strong, and the inner one diverges so as to form a thumb rather than a great toe.

Fig. 8. Foot of Gorilla.

It remains to notice some of the most marked varieties of form which the bones of the foot present in mammals. In the following group of figures the same letters are attached to the same bones. Thus, *a* marks the astragalus; *cl*, the calcaneum or heel-bone (the posterior projection of which forms the hock of the horse); *s*, the scaphoid; *b*, the cuboid; *ce*, the ecto- or outer, *cm*, the meso- or middle, *ci*, the ento- or internal cuneiform. Now, as a general rule in all mammalia, the ecto-cuneiform supports the third or middle of the five toes when they are all present, the meso-cuneiform the second, and the cuboid the fourth and fifth. Bearing in mind this law, we see that the large bone in the horse, known as the cannon-bone, which is articulated to the ecto-cuneiform, *ce*, is the metatarsal of the third toe, to which are articulated the three phalanges of that toe, the last phalanx, 3, being expanded to form the hoof. The small bone popularly known as the splint-bone (not shown in the figure), and articulated to the meso-cuneiform, is the rudimentary or stunted metatarsal of the second toe, 2; and the outer splint-bone, articulated to the cuboid, is the rudimentary metatarsal of the fourth toe, 4; so that in the horse we have only one toe, the third, sufficiently developed to reach the ground, with mere traces of a second and fourth toe on either side. In the foot of the ox the cuboid, *b*, is relatively larger than in the horse, and is equal in size to the ecto-cuneiform, *ce*. The cannon-bone articulates with both these tarsal bones, and hence answers to the metatarsal bones of both the *third* and *fourth* digits; it is accordingly found to consist of two distinct bones in the fœtus; and in the adult it is divided internally into two cavities, and its original separation is marked out by an external elongated ridge.

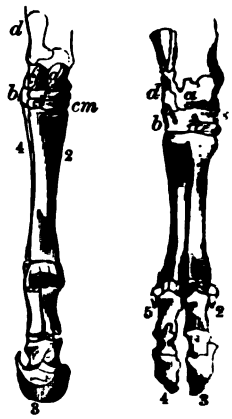


Fig. 9.—Horse. Fig. 10.—Ox.

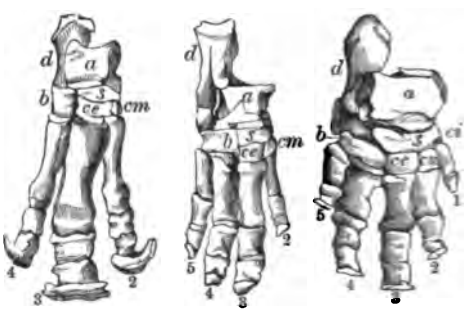


Fig. 11. Rhinoceros. Fig. 12. Hippopotamus. Fig. 13. Elephant.

At the lower end are two distinct joints for the phalanges of the third and fourth toes. While in the horse we had the rudiments of the *upper* parts of two toes (the second and fourth), in the ox we have the rudiments of the *lower* parts or phalanges of two toes (the second and fifth), forming the 'spurious hoofs,' and marked 2 and 5 in the figure. In the rhinoceros there is one principal toe (the third), as in the horse, with the second and fourth toes in a less developed state; while in the hippopotamus there are two principal toes (the third and fourth), as in the ox, with the second and fifth toes not fully developed. In the elephant there is a fifth digit added, answering to our great toe, and articulating with an ento-cuneiform bone, so that in the foot of this animal we have all the bones occurring in the human foot. Owen concludes from these and similar observations that the course of the simplification of the five-toed foot is, first, a diminution and removal of the innermost toe; next, of the outermost; then, of the

second; and lastly, of the fourth; the third or middle toe being the most constant and (in the lower animals) the most important of the five.

Foot, the most common unit of lineal measure all over the world, was taken originally from the length of the human foot. The three foot-measures that occur most frequently are the Paris foot or *pied de roi*, the (German) Rhenish foot, and the English. Compared with the French *mètre* (= 3·28090 English feet) they stand thus:

		Mètre.			English Inches.
English foot	=	0·30479	Paris foot	=	12·78912
Paris "	=	0·32484	Rhenish "	=	12·35652
Rhenish "	=	0·31385			

In round numbers, 46 Paris feet = 49 English feet, 34 Rhen. or Ger. feet = 35 English, and 57 Paris feet = 59 Rhenish. The Russian foot is almost exactly equal to the English. Many local feet are only about 10 inches. The foot has almost uniformly been divided into 12 inches, and the inch into 12 lines (often, however, into tenths). The French *pied usuel* is the third part of the mètre (see YARD, MÈTRE). In Music a foot is the short figure with one accent, and in Metre (q.v.) a certain number of syllables (dactyl, iambus, &c.).

Foot-and-Mouth Disease. See MURRAIN.

Football. Probably no game has ever been able to count upon so much popularity and so many opponents at one and the same time as the now great English winter pastime of football. When it was first played it is impossible to say, but in one form or another the game has existed for very many centuries, in spite of an amount of opposition that would have completely extinguished a less attractive form of exercise. As in the case of cricket, and indeed many other ball games, opinions are divided as to whether football sprung up on English soil or was an importation. The Greeks had a game to a certain extent resembling football, which was played with the kind of ball known as *harpaston*, and one set of players had to force the ball into that portion of the ground guarded by a rival team in any way they chose. Amongst the Romans, too, there was a game played with a large inflated ball, the *follis;* and, though it is evident this was only struck with the hand, yet the ball used was undoubtedly similar to the football of later years. No old-time trace of the game as at present understood has, however, been discovered outside of Britain, where it has flourished for centuries. That football in its early days was played with a boisterous vigour that very closely approached brutality, and often led to breaches of the peace, ample proof is adduced by the numerous attempts made to prohibit it. As early as 1314 a proclamation was issued by Edward II. forbidding the hustling over large balls (*raqaries de groses pelotes*), which it is to be presumed had reference to football. In 1349 the game, designated in the statute by its present name, was objected to by Edward III.; and similar measures were adopted with a view to its suppression by Henry IV. (1401) and Henry VIII.; while during the reign of Elizabeth the game was forbidden upon pain of imprisonment. Despite these prohibitive measures and much hostile criticism, football continued to be regularly pursued by the people at large until the middle of the 17th century, when it began to decline in popularity, the change being due possibly to the influence of Puritanism. It was not, however, allowed to die out altogether, and after being kept alive by the younger generation it ultimately became a regular item in the public school curriculum. This flame was fanned by the athletic revival of the 19th century, and it is now an open question whether the votaries of football do not outnumber those of cricket.

The description of game played in the early ages was like that of the present day in that it consisted in forcing the ball through goals which were then defined by objects dependent upon the spot where the game was decided. The ball at the start was placed as now midway between the two goals, and each side, consisting of any number of players, endeavoured to gain the upper hand by any device or strategy. The game was played either in the street, on a field, or 'across country,' when in some instances the goals were several miles apart. Shrove Tuesday was the great football day. Until 1540 a game took place annually on this day on the Roodee, at Chester, and in some parts of England a game similar in character is still indulged in. The ball was kicked or thrown at the discretion of the player, and in the struggle to gain or retain possession of the ball there was some exceedingly rough work. A description of such a contest played as recently as 1888 was given in *The Field* of March 3 of that year. Joseph Strutt, writing in 1801, describes the game of that time, and by its close affinity it is evident that this was the prototype of the old hacking and tripping game, an early development of Rugby Union football.

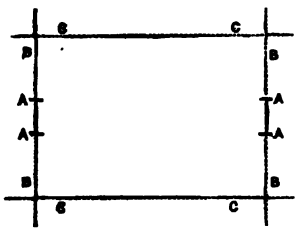
Football at the public schools was and is still of very varied character, the rules of the game having, as an admirable authority has suggested, been probably drawn up to suit the capacity of the playground. Where the ground, as at Rugby School, took the form of a large meadow, there running with the ball, the consequent tackling or collaring, and the rough tactics adopted in the primitive game could be indulged in without fear of serious danger; but not so in the circumscribed and more general kind of playground, with, in many cases, its flagged pavement. Here it was necessary that the rougher element should be eliminated; and hence arose the game in which kicking the ball was alone permissible, to be subsequently known by the name of Association football.

About the middle of the 19th century clubs began to be formed by old public school boys. The Sheffield and Hallam clubs, playing the 'dribbling' or non-handling game, were started in 1857; a year later the celebrated Blackheath Club was formed for the purpose of promoting the 'carrying' game; and in 1858 came the institution of the famous Richmond Club. Others of course followed, and in 1863 a praiseworthy attempt was made to determine upon one code of rules to govern all players. This attempt failed, but a body, to be ever afterwards known as the Football Association, was in the same year formed by the 'dribbling' clubs, who were numerically stronger than the followers of Rugby. The latter section was content to remain without organisation until 1871, when the Rugby Football Union sprang into existence. Under the management of the societies named, the game has improved and grown in marvellous manner, until it stands unrivalled in Great Britain as a winter pastime. International and all other kinds of matches are played, and so extraordinary is the popularity of football that nearly 30,000 people have been known to attend a single match, while a company numbering 10,000 is by no means a rare occurrence; and since 1888 there have been some clubs organised as limited liability companies, which have declared fair dividends.

The diagram on the following page will give some idea of the field of play.

In Rugby Union football the area for play is usually 110 yards by 75 yards; each goal is composed of two upright posts exceeding 11 feet in height from the ground, and placed 18 feet 6 inches

apart, with a cross-bar 10 feet from the ground. For a match the opposing sides number fifteen each, and are generally disposed of as follows: one full back, three three-quarter backs, two half-backs, and nine forwards. The arrangement of the side is, however, entirely in the hands of the captain, who may deem it expedient to draw from the forwards for additional strength behind the scrimmage. The dimensions of the ball are: length, 11 to 11¼ inches; length circumference, 30 to 31 inches; width circumference, 25½ to 26 inches. From these it will be gathered that the ball, weighing from 12 to 13 oz., is oval in shape. It is the object of each side to obtain as many tries or goals as possible. At the present time matches in England are decided by a number of points; a goal from a try or drop-kick scores three points; from a free kick (penalty for infringement of offside and other rules), two points; for a try, one point is allowed. In other portions of Great Britain a goal counts more than any number of tries, an arrangement which is not of the most equitable kind. A try is gained when a player touches the ball down in his opponents' goal. This is accomplished by a player, when not offside, dodging his opponents and crossing the goal-line at any spot. A player is put offside if he enters a scrimmage from his opponents' side, or, being in a scrimmage, gets in front of the ball, or when the ball has been kicked, touched, or is being run with by any of his own side behind him—i.e. between himself and his own goal-line. A side having so touched the ball down, one of the players of the same side must bring it up to the goal-line in a straight line from the spot where it was touched down, and thence walk out with it in a line parallel to the touch-lines such distance as he thinks proper and there place it for another of the side to kick. Should the ball be kicked directly over the cross-bar (not over either post) it is a goal. A goal may, however, be obtained by a drop-kick (made by letting the ball fall from the hands and kicking it the very instant it rises) at any time during the game; or from a place-kick (made by kicking the ball after it has been placed in a nick made in the ground for the purpose of keeping it at rest) or a drop taken as a free kick for a fair catch (a catch made direct from a kick, throw forward, or a knock on by one of the opposite side), or as an award for a penalty.



AA, goal-posts; BB, goal-lines; CC, touch-lines.

In the Rugby Union game the four corners outside the lines marking the field of play are known as touch in goal.

For Association football the maximum size of ground is 200 yards by 100; the minimum, 100 yards by 50. The most popular dimensions are 120 yards by 80, and for cup tie matches, which are exceedingly numerous, the field of play must not be less than 110 yards by 70. The goal-posts are placed eight yards apart, with a bar across eight feet from the ground. In this game only goals count, and to obtain a goal the ball must be passed between the goal-posts under the bar. No player is permitted to carry (take more than two steps when holding the ball), knock on (strike or propel the ball with hand or arm), or handle (play the ball with hand or arm) the ball under any pretence whatever, except in the case of the goal-keeper, who, within his own half of the ground, may use his hands in defence of his goal, either by knocking on or throwing, but not carrying the ball. A goal cannot be scored from a free kick—the penalty for handling the ball, offside play, or when a player sends the ball over his own goal-line. The ball in the Association game is of an average circumference of not less than 27 inches and not more than 28 inches. Matches are played between sides numbering eleven each, the players being generally disposed as follows: a goal-keeper, two backs, three half-backs, and five forwards. As at Rugby Union, the greatest factor towards success is the working together of the whole team.

At the present time, even, complaints are frequent that football is associated with a large number of accidents. It certainly cannot be argued that the game is one of gentle character; but it is beyond doubt that the large majority of mishaps occur through the non-observance of those rules which the governing bodies have from time to time drawn up with a view to the elimination of the rough element.

In many parts of the world besides Great Britain football has of recent years spread in a remarkable way, but it has perhaps taken the strongest hold in Australia, New Zealand, and Canada. The latter two countries each sent a team to England in 1888; and in the early part of the same year a body of English football players visited Australasia, and found there opponents quite worthy of them. Two games are played in Australasia, the one being strictly according to the English Rugby Union code, the other a combination of the two styles so well known in Great Britain. In the Victorian or Australasian game, which is played almost universally in Victoria, New South Wales, and South Australia, the ball has to be bounded by the player while running, and in this particular the game differs from both Rugby Union and Association. It is with the New Zealanders chiefly that Rugby Union finds favour, but both games are exceedingly popular with the public, who muster in their thousands at the more important matches. Comparatively little Rugby Union is played either in Canada or the United States, but in both countries the Association game flourishes, the team from the former country which visited England, as mentioned above, proving how assiduous had been their practice. Until the last quarter of the present century football was less known in the United States; but then, under the guidance of the New York and Paterson clubs, the game grew rapidly, and in April 1884 there was formed the American Football Association. From some quarters much opposition was experienced by American admirers of the game, which was voted altogether too rough, but despite opposition it has continued to make headway. It is worth mention that a variety of football is very popular with some Indian tribes, as the Washoes of Nevada.

Foote, ANDREW HULL, American naval officer, was born in New Haven, Connecticut, in 1806, entered the navy in 1822, and after some service against the pirates of the West Indies was appointed captain in 1849. In 1856 he gallantly carried by storm four Chinese forts at Canton, from which he had been fired on while protecting American property. On the outbreak of the civil war he equipped and organised the western flotilla, and in February 1862, with his gunboats, he stormed Fort Henry. At Fort Donelson, in the same month, he received a wound which soon afterwards compelled him to resign his command; but his services obtained for him the rank of rear-admiral and a vote of thanks from congress. He died in New York city on the 26th day of June 1863, while on his way to take command of the fleet off Charleston.

Foote, SAMUEL, English actor and writer of comedy, was born at Truro, in Cornwall, in January 1720. His father at one time sat in parliament for Tiverton, and was mayor of Truro; his mother inherited a considerable fortune from her brother, Sir John Goodere, Bart., who was murdered by another brother. Foote left Worcester College, Oxford, without a degree, and about 1740 entered the Temple; but after wasting his fortune in a career of pleasure he turned to the stage as a means of support, and in 1744 made an unsuccessful début as 'a gentleman' in 'Othello.' In 1747 he opened the Haymarket Theatre—where he was at once director, actor, and dramatic author—with *Diversions of the Morning*. In this and other pieces he introduced well-known living characters, and, by his admirable powers of mimicry, succeeded in drawing large audiences; the theatre was closed by order of the magistrates, but Foote hit on the device of inviting his friends to 'a cup of tea,' for which tickets were to be obtained at the coffee-houses. He appeared in a great number of parts in London, Edinburgh, and Dublin, but would seem to have achieved success almost solely in his own plays. In 1766 he broke his leg by a fall from his horse, and amputation was found necessary. This, however, did not interrupt his career; he even turned the incident to account on the stage, by composing parts expressly adapted to his own state. He died at Dover on 21st October 1777. Many anecdotes of him, though not infrequently borrowed from earlier sources, are given in Cooke's *Memoirs of Samuel Foote* (1805); see also Forster's essay in the *Quarterly Review*, 1854, and the article by Joseph Knight in the *Dict. of Nat. Biog.*, vol. xix. (1889). Of his plays the best are *An Auction of Pictures*, *The Minor*, *The Liar*, and *The Mayor of Garratt*, which have been frequently published.

Foot-guards, the flower of the British infantry, and the garrison ordinarily of the metropolis, comprise three regiments, the Grenadier, Coldstream, and Scots Guards. See GUARDS.

Foot-pound is the unit used to express the *work done* by any form of force. Thus, taking 1 lb. and 1 foot as the units of weight and distance, if 1 lb. be raised through 1 foot, the *work done* is equivalent to 1 foot-pound; and generally, if W represent the *work done*, P the *weight in pounds*, and *h* the *height in feet*, then W (in foot-pounds) = P*h*.

Footprints. See FOSSIL.

Foot-rot amongst sheep is of two varieties, the commoner consisting of an inordinate growth of hoof, which, at the toe or round the margin, becomes turned down, cracked, or torn, and thus affords lodgment for sand and dirt. Insufficient wearing of the hoof is the obvious cause, and hence the prevalence of foot-rot in soft rich pastures, and especially amongst sheep previously accustomed to bare, rough, or upland walks, where the hoof is naturally worn down by the greater amount of walking necessary to procure sustenance. Taken in time, when lameness is first apparent, and before the hoof is cracked and the foot inflamed, a cure rapidly follows the careful paring of the superfluous and diseased hoof; indeed, further treatment is scarcely necessary unless any of the vascular parts have been laid bare, when a little tar may be applied as a mild astringent and protection from flies. When from inattention or neglect the hoof is separated from the sensitive parts beneath, when ulcers appear on the sole, or proud-flesh springs up, active astringents or mild caustics are necessary. The shepherd's old favourite butter of antimony, diluted with an equal quantity of tincture of myrrh, is a good remedy when cautiously and temperately used. A convenient paste, which in inexperienced hands is safer than a fluid caustic, may be made with equal weights of flowers of sulphur and finely-powdered sulphate of copper, rubbed up to the needful consistency with lard or oil. Many have great faith in a mixture of the salt of copper with gunpowder and lard.

The second and more troublesome variety is allied to what is termed *foul* in the foot: instead of commencing at the ground surface, it begins in the interdigital space, appears to depend upon constitutional rather than local causes, and frequently occurs along with the other variety, and is supposed to be contagious. The foot is hot, tender and swollen around and immediately above the coronet. There are ulcerations in the interdigital space, and the swelling and subsequently the sprouting of proud-flesh cause a separation of the toes. When the tenderness and heat are great, poultices are advisable; but in the milder cases and earlier stages the parts should be well washed with a solution of chloride of zinc, and in all cases the loose and semi-detached horn carefully removed, the parts thoroughly cleansed before applying the dressing, and afterwards protected by a bandage or a leather shoe well padded with tow. When ulcers appear they must be touched with lunar caustic or dressed with the paste already recommended.

Foraminifera, a class of unicellular animals or Protozoa, almost always marine in distribution, most characteristically provided with limy shells, which have formed the chalk of the past and are now forming similar deposits in the deep sea. A living Foraminifer, often about the size of a pin's

A living Foraminifer (*Polystomella strigillata*).

head, consists of a central nucleated mass of protoplasm, of a shell surrounding this, and of long, branched, and interlacing threads of living matter streaming outwards, with food-absorbing and locomotor functions.

Description.—The shell, which is much better known than its tenant, is characteristically calcareous, chambered, and covered with minute holes. But it is occasionally chitinoid, and often sandy, while a few forms approach Radiolarians in being flinty. At first a simple enough insheathing test, and so remaining in many forms, the shell is very generally added to, so as to cover successive overflowings of growth. The ways in which fresh chambers are formed—in linear series, in spirals, and the like—produce types of architecture of great beauty and variety, as to the building of

which we can only conceal our ignorance by calling them organic crystallisations. The spirals often look like miniature sketches of the shells of Nautili, snails, and other molluscs. When partitions are formed between successive chambers they leave apertures through which bridges of protoplasm preserve the vital continuity. On the

Shells of various Foraminifera.

outer surface the outflowing protoplasm may reserve for itself one relatively large aperture, or a couple, or a few, but most characteristically there are numerous minute holes left all over the shell.

The internal protoplasm, so far as observed, is homogeneous, except for granules, frequent pigment, and the essential nucleus or nuclei. On the outflowing processes, which are more irregular and interlaced than is usual in Radiolarians, granules stream outwards and inwards in active currents. The colouring matter often resembles that of the diatoms on which the organisms so largely feed. The general absence of vacuoles, contractile or otherwise, is another of the contrasts between Foraminifera and Radiolarians, and is probably associated with the non-pelagic life of the former. Partner plant-cells or symbiotic algæ have been but rarely seen within Foraminifers, whereas they are almost constant in Radiolarians. Multiplication typically takes place by a sort of internal budding. The nucleus divides into several, round each product of nuclear division the protoplasm gathers, and thus are formed young individuals which are eventually enclosed in shells and liberated from the parent. Division of the entire animal has also been observed in a few cases. Dimorphism, or the occurrence of two diverse forms (possibly male and female) in one species, has been noticed, but no conjugation or incipient sexual union. In a few cases—e.g. *Microgromia socialis*—a number of individuals are united to form a loose colony, a primitive kind of association exhibited by not a few Protozoa. Most modern forms are small, below half an inch in diameter, and many very much less, down to microscopic dimensions. The largest living species (*Cyclo-clypeus carpenteri*) measures slightly over 2 inches across the shell, and recalls the extinct giant Nummulites, many of which were as large as half-crowns.

Distribution.—The Foraminifera are mostly marine, and occur at all depths; a few (Globigerinids), like the Radiolarians, are pelagic; most live on submerged objects or at the bottom. A few from brackish and even fresh water are known, and one species (*Gromia terricola*) has gone ashore. The pelagic forms as they die sink gently to the bottom, and are there forming, especially at depths between 1000 and 2000 fathoms, great beds of Globigerina ooze or modern chalk. In other regions sandy-shelled forms predominate at the bottom.

In marine geological strata from the Silurian onwards Foraminifera abound. Chalk consists almost wholly of fossil Globigerinids, and the Nummulites have contributed largely to the great Eocene limestones. The animal nature of Eozoon (q.v.) from the pre-Cambrian strata is now generally denied, and is at least very doubtful.

Position and Classification.—The Foraminifera were so named by D'Orbigny in 1826, and placed beside the Cephalopods, to the shells of some of which the tests present a mimetic or prophetic resemblance. The title referred not, as might be supposed, to the superficial apertures on the shell, but to the communications between successive chambers. Hertwig would call them Thalamophora, in allusion to the typical chambered shell; while Carpenter emphasised the living network of processes in the title Reticularia. Accenting as they do the amœboid phase of cell-life, the Foraminifera have their place beside Amœbæ, Radiolarians, and Sun-animalcules in the Rhizopod division of Protozoa (q.v.). They were formerly classified as Perforate and Imperforate according to the presence or absence of numerous apertures on the test, but as this distinction separates apparently adjacent forms it is no longer generally adopted. By Brady, who has described the *Challenger* collection in a monumental monograph, they are classified in ten families, of which Gromia, Miliolina, Astrorhiza, Lituolina, Textularia, Chilostomella, Lagena, Globigerina, Rotalia, and Nummulites are the name-giving types. In Gromia the shell is chitinoid, flexible, and with a single aperture; in the related Shepheardella there is an aperture at each end of an elongated test. The test of Miliolina is normally of lime, but in brackish water tends to become chitinoid, and at great depths a siliceous film. Irregular sand particles form the primitive test of Astrorhiza, and the use of detached sponge spicules led to the related Halyphysema being mistaken for a very simple sponge. Among Lituolidæ, Parkeria and Loftusia are relatively large forms—about two inches in diameter and length respectively. A peculiarly interesting *Challenger* form among the pelagic Globigerinids—*Hastigerina murrayi*—has the shell surrounded by a zone of bubbly protoplasm, and in its vacuoles and internal shell suggests Radiolarian characteristics. The species of Foraminifera are legion, probably above two thousand. They are interesting, as illustrating complexity and beauty of architecture at the very threshold of life, and important both in the making of the earth and in the present-day economy of submarine life.

See EOZOÖN, NUMMULITES, OOZE, PROTOZOA, RADIOLARIA; Brady, *Challenger Report*, 1884; Bütschli, *Protozoa* (Bronn's *Thierreich*); Carpenter, Parker, and T. Rupert Jones, *Introd. to Study of Foraminifera* (Ray Soc. Lond. 1862); Schultze, *Organismus der Polythalamien* (Leip. 1854); and other works cited in Sherborn's *Bibliography of Foraminifera* (1888).

Forbach, a manufacturing town of 6842 inhabitants, in Lorraine, 6 miles SW. of Saarbruck. Here on 6th August 1870 the French had to retreat.

Forbes, ALEXANDER PENROSE, bishop, was born in Edinburgh, the second son of Lord Medwyn, a judge of session, 6th June 1817, and spent the years 1837–40 in the East India Company's service, until ill-health compelled his retirement. He graduated at Oxford in 1844, was ordained in the same year, and in 1847, at the early age of thirty, was consecrated Bishop of Brechin, in Scotland, receiving the honorary degree of D.C.L. in 1848. A warm friend of Pusey, he delivered a charge in

1857 which was practically a manifesto on the manner of the Eucharistic Presence and on the nature of the Eucharistic Sacrifice; its publication raised a storm which culminated in its author's trial before the other bishops of the Scottish Episcopal Church in 1860, resulting in a 'declaration of censure and admonition.' Forbes died on 8th October 1875, more widely mourned than any Scottish bishop since the Reformation. He edited, with his brother, the *Arbuthnot Missal* (1864), published with an elaborate preface *Kalendars of Scottish Saints* (1872), and was the author of valuable expositions of the Articles (2d ed. 1871) and Nicene Creed (2d ed. 1866), and of numerous other works, chiefly devotional. See Memoirs by Miss Skene (1876) and Canon Mackey (1888).

Forbes, ARCHIBALD, special correspondent of the *Daily News*, is a native of Morayshire, and a 'son of the manse,' born in 1838. He was educated at Aberdeen University, and served for some years in the Royal Dragoons. But in 1870–71 he went through the Franco-German war as war-correspondent; and thenceforward, whether in Spain with the Carlists, in Cyprus, in the Russo-Turkish campaign, or in the Zulu war of 1879, he accustomed the British public to expect feats of unexampled audacity, swiftness, tact, and pluck in securing and transmitting his vivid first-hand notes of events at the front to his newspaper. A memorable exploit was his famous ride of 110 miles in 15 hours, in order to report at once the victory of Ulundi (1879). He has lectured in Great Britain, America, and Australia, and has written a novel, *Drawn from Life* (1870), *Glimpses through the Cannon Smoke* (1880), and a short life of *Chinese Gordon* (1884).

Forbes, DUNCAN, of Culloden, a Scottish politician of the 18th century, and Lord President of the Court of Session, was born either at Culloden or at Bunchrew—for the family possessed both estates—in the neighbourhood of Inverness, on the 10th November 1685. In 1704 he commenced his legal studies in Edinburgh, and completed them at Leyden. On his return from Leyden he was called to the bar, and almost immediately after appointed Sheriff of Midlothian. He rose rapidly into practice and into political influence through his connection with the great Duke of Argyll. During both of the rebellions he acted a prominent part on the side of the Hanoverian government. In 1715 he was in the north actively engaged in opposing the rebels along with his elder brother John. After the suppression of the rebellion he was opposed to the project of carrying the prisoners out of Scotland to be tried by English juries; and he was opposed to the forfeitures also on grounds of policy as well as of humanity. The only effect of his moderation was to bring suspicion on his own loyalty. In 1725 he became Lord Advocate. He was not distinguished as a debater, but he was much employed at this period of his career in appeal cases. In 1734 his brother John died, and he succeeded to the estates of the family. During many subsequent years he largely ruled the destinies of Scotland and contributed to her dawning prosperity by fostering and developing her internal resources. His policy, even before 1745, was to extinguish the rebellious temper by gaining over the Jacobites to the government, and by forming Highland regiments under loyal colonels. Forbes was appointed President of the Court of Session in 1737; but he still continued his interest in the general improvement of the country. Though he was aware of the character and, in general, of the designs of the Jacobites, the rebellion of 1745 took him by surprise. But he was no sooner aware of the danger than he hastened to the north, as he had done on the occasion of the former outbreak; and by his presence and the influence which he possessed in his own district, he did much to counteract the proceedings of the rebels. Lovat made an attack on Culloden House, from which he was beaten off with great spirit by the president and his people. When the rebellion spread he was compelled to take refuge in Skye; and on his return after Culloden, instead of reaping the fruits of his services, he was regarded with jealousy and aversion by the government. Even the large sums of money he had advanced were never repaid him. The ingratitude of the government and the disasters brought on the country by the rebellion shortened his days; but he discharged his judicial duties till within a month of his death, 10th December 1747. See Hill Burton's *Lives of Lord Lovat and Duncan Forbes of Culloden* (1847).

Forbes, EDWARD, naturalist, was the son of a banker, and was born at Douglas, Isle of Man, February 12, 1815. He received a desultory and imperfect education in early life in consequence of ill-health. In 1831 he went to London with the intention of becoming a student at the Royal Academy, but later in the same year entered the university of Edinburgh as a student of medicine; and in 1836 he finally relinquished his medical studies to devote himself exclusively to the natural sciences. In 1836–37 he studied at Paris under Geoffroy St-Hilaire, Jussieu, and De Blainville. From the first year of his college life Forbes had spent his summer vacations in rambles over various parts of Great Britain or in excursions on the Continent, publishing the results of the observations which he made either as separate works or in the pages of scientific journals. In 1841 he joined the surveying ship *Beacon* as naturalist, and accompanied that vessel during the survey of a part of Asia Minor. On his return to England in 1843 he became professor of Botany in King's College, London, and curator of the Geological Society. In 1844 he was appointed palæontologist to the Museum of Geology in connection with the Ordnance Geological Survey; in 1851 professor of Natural History in the School of Mines; in 1852 president of the Geological Society; and in 1853, on the death of Professor Jameson, he was elected to the vacant chair of Natural History in the university of Edinburgh. In the summer of 1854 he delivered a short course of lectures—the only one he was destined to give—for at the commencement of the winter session he was seized with a severe illness, which speedily proved fatal; and he died on the 18th November 1854, in the thirty-ninth year of his age, and in the very zenith of his fame. Forbes had been a voluminous writer and a diligent observer of nature from his earliest youth, and had collected an immense mass of materials, many of which were, however, left at his death in a state of disorder. He did much to advance and systematise special departments of natural history, both by his own labours and by the stimulus which he imparted to his associates and pupils. His classification of the British star-fishes opened a new era in that branch of zoology; and his discovery that air-breathing molluscs lived at the period of the Purbeck beds rectified many erroneous hypotheses. From an early period he had directed his attention to the distribution of animal and vegetable life in different zones of the sea and land, and his observations in this path of inquiry have opened many new fields of research. Of his separate works, papers, and monographs upwards of two hundred were published, many of them copiously illustrated by his own beautiful drawings. Among them may be instanced the following: *On the Distrib. of Pulmonif. Mollusca in Europe* (1838), *Malacol. Monensis* (1838), *Star-fishes* (1841), *The Radiata and Mollusca of the Ægean* (1843), *Travels*

in Lycia (in conjunction with Spratt, 1846), *Naked-eyed Medusæ* (1847), *British Mollusca* (conjointly with Hanley, 4 vols. 8vo, 1853), and *Collection of Literary Papers by E. Forbes* (1855). See the Memoir by G. Wilson and A. Geikie (1861).—His brother DAVID (1828–76) was distinguished as a geologist.

Forbes, JAMES DAVID, physicist, was the son of Sir William Forbes of Pitsligo, and grandson of the Sir William given below. Born at Edinburgh, April 20, 1809, he studied in the university there from 1825 until 1830, when he was called to the Scottish bar. But the physical sciences were from an early age serious rivals to the law in his affections. From 1833 he held the chair of Natural Philosophy in Edinburgh University, exchanging it in 1859 for the principalship of the United College in the university of St Andrews. Among his contributions to science are his investigations on the polarisation of radiant heat by the tourmaline, and also by reflection, and its circular polarisation (1834)—discoveries forming some of the strongest proofs of the identity of calorific and luminous rays; the unequal polarisation of heat from different sources (1844); the conductivity of heat by iron; the refrangibility of heat; the depolarisation of heat; underground temperatures, &c. He is, however, best known by his researches on the motion of glaciers, in connection with which subject he wrote *Travels through the Alps* (1843), *Norway and its Glaciers* (1853), *Tour of Mont Blanc and Monte Rosa* (1855), and *Occasional Papers on the Theory of Glaciers* (1859). He was the first to establish the great fact that glacier ice moves in its channel like a viscous fluid, the middle moving faster than the sides, and the upper portions faster than the lower. In meteorology Forbes, among other things, improved Wollaston's application of the thermometer to the determination of heights, and verified Fourier's theoretical results concerning the temperature of the ground at different depths and in different kinds of soil and rock. He also contributed numerous papers on astronomy and other subjects to the *Transactions* of the Royal Societies of London and Edinburgh, to the *Edinburgh Philosophical Journal*, and similar periodicals. He died December 31, 1868. See his *Life and Letters*, edited by Shairp, Tait, and Adams Reilly (1873).

Forbes, SIR JOHN, physician, was born about the close of 1787, at Cuttlebrae, Banffshire. After studying at Aberdeen and Edinburgh he entered the navy in 1807 as assistant-surgeon; in 1817 he took the degree of M.D. at Edinburgh; and after practising as a physician at Penzance and at Chichester he went in 1840 to London, where he speedily made a large practice. He was knighted in 1853 by the Queen, to whose household he held the appointment of physician in ordinary. He was F.R.S. and D.C.L. of Oxford, as well as member of numerous foreign societies. Conjointly with Drs Tweedie and Conolly he was the editor of the *Cyclopædia of Practical Medicine* (4 vols. 1832–35). In 1836 he founded the *British and Foreign Medical Review*, which he carried on for twelve years. To him in a great measure belongs the merit of having introduced the use of the stethoscope in England, and of having successfully directed the attention of British practitioners to the art and practice of physical diagnosis. He died 13th November 1861.

Forbes, SIR WILLIAM, of Pitsligo, an eminent Scottish banker, son of Sir William Forbes, Bart., advocate, was born in Edinburgh, April 5, 1739. In his fifteenth year he entered the bank at Edinburgh of Messrs John Coutts & Co., and in 1761 was admitted a partner; and in 1763 a new company was formed of which Sir William Forbes ultimately became the head. In 1781 he purchased the estate of Pitsligo, Aberdeenshire, which had been forfeited by Lord Forbes of Pitsligo for taking part in the rebellion of 1745. He published a Life of his friend Beattie, the poet, in 1805; also *Memoirs of a Banking House*, being the history of his own (1803; ed. by Robert Chambers, 1860). He died November 12, 1806. His bank became in 1830 the Union Bank of Scotland. One of his sons was John Hay Forbes, Lord Medwyn.

Forbes-Mackenzie, WILLIAM (1801–62), M.P. for Peeblesshire, whose name is known in connection with an Act introduced by him and passed in 1853 'for the better regulation of public-houses in Scotland,' prohibiting provision-merchants from selling excisable liquors 'to be drunk on the premises,' permitting public-houses to be open on week-days only between 8 A.M. and 11 P.M., and forbidding the sale of liquor in hotels throughout the Sundays save to lodgers and *bonâ-fide* travellers. See LICENSING LAWS.

Forbidden Fruit, or ADAM'S APPLE, a name fancifully given to the fruit of different species of Citrus, especially to *C. Medica*, var. *paradisi*, which has indentations in its rind suggesting tooth-marks. In Ceylon the same name is applied to the fruit of *Tabernæmontana dichotoma* (Apocynaceæ). The shape of the fruit suggests the idea of a piece having been bitten off, and the legend runs that it was good before Eve ate of it, although it has been poisonous ever since.

Force. As employed in physical science, the term force means any cause which changes the direction or speed of the motion of a portion of matter. It is therefore correctly applied to a push or pull, to the weight of a body, the attraction exerted by a magnet on a piece of iron or by an electrified body on a pith-ball, &c. This is expressly laid down in the first of Newton's Laws of Motion—to wit:

Every body perseveres in its state of rest, or of uniform motion in a straight line, except in so far as it is compelled by forces to change that state.

Now, we find that we can, by conscious muscular exertion, set a piece of matter in motion, and also change its motion both in speed and in direction. Hence we figure to ourselves that we are exerting force upon it. But here great caution is requisite, as the direct impressions of sense are, in many cases, notoriously misleading. Until we know what Matter (q.v.) is, it is practically useless to speculate as to the precise nature of force, if indeed there be such a *thing* at all. Even Newton's language has an anthropomorphic character which it would be difficult to avoid without coining words for the purpose. Of course in Newton's system the force is assigned in direction and magnitude by the change of motion (i.e. of Momentum, see MOMENT) said to be produced by it in a given time. This is the essence of the second law of motion.

And the third law greatly extends our view of the subject, for it points out that force is always dual:

To every action there is always an equal and contrary reaction, or the mutual actions between two bodies are always equal and oppositely directed.

But, as the results of the action and reaction alike are mere changes of momentum, and as neither can present itself without the other, all that we are logically entitled to say is that no change of motion takes place unaccompanied by an equal and opposite change. The introduction of the action and reaction may thus be merely an attempt to explain this observed interchange of momentum by the help of the sense-suggested notion of force.

There is no doubt that the introduction of the idea of force has been very useful, if only in

enabling us to express the fundamental laws of dynamics in a particularly concise and easily intelligible form. But there is equally little doubt that everything yet known on the subject can be perfectly well expressed without the use of the term force, or of the idea which it embodies.

The dynamical expression for which the term force has been introduced as a substitute presents itself in two forms, different in name and conception, but intrinsically the same—viz. the time-rate at which momentum (see MOTION, LAWS OF) changes, or the space-rate at which Energy (q.v.) is transformed or transferred. Thus, when a stone is let fall, the momentum which it acquires is proportional to the time of falling, so that after t seconds its amount is, say, At; and in falling through a space of h feet it loses in potential energy, while it gains in kinetic energy, an amount proportional to the height fallen through, say, Bh. Experimental measurement shows us that A and B are one and the same quantity, and we say it represents the weight of the stone—i.e. the force under which we figure to ourselves that the fall takes place. It is very convenient to do so. But, except the indications of our muscular sense, we have no proof whatever that there is any reason for the fall of the stone other than the observed fact that energy has the property of preferring the kinetic to the potential form. And the statement that a stone of given mass has potential energy to a given amount, depending directly on its elevation above the earth, is sufficient (without even *mention* of weight, or of force in any form) to enable us to calculate all the circumstances of its fall. Though we have confined ourselves to an exceedingly simple example, a similar but of course more general statement as to energy enables us to make the calculation requisite for determining the motion in all cases, however complex.

Newton's definition of force has sometimes been amended (?) into 'Any cause which changes, *or tends to change*, the motion of a body.' But this is entirely foreign to his system. For his second law expressly says, '*Change of momentum is proportional to force, and takes place in the direction of the force.*' Hence, from Newton's point of view, there is no balancing of forces, though there may be balancing of the effects of forces.

The *Resultant* of two forces which act on the same particle of matter is defined as the single force which could produce in that particle the same change of momentum as would the two given forces if they acted jointly on it for the same period of time. As it follows at once from Newton's second law that different forces, acting for equal times on the same particle, produce velocities in their own directions *and proportional to their magnitudes*, the question of compounding these forces is the same as that of compounding the corresponding velocities. Hence we have at once the only correct basis for the proof of that *Parallelogram of Forces*, or *Triangle of Forces*, on which (from the so-called *statical* point of view) as much absolutely useless thought has been expended as upon Euclid's celebrated twelfth axiom and its consequences.

The true measure of a force is, of course, the amount of momentum which it produces in a given time. Hence, if our fundamental units of mass, length, and time be the pound, foot, and second, unit force is that which gives in one second a speed of one foot per second to a mass of one pound. This is the British absolute unit of force. As gravity produces a speed of about 32 feet per second during each second of the motion of a falling body, the unit force is (speaking very roughly) about $\frac{1}{32}$d part of the weight of a pound—i.e. about the weight of half an ounce. If we adopt the so-called C.G.S. system, in which the units are the centimètre, gramme, and second, the unit force (called a *dyne*) is that which in one second produces a speed of one centimètre per second in a mass of one gramme. Compared with the British absolute unit, the dyne is very small, being little more than $\frac{1}{14000}$th part of it.

But the most startling of all the reflections on force and its ultimate nature which have perhaps ever been made are those of Faraday. Without calling in question in ordinary cases the truth of the conservation of energy, he has endeavoured, by experiment (the only genuine test in a question so novel and so profound), to prove what may be called the Conservation of Force. Here we understand *force itself*, and *not energy*. He argues thus: Two masses, according to the undisputed law of gravitation, attract with four times their mutual force if their distance be diminished to half, and with only one-fourth of the same if their distance be doubled. He asks *whence comes* the additional force in the former, and *what becomes of* the lost force in the latter case?

Now, it is evident that this is a new question, totally distinct from any we have yet considered. To answer it, we must know *what* force is. Would gravitation have any existence if there were but one particle of matter in the universe, or does it suddenly come into existence when a second particle appears? Is it an attribute of matter, or is it due to something between the particles of matter? Faraday has tried several experiments of an exceedingly delicate kind, in order to get at some answer to his question. A slight sketch of one of them must suffice. A pound-weight is not so heavy at the ceiling of a room as it is when on the floor; for, in the former case, it is more distant from the mass of the earth than in the latter. The difference for a height of 30 feet is (roughly) about $\frac{1}{11000}$th of its weight. Now, if a mass of metal be dropped through such a space, an additional force, $\frac{1}{11000}$th of its weight, is called into play; and the object of the experiment was to detect whether electrical effects accompanied this apparent *creation* of force. The mass, therefore, was a long copper wire, whose coils were insulated (see ELECTRICITY) from each other, and whose extremities were connected with those of the coil of a delicate Galvanometer (q.v.). Had any trace of an electric current been produced, the needle of the galvanometer would have been deflected; but, when all disturbing causes were avoided, no such deflection was detected. Other experiments with a view to the detection of other physical energies were also tried, but, like the first, with negative results only.

From what has been said above it is clear that we must not hastily conclude that there is such a *thing* as force, though we are in the constant habit of speaking about it. Our sensations are all more or less misleading until we can interpret them. The pain produced by a blow is quite a different thing from the energy of motion of a cudgel; and, when our muscular sense impresses on us the idea that we are exerting force, we must be cautious in our conclusions. For it is certain that force is *merely the rate per unit of length* at which energy is transferred or transformed.

Force and Fear, a technical term used in the law of Scotland to denote that amount of constraint or compulsion which is enough to annul an engagement or obligation entered into under its influence. As consent is the essence of contracts, contracts entered into under compulsion are, in law, void from the first, as if they had never been entered into. But it is not every degree of constraint which will have this effect in law. As Bell states it (*Principles*, 12), the force and fear must be 'not vain or foolish fear, but such as to overpower a mind of ordinary firmness, or such as,

applied to a person of weaker age, sex, or condition, will produce the effect of overpowering violence on a firmer mind. Among the instruments of force and fear which have been held to annul engagement are threats and terror of death; pain to one's self, or one's parent or child; infamy and disgrace; imprisonment, when employed to obtain an advantage beyond the lawful object of it; and even loss of property.' On proof of force and fear the law restores the parties to the contract to the position in which they were before it was entered into, and will find the party employing it liable in damages as reparation for any injury done to the party constrained. The corresponding term in English law is Duress (q.v.). This is by imprisonment or by threats. The kind of threats held to constitute duress are threats of imprisonment, or of loss of life or limb, or threats of *mayhem*—i.e. of the deprivation of a member proper for defence in fight, as an arm, a finger, an eye, or a fore-tooth (but not a jaw-tooth, or an ear, or a nose, because these are supposed to be of no use in fighting). The maxim of the common law with regard to duress is that 'what otherwise is good and just, if sought by force or fraud, becomes bad and unjust.'

Forcellini, EGIDIO, Italian lexicographer. See FACCIOLATI.

Forceps (Lat., 'a pair of tongs or pincers'), the name given by surgeons to an instrument of great antiquity, used as a substitute for the fingers, and consisting of two levers of metal jointed together crosswise, nearer to one end than the other. The hand grasping the longer ends of the levers or handles closes the shorter ends, which are shaped so as to seize firmly the intended object. There is scarcely a surgical operation in which some form of forceps is not applied; and very numerous different shapes and sizes are made for different purposes. In addition to the forms used for the extraction of teeth (see DENTISTRY) there are, e.g., the *dissecting* forceps, which have roughened points, to lay hold of small portions of tissue which are to be divided by the knife; the *lithotomy* forceps, which have blades concave like spoons; and *fenestrated* forceps, which have apertures in the blades, and, as the soft tissues project into these, obtain a firm hold with less risk of tearing the parts. By means of Liston's *cutting* forceps a powerful hand can divide a great thickness of bone. But the most important of all are the *midwifery* forceps, an invaluable invention in cases of difficult delivery, which daily rescues from suffering and danger numerous mothers and infants. It was invented in the 17th century, probably by Paul Chamberlen, who, however, with his son and grandson, kept their method of facilitating delivery as a profitable family secret; and it did not become generally known to the medical profession till the first half of the 18th century. Numerous modifications of the instrument have since been introduced, but its main principle remains unchanged. It consists of two concave fenestrated blades, forming a cavity into which the head of the child fits. The blades are applied separately, one to each side of the head, and then locked together. Holding by the handles, the accoucheur aids the natural efforts of labour. The instrument does not necessarily or generally injure either mother or child.

Forcible Entry. According to English law any person who enters on property, in order to take possession of it, with violence or intimidation is guilty of a misdemeanour. It is immaterial whether the person so entering has a right to the property or not. If a person wrongfully in possession detains property by violence or threats he is guilty of the offence known as forcible detainer.

Forcing, in Gardening, is a term used to designate a process in which artificial heat is applied so that flowers, fruits, or other products of plants are obtained at a date or season other than that at which they may be had in the ordinary course of culture. Thus, for example, kinds of grapes which by the simple influence of the heat of the sun in a vinery do not ripen till September or October are induced by forcing to ripen in March or later, according to the period the process is commenced; and strawberries, which ripen in the open air in Britain variously from June to September, in the forcing-house yield their fruit from February onwards. Conducted, as the system is, during the short days of the year, the chief obstacle the gardener has to contend with is diminished light. This in the case of forcing fruits taxes his skill to the utmost, because abundant light is essential both to the proper fertilising of the flowers and to the perfecting of the fruit. Some vegetables and salads and many flowers are, however, more successfully forced in the dark than in light. Rhubarb, sea-kale, mushrooms, lily of the valley, lilac, are all forced in greater or less darkness in order the better to develop their individual perfections. The remarkable purity of the colour of the flowers of the last two, as seen in the shops in December and January, is due to this circumstance; and the result will appear the more striking to the uninitiated when it is stated that a purple variety of lilac is preferred to a white one for forcing, because it not only comes out of the process a purer white, but with greater substance than the latter. Forcing in its application to various plants—especially flowering plants—has greatly extended during the last twenty years, and is still extending. It may be regarded as the greatest triumph of horticultural art, because it renders possible the enjoyment of nature's summer bounties in all their freshness, lusciousness, and beauty in winter. See GARDENING.

Ford, JOHN, dramatist, was the second son of Thomas Ford of Ilsington, Devonshire. He was baptised at Ilsington, 17th April 1586. After studying for a short time at Exeter College, Oxford, he became in November 1602 a member of the Middle Temple. His first work was an elegy on the death of the Earl of Devonshire, entitled *Fame's Memorial* (1606), with a dedicatory sonnet to Penelope, Countess of Devonshire (the 'Stella' of Sidney's sonnets); and in the same year he published *Honour Triumphant; or the Peers' Challenge . . . Also the Monarchs' Meeting; or the King of Denmark's Welcome into England.* He was writing for the stage as early as 1613, when his unpublished comedy, *An Ill Beginning has a Good End*, was acted at the Cockpit; but the first of his published plays is *The Lover's Melancholy*, produced 24th November 1628 and printed in 1629, a comedy of no particular merit. His most powerful tragedy, *'Tis pity She's a Whore*, acted at the Phœnix in Drury Lane, was published in 1633, with a dedicatory epistle to John, first Earl of Peterborough. To the same year belongs *The Broken Heart*, dedicated to Lord Craven. The closing scenes, deeply impressive but strangely fantastic, were passionately admired by Charles Lamb. *Love's Sacrifice* (1633), dedicated to the author's cousin, John Ford of Gray's Inn, is in parts excellent, but disappointing as a whole. Far more satisfactory is *The Chronicle History of Perkin Warbeck* (1634), dedicated to the Earl (afterwards Duke) of Newcastle. *The Fancies Chaste and Noble* (1638), dedicated to the Earl of Antrim, has an interesting but badly handled plot. *The Lady's Trial* (1638), had it been equal at all points, would have been a good play; it fails in the last act. *The Sun's Darling*, licensed for the stage in March 1623-24 and posthumously published in 1656, was

written in company with Dekker, who probably supplied the pleasing lyrical passages. Two other plays by Dekker and Ford, *The Fairy Knight* and *The Bristowe* (Bristol) *Merchant*, were produced in 1624, but were not published. *The Witch of Edmonton*, produced *circa* 1621 and published in 1658, was written with Dekker and William Rowley. Ford's share was probably confined to the scenes which relate to Frank Thorney. On one occasion Ford collaborated with Webster; but the tragedy, *A late Murder of the Son upon the Mother*, licensed for the stage in September 1624, was not given to the press. To Webster's *Duchess of Malfi* (1623) Ford prefixed a copy of commendatory verses. Among the plays unfortunately destroyed by Bishop Warburton's cook were four pieces by Ford, a tragedy, and three comedies. The tragedy, *Beauty in a Trance*, was entered in the Stationers' Register in 1653, and the three comedies, *The London Merchant*, *The Royal Combat*, and *An Ill Beginning has a Good End*, were entered in 1660; but all four remained unpublished.

After the publication (1639) of *The Lady's Trial* Ford passes from notice. There is a tradition that he secured a competence by his professional labours, and ended his days in Devonshire. It is certain that he was not dependent on the stage for his livelihood. In procuring practice he was doubtless aided by the influence of his maternal uncle, Lord Chief-justice Popham. Ford had little comic talent, but his place among the tragic poets is unassailable. There is often a want of spontaneity in his writings; he is too elaborate and too subtle; but his two great tragedies, *'Tis Pity* and *The Broken Heart*, are not far inferior to Webster's masterpieces. William Gifford edited Ford's works in 1827; another edition by Hartley Coleridge appeared in 1840; and in 1869 Alexander Dyce issued a revised edition of Gifford's *Ford*.

Ford, RICHARD, F.S.A., was born in 1796, graduated at Oxford in 1817, and was called to the bar, though he never practised. The years 1830–34 were spent in a series of long riding tours in Spain; and in 1845 appeared the first edition of his delightful *Handbook for Travellers in Spain*. His *Gatherings from Spain* (1846) is mainly made up of charming matter which want of space caused to be cut out of the second edition of the *Handbook*. For twenty years Ford was a contributor to the *Quarterly* and other reviews, and his papers on Spanish art especially are of great value. He died 1st September 1858.

Fordun, JOHN OF. This early Scottish chronicler was a secular priest, and a canon of the cathedral church of Aberdeen. It has been inferred from his name that he was born at Fordun, in Kincardineshire. Having proposed to himself the compilation of a chronicle of Scotland, he is said to have travelled on foot through Britain and Ireland in search of materials. He lived to write only five books of his *Scotichronicon*, bringing the history down to the death of King David I. in 1153. He left collections extending to the year 1385, about which time he is supposed to have died. The work which John of Fordun had left unfinished was resumed in 1441 by Walter Bower, abbot of the monastery of Austin Canons Regular, at Inchcolm, in the Firth of Forth. Making use of his collections so far as they went, Bower enlarged the five books which Fordun had completed, and wrote eleven new books, bringing the *Scotichronicon* down to the year 1437; but many of his alterations corrupted Fordun's narrative. The work is the chief authority for the history of Scotland prior to the 15th century; its value being greatest during the 14th, when it is contemporary. Of the *Scotichronicon* there exist upwards of twenty MSS., the purest as regards Fordun's text being that preserved in the Wolfenbüttel library. Four printed editions have been published. The latest edition of Fordun's own work is that chiefly from the Wolfenbüttel MS. edited by W. F. Skene (2 vols. Edin. 1871–72); one of the volumes being an English translation of the Latin text.

Forecasts. See METEOROLOGY.

Foreclosure, in English law, the process by which a mortgagor failing to repay the money lent on the security of an estate is compelled to forfeit his right to redeem the estate. Every person having mortgaged his estate is entitled to an equity of redemption, which can only be cut off by a formal process. For this purpose the mortgagee files a bill of foreclosure, praying that an account may be taken of the principal and interest due under the mortgage, and that the mortgagor, on failing to pay, may forfeit his equity of redemption. If on the day fixed for payment the money be not forthcoming, the mortgagor will be declared to have forfeited his equity of redemption, and the mortgagee will be allowed to retain the estate. See MORTGAGE.

Foreign Enlistment Act. In the law of England there was a statutory prohibition of enlistment in the service of a foreign prince from the times of James I.; but the statute commonly known as the Foreign Enlistment Act is that of 1870. It provides that if any British subject shall agree to enter the service of any foreign state at war with any friendly state, either as a soldier or a sailor, without the license of Her Majesty, or an order in council or royal proclamation, or if any person within the British dominions induces any other person to enlist in the service of a foreign state, such person shall be guilty of a misdemeanour. The officers of the customs, on information on oath, may detain any vessel having persons on board destined for unlicensed foreign service. Masters of vessels knowingly having such persons on board are punishable by fine or imprisonment or both. Persons building any vessel for foreign service without license are guilty of a high misdemeanour, and the ship and stores are forfeited. Even to assist a foreign state at war with a friendly state by supplying warlike stores without license is a misdemeanour punishable with fine and imprisonment. These penalties are irrespective of any consequences that may follow to the individual for having committed a breach of international law. See MERCENARIES.

Foreigner. See ALIEN.

Foreign Law. The term foreign is applied by lawyers to places and matters outside the limits within which certain laws apply and courts have jurisdiction. Thus, to an English lawyer Scotland is a foreign country. Foreign law as such has, of course, no application to England; but the comity of nations requires that it should be recognised and acted upon in certain cases, as, for example, by the Extradition (q.v.) of offenders. The judgment of a foreign court, if in favour of the defendant, is an answer to an action brought on the same complaint in England; if in favour of the plaintiff, it is accepted as *primâ facie* evidence that his claim is well founded, and he may obtain satisfaction by suing on the judgment in England. Foreign law is proved in an English court as a matter of fact by the evidence of experts, or, if necessary, by taking the opinion of a foreign court. Government is empowered to make treaties for facilitating mutual ascertainment of laws. The courts will not act on a judgment which seems to have been improperly obtained, nor will they enforce a foreign law which is not in

accordance with natural justice as we understand it. The foregoing rules are not peculiar to England; they are followed by the courts of other countries. The French courts, for example, give effect to English judgments. A creditor in Britain suing a debtor who is abroad may usually obtain leave to cite or serve him with process in his absence; in England leave is also given to serve process out of the jurisdiction; as to Scotland, see EDICTAL CITATION. The judgment obtained in the debtor's absence may be enforced by a foreign court. Foreigners resident but not domiciled in a country may usually sue one another in the ordinary courts; but the French courts have refused to entertain such suits, except in commercial matters.

The Foreign Jurisdiction Acts regulate the proceedings of criminal courts in places (such as Turkey, for example) where the local government is bound by treaty or capitulation to permit British magistrates to act. The Foreign Enlistment Act is a separate article (q.v.). In London and some other cities there is a custom called Foreign Attachment. When a defendant fails to appear to an action his property within the local jurisdiction (e.g. debts due to him) may be attached in order to compel his appearance or to obtain satisfaction of claims against him; see ATTACHMENT.

Foreign Money. See TENDER.

Foreign Office. See SECRETARY OF STATE.

Foreland, NORTH and SOUTH, two promontories of England, on the east coast of Kent, between which are the Downs and Goodwin Sands. North Foreland, the *Cantium* of Ptolemy, which forms the north-east angle of the county in 51° 22′ N. lat. and 1° 26′ E. long., consists of chalky cliffs, nearly 200 feet high. It has a lighthouse 85 feet high, with a fixed light, 188 feet above the sea, and seen 20 miles off. South Foreland, also composed of chalk-cliffs, is 16 miles S. of North Foreland, in 51° 8′ N. lat. and 1° 22′ E. long. It has two fixed lights, respectively 380 and 275 feet above the sea, and seen from a distance of 25 and 22 miles. It was off this part of the coast that the four days' sea-fight between Monk and De Ruyter took place in 1666.

Forensic Medicine, another term for Medical Jurisprudence (q.v.).

Foreshore. See SEASHORE.

Foreshortening, a term in Painting or Drawing, applied to signify that a figure, or a portion of a figure, which is intended to be viewed by the spectator directly or nearly in front, is so represented as to convey the notion of its being projected forward; and, though by mere comparative measurement occupying a much smaller space on the surface, yet to give the same idea of length or size as if it had been projected laterally.

Forestalling. See ENGROSSING.

Foresters, ANCIENT ORDER OF. See FRIENDLY SOCIETIES.

Forest-fly, or HORSE-FLY (*Hippobosca equina*),

Forest-fly (*Hippobosca equina*), magnified: *a*, natural size; *b*, the pupa, as deposited by the mother.

a Dipterous insect, parasitic on horses, oxen, &c., frequent in forests, particularly in the New Forest, Hampshire. It is a small insect, about four lines long, of a shining brown colour, with some yellow. Living on the blood of its host, it especially infests the tail, belly, and flanks. The insect passes the larval stage and becomes a pupa within the mother. One only is produced at a time, enclosed in a relatively large, black, bead-like, tough cocoon, from which the insect finally emerges by bursting open a kind of lid.

Forest Laws. Forest is defined by Coke to be a safe preserve for wild animals (*ferœ*) of the chase. A forest, in the sense of the law of England, is a large tract of open ground, not necessarily covered with wood, but usually containing woodland interspersed with pasture, and forming part of the property of the monarch, and governed by a special code, called the forest law. This particular law not only had reference to matters connected with hunting and the like, but generally governed the persons living within the forest in all their relations. Though the privilege of forest belongs of right to the sovereign alone, it may be granted by him in favour of a subject, who becomes entitled to exercise the privileges of forest in the district assigned. This right was exercised by the Saxon kings, who reserved large tracts of country for hunting. William the Conqueror greatly extended the royal forests, by laying desert vast districts in Hampshire and Yorkshire; he also introduced penalties of the severest kind for offences against the game. But the laws of the forest were first reduced to a regular code by the Forest Charter of 1217. The right of the sovereign to create a forest is by the common law confined to lands of his own demesne. Henry II. had arbitrarily exercised his power by afforesting the lands of his subjects; but by this charter of Henry III. it was provided that all forests so made should be disafforested. By the same charter the penalties for destroying game were greatly modified, it being provided that no man should lose life or limb for slaying deer, but that the punishment should be restricted to fine or imprisonment for a year and a day. Chap. 11 contains the following curious privilege: 'Whatsoever archbishop, bishop, earl, or baron, coming to us at our commandment, passing by our forest, it shall be lawful for him to take and kill one or two of our deer by view of our forester if he be present; or else he shall cause one to blow an horn for him, that he seem not to steal our deer; and likewise they shall do returning from us.' Charles I.'s attempts to impose penalties and exact fines for alleged encroachments on the ancient boundaries of the forests, though the right to the lands thus taken was fortified by possession for several centuries, were among the first grievances with which the Long Parliament dealt. Since the passing of the Act for the 'certainty of forests' (16 Car. I. chap. 16), the laws of the forest have practically ceased. In Coke's time there were sixty-nine royal forests; of these the principal were the New Forest, Sherwood, Dean, Windsor, Epping, Dartmoor, Wychwood in Oxfordshire; Salcey, Whittlebury, and Rockingham in Northamptonshire; Waltham in Lincolnshire; and Richmond in Yorkshire. Some of these, however, including Whittlebury and Wychwood, have been disafforested since 1850. The royal forests of Scotland in ancient times seem to have been nearly as numerous as those of England. In Perthshire there were the forests of Athole, Glenartney, Glenfinlas, Glenalmond, Birnam, Cluny, Alyth, &c.; in Forfarshire, Platan, Montrethmont, Kilgerry; in Kincardineshire, Cowie and Durris; in Aberdeenshire, the Stocket, Dyce, Kintore, Benachie, Drum, Birse, Braemar; in Banffshire, the Boyne and the

Enzie; in Elgin, Darnaway, &c. South of the Forth were those of Torwood, Cadzow, Ettrick, Selkirk, Jedburgh, Traquair, the New Forest in Dumfriesshire, &c. The forest code of Scotland (*Leges Forestarum*), though neither so complete nor administered with the same rigour as that of England, was still generally complained of for its severe penalties and vexatious restraints. The grant of a right of forestry conferred the same privilege as if the ground over which it extended had been originally, and had continued to be, a king's forest. See DEER-FORESTS, GAME LAWS, WOODS AND FORESTS; and for other information about forests, ARBORICULTURE, METEOROLOGY, FOSSIL; also the articles on DEAN, EPPING, SHERWOOD FOREST, NEW FOREST, &c.

Forest Courts were established for the purpose of enforcing the laws relating to the royal forests. Of these there were in England four—viz. the Court of Attachments, of Regard, of Swainmote, and of the Lord Justice in Eyre in the Forest, or Justice Seat. The last Court of Justice Seat at which business was transacted was held in the reign of Charles I. before Lord Holland; the office of itinerant forest justices was not abolished until 1817, the criminal law of the forest having been almost wholly repealed half a century before.

Forest Marble, a member of the middle division of the Jurassic System (q.v.), so called because of the occurrence of the typical beds in Wychwood Forest, Oxfordshire. The principal bed is a fissile limestone, containing large numbers of dark-coloured shells (chiefly Ostrea and Pecten), and capable of sustaining a fine polish. On this account it is used to some extent as 'marble.' It is interstratified with beds of clay and shale, occasional marls, and sandstones. The thickness of the group in North Dorsetshire is 450 feet, but it thins away northwards, being about 100 feet near Bath and Cirencester.

Forest Oak, a name sometimes given in commerce to the prettily marked timber of *Casuarina torulosa* of Queensland.

Forfar, the county town of Forfarshire, 14 miles NNE. of Dundee, stands at the east end of Forfar Loch, on a rising ground in the fertile valley of Strathmore. It was a royal residence as early as the reign of Malcolm Canmore, whose son, David I. (1124–53), made it a royal burgh; but in 1308 Bruce captured and razed the castle—its site is marked now by the town cross of 1684. Forfar, says Boece, was 'brought in 1526 to little more than a country village;' but since the middle of the 18th century it has risen again to a comfortable town, with several good public buildings, among them a striking Episcopal church (1881). The making of brogues by the 'Forfar souters' is a thing of the long past; and linen is now the leading manufacture. With Montrose and three other burghs it returns one member to parliament. Pop. (1841) 8362; (1891) 12,844. Glamis Castle, a stately château-like pile, the seat of the Earl of Strathmore, lies 5 miles WSW.

Forfarshire, or ANGUS, a maritime Scottish county, washed on the east by the German Ocean, on the south by the Firth of Tay. It has an utmost length and breadth of 36 and 36½ miles, and an area of 890 sq. m. The surface is finely diversified, the rich plain of Strathmore—the Howe of Angus—dividing the Sidlaw Hills (1399 feet) from the Grampian Braes of Angus in the north-west, which culminate in Cairn na Glasha (3484 feet) on the Aberdeenshire boundary, and exceed 2000 feet in twenty-two other summits. The chief streams are the North and South Esks and the Isla; and Loch Lee (9 by 2 furlongs) is the largest of several small lakes. The rocks are Silurian in the north-west, and elsewhere Old Red Sandstone; the soils are very various. Somewhat less than half of the entire area is in cultivation, and more than one-nineteenth under wood. Agriculture is practised on the best methods, and much attention is paid to live-stock, though the celebrated 'polled Angus' belongs now specially to Aberdeenshire (see CATTLE). Linen and jute are the staple manufactures of the towns. These include Dundee, Montrose, Arbroath, Brechin, Forfar, Broughty-Ferry, Kirriemuir, and Carnoustie. The county returns one member to parliament. Pop. (1841) 170,453; (1881) 266,360; (1891) 277,788. Part of Southern Pictavia, then till 1242 the *mormaer*-ship or old Celtic earldom of Angus, Forfarshire is rich in antiquities—vitrified and other hill-forts, cairns and standing-stones, Roman camps, the sculptured stones of Meigle, Aberlemno, St Vigeans, Glamis, &c., the ruins of Restennoth priory and Arbroath abbey, the round tower and cathedral of Brechin, and the old castles of Glamis, Edzell, Finhaven, Airlie, &c. See A. Jervise's *Memorials of Angus and Mearns* (1861), and *Land of the Lindsays* (2d ed. 1882); and Warden's *Angus or Forfarshire* (4 vols. 1880–83).

Forfeiture is a legal term which includes the various cases in which a person is penally deprived of property. An offender who is fined forfeits a sum of money, which is recovered out of his general estate. The feudal law of England made forfeiture of land and goods part of the punishment of an offence involving disloyalty or breach of feudal duty; thus, the lord might claim lands in case of what was called 'escheat with attainder,' and there was forfeiture to the king in case of treason. An act of 1870 abolishes forfeiture in case of conviction for treason and felony; but the crown may appoint a person to administer the property of a convict; compensation to parties injured, and the costs of the prosecution, may be paid out of his estate. Civil forfeiture of land may still be incurred by unlawful alienation in Mortmain (q.v.), or by breach of the conditions on which the property has been acquired. A tenant, for example, may incur forfeiture by breach of his covenants, or by wrongful disclaimer—i.e. setting up a claim adverse to that of his landlord. Forfeiture for tortious alienation (i.e. for attempting to convey an estate greater than the grantor is entitled to) is now obsolete. The courts will always lean against a forfeiture, and the Conveyancing Act, 1881, protects a tenant against this extreme penalty where compensation in money meets the justice of the case.

In Scotland civil forfeiture may arise either from statutory enactment, at common law, or by agreement. By 1597, chap. 246, it is enacted that vassals failing to pay their feu-duties for two years shall forfeit their right. This forfeiture must be established by an action to recover the feu-duties in arrear, and may be avoided by payment at the bar. At common law a vassal forfeited his land by disclamation or purpresture. The former is analogous to the English disclaimer, and consists in the denial by a vassal of his lawful superior. Purpresture was incurred by the vassal's encroachment on the streets, highways, or commonties belonging to the crown or other superior. These forms of forfeiture are fallen into disuse. Forfeiture on special agreement depends wholly upon the terms of the condition inserted in the titles to the land. The condition must be fortified by irritant and resolutive clauses, and must enter the sasine, in order that it may be effectual against purchasers of the lands. Of this kind of forfeiture are breaches of Entail. See ENTAIL. See also ATTAINDER, TREASON.

Forgery (Fr. *forger*, 'to form metal into shape,' 'to fabricate')—the *crimen falsi* of Roman law, in

which it was punished with banishment or death, according to the enormity of the particular offence and the rank of the offender—may be roughly defined as 'the fraudulent making or altering of a writing or seal to the prejudice of another man's right, or of a stamp, to the prejudice of the revenue' (East, *Pleas of the Crown*).

The essential elements in the crime of forgery are (1) that there should be in the offender an intention to deceive, and (2) that the fabrication or alteration should be sufficiently skilful to render possible the deception of a person using ordinary observation. It is not necessary that the fraudulent imitation should be exact. The fraudulent application of a real signature to a false document, and of a false signature to a real one, are both forgeries. In Scotland it has been held to be forgery fraudulently to sign the name, or add the cross or mark, of a person unable to write (Alison's *Criminal Law*, i. 374), or the name of another on a false pretence that he gave authority so to do, or for a person to sign his own name with intention to pass off the signature as that of another person bearing the same name.

By the common law of England forgery was a mere misdemeanour, and punishable as such by fine, imprisonment, and the pillory; though capital punishment was the usual penalty for the more serious class of offences under this head. In 1861, however, a statute was passed which made it felony (*a*) to counterfeit the great seal, the privy seal, the sign manual, the seals of Scotland or of Ireland, any stamp, exchequer bill, bank-note, bill of exchange, deed, receipt, order for the payment of money or the transfer of stock, will, register of births, marriages, and deaths, marriage license, or any one of various other enumerated documents, or (*b*) to have in possession without lawful excuse—such excuse to be proved by the party accused—any forged bank-note, &c., knowing it to be forged, or any frames, mould, plates, paper, &c., used in making such bank-notes. The act also made felonious certain practices connected with, or aiding in, the perpetration of the crime of forgery. By the Forgery Act, 1870, the forgery of stock certificates or of coupons issued by the Bank of England in payment of the interest of the national debt is a felony. Capital punishment in cases of forgery was restricted by acts passed between 1830 and 1832, and abolished in 1837. Under the consolidating Act of 1861 the punishment varies from penal servitude for life to not more than two years' imprisonment, with or without hard labour. See TRADE-MARKS.

Long before the amendment of the laws of evidence, by which parties were admitted as witnesses in their own causes, it was provided in 1829 that the party whose name had been forged might be a witness to the effect that the writing was not his.

Comparison of handwriting is competent, but is not *by itself* conclusive evidence of forgery. Identification of handwriting is, if possible, more difficult than identification of the person, which so often forms the chief difficulty in criminal trials. 'As illness, strange dress, unusual attitude, and the like, cause mistakes in identifying the individual, so a bad pen, or rough paper, a shaky hand, and many other things change the appearance of a person's handwriting. This kind of evidence ought never, therefore, to be regarded as full proof by the crown in criminal trials; and even in civil cases corroborative evidence should be required, unless the proof of handwriting is so clear as to shift the *onus probandi*.' The best witness is one who has often seen the party write, through whose hands his writing has been continually passing, and whose opinion is not the result of an inspection made on a particular occasion for a special purpose.

The writing of letters in another man's name (as in the forged letters of the Parnell Commission) is not forgery in the statutory sense. See also FRAUD, COINING, RECORDS (PUBLIC).

In the United States, also, falsification of writing is not necessarily forgery in a legal sense; the writing of letters and signing them with the name of another, however injurious to the feelings and interests of that other, is not forgery in law unless pecuniary rights, obligations, or engagements are intended to be directly affected by the false writing. The definition in Bishop's *Criminal Law* (Boston, 1858) is: 'Forgery is the false marking or materially altering, with intent to defraud, of any writing which, if genuine, might apparently be of legal efficacy in the foundation of a legal liability.' At common law the publication or uttering of the forged instrument is not necessary to constitute forgery. But the statutes of the United States generally make the uttering or using of the forged instrument essential to the offence.

LITERARY FORGERIES.—Some of these deserve to be commemorated for their audacity or ability. They are to be distinguished from all use of more or less ingenious pseudonyms, devised to conceal the identity of a writer; and from all writings in imitation of some author's style, and temporarily fathered upon him for mere literary purpose; as well as from so-called *pious* frauds, by which writings honestly intended for edification are connected with some more or less ancient name that commands respect. Such compositions as are deliberate attempts to pass for what they are not are literary forgeries, and are as unpardonable as forgeries of the signature of a London banker. The fictitious account of Formosa, with an alphabet and specimens of a language, published by George Psalmanazar in 1704, was such an imposture as could not long escape discovery. The most famous of such literary forgeries in English literature are connected with the name of Shakespeare—himself but a stalking-horse for another, according to thousands of half-educated people whom no evidence could satisfy. The famous Ireland forgeries began with an autograph of Shakespeare, fabricated by Samuel W. H. Ireland, to gratify his father, but soon grew into a heap of papers, and an entire play, entitled *Vortigern*, which was quickly damned at Drury Lane. The criticisms of Malone, and the alarm of young Ireland's father, necessitated a confession, published in 1796. Twenty years before, Chatterton's Rowley poems had opened up a bitter controversy about their authenticity, from which the boy-poet escaped by untimely suicide; and the Ossianic poems produced by MacPherson (1762–63) have been rank forgeries to a chain of scholars from Dr Johnson to J. F. Campbell, although as vigorously defended by many enthusiastic writers. The famous Perkins Folio of Shakespeare, said by J. P. Collier in 1852 to have been discovered, with an extensive series of contemporary marginal annotations, created a great commotion among Shakespeare scholars, but was at length unanimously condemned, and its annotations proved to be recent fabrications. In 1852 was published by Mr Moxon a series of letters by Shelley, which were discovered a few weeks later to be impudent forgeries, and were at once suppressed by the publisher. It was discovered that there was a brisk trade in the manufacture of letters, autographs, and marginal annotations upon books by Shelley, Byron, and others, and that many of these showed not only great technical skill in imitation, but no mean literary ability in their composition. It would be well for purchasers of letters and autographs of famous persons to make sure of their history, as there is still too good reason to believe that the supply of these is adapted to correspond

with the demand. The most remarkable of all the dupes of literary forgers was Michel Chasles (q.v.), upon whom had been passed as many as 27,000 autographs, including those of Pascal, Shakespeare, Dante, and even Julius Cæsar. The fragment of a Moabite Deuteronomy, inscribed on fifteen pieces of sheepskin, brought to London in 1883 by Shapira, was a really skilful imitation, but failed to deceive the practised eyes of Dr Ginsburg and Clermont-Ganneau, and the forger or forger's dupe cut short his humiliation by suicide.

Forget-me-not (the name is accounted for by various legends) is *Myosotis palustris;* but the term has spread to the larger-flowered species, and indeed to all the members of the species — practically superseding the more prosaic title of Scorpion-grass, derived from the inflorescence so characteristic of the Boraginaceæ, and also that of Mouse-ear, from the hairy leaves. *M. silvatica*, the wood forget-me-not, the Alpine *M. alpestris*, and among exotic species *M. azorica*, are specially worthy of cultivation. *M. versicolor*, a common weed, is remarkable for the change of colour in its flowers, which not only show the change from red to blue in opening so common in the order, but begin with a distinct yellow.

Wood Forget-me-not (*Myosotis silvatica*): a, a flower.

Forisfamiliation (lit., 'the putting forth from or beyond the family') is the separation of a child from the family of his father. A child is said to be forisfamiliated either when he marries or when he receives from his father a separate stock, the profits of which are enjoyed by himself, though he may still reside with his father, or when he goes to live in another family with the consent of his father. The same result is also brought about when a child renounces his *legitim*—i.e. his legal share of the succession to his father's free movable property.

Fork. See CUTLERY.

Forli, capital of the province of the same name in Italy, situated at the foot of the Apennines, in a pleasant and fertile plain, 40 miles SE. of Bologna by rail, is a well-built and handsome city. Of the churches the cathedral, S. Girolamo, and S. Mercuriale are the most notable. In these and in the city gallery are some of the best pictures of Cignani, Guido, Melozzo, Guercino, and others. The citadel, founded in 1361, is now used as a prison. There are manufactures of silk, shoes, hats, and cloth. Forli (the ancient *Forum Livii*) is said to have been founded by Livius Salinator, after his victory over Hasdrubal, on the Metaurus, 207 B.C. In the middle ages it formed a republic, and during the subsequent struggles of the Guelphs and Ghibellines frequently changed its rulers. In 1860 Forli, which had been incorporated in the States of the Church since the time of Pope Julius II., became Italian. Pop. 19,442.

Forlorn-hope, the body of men selected to effect a lodgment on a breach, or to lead in scaling the wall of a fortress. Professor Skeat derives the expression from the corresponding Dutch *de verloren hoop*, the word *hoop* (pron. as English *hope*) meaning a band or troop. The French equivalent term is *enfants perdus*. The name is given on account of the extreme danger to which the leaders of a storming-party are necessarily exposed. As, however, the honour of success is proportionate to the peril of the undertaking, there is ordinarily no lack of volunteers for this arduous service.

Forma Pauperis. See IN FORMA PAUPERIS.

Formation has by English geologists been generally applied to a group of strata united by some character which they have in common, whether of age, origin, or composition, as the *Carboniferous Limestone formation*, which, together with the formations of the *Millstone Grit* and the *Coal-measures*, constitutes the Carboniferous System. The term is therefore of subordinate importance to *system*. Foreign geologists seldom use formation in this sense. With them the word is descriptive of the materials composing strata, as *chalk formation*, meaning thereby not the Cretaceous System, but beds composed of chalk; so *carboniferous formation* is a group of beds containing coal. To bring our nomenclature into uniformity with that of foreign geologists some purists propose dropping the term formation out of our systems of rock classification. But to do that would require despotic authority, and the term will probably survive in spite of its supposed inconvenience.

Formes, KARL, bass singer, was born in 1810 at Mülheim, on the Rhine, and was for some years a verger before he made his début on the stage at Cologne, in 1842, as Sarastro in the *Zauberflöte*. He was engaged for a time in Vienna, and sang in Italian opera at Covent Garden until 1857, when he visited America, and entered on a comparatively wandering life, in spite of the possession of a voice that for volume, compass, and quality was one of the most magnificent ever heard. Died in 1889.—His brother, THEODOR, born in 1826, appeared first at Ofen in 1846, as Edgardo in *Lucia*, and for some years after was one of the most noted tenor singers in Germany. He died in 1874.

Formia, formerly Mola di Gaeta, a seaport of Italy, on the Gulf of Gaeta, with 8551 inhabitants. The ancient *Formiæ*, it became a Roman town in 338 B.C., and was celebrated for its wine. Here are the ruins of Cicero's villa, Formianum.

Formic Acid, CH_2O_2 or HCOOH, derives its name from the circumstance of its having been first obtained from the red ant (*Formica rufa*). It occurs in ants, in the stings of bees, wasps, and nettles, in fir needles, and in various animal secretions. It may be obtained from any of these by distillation with water. Anhydrous formic acid is a mobile liquid of extremely penetrating odour, crystallising at 35° F., and boiling at 214° F., miscible in all proportions with water and alcohol. It produces a painful blister if dropped on the skin. The aqueous acid is prepared in the following manner: Half a pound of oxalic acid is mixed with one pound of glycerine, and the mixture heated in a retort to 275° F.; a little dilute formic acid distils; another quantity of oxalic acid is added, and the mixture again heated, and so on indefinitely, the glycerine remaining unchanged at the end of the operation. The decomposition is as follows:

Oxalic Acid.		Formic Acid.		Carbonic Acid.
$C_2H_2O_4$	=	CO_2H_2	+	CO_2.

Acid containing 56 per cent. of the pure substance

is obtained in this way. The anhydrous acid is procured by preparing the lead salt, and decomposing this with sulphuretted hydrogen. It may be formed synthetically in various ways: (1) By direct combination of carbonic oxide, CO, and caustic potash, KOH, forming KCO_2H, potassium formate; (2) by boiling aqueous prussic acid; (3) by heating chloroform with caustic potash. Formic acid and all its salts (called formates or formiates) are strong reducing agents, and precipitate metal from solutions of gold, silver, or mercury salts. Formic acid is obtained in small quantities by the oxidation of a great number of organic substances. Formates of silver and lead are sparingly soluble; all the others are freely so. By heat they are converted into oxalates yielding pure hydrogen.

Potassium Formate. Potassium Oxalate. Hydrogen.

$$2KCO_2H = K_2C_2O_4 + H_2.$$

Formosa, called by the Chinese *Taiwan*, an island lying off the coast of China, over against the province of Fû-chien, from which it is separated by the Fû-chien Strait, varying from 90 to 220 miles in width. Stretching between the limits of 120° 15′ and 122° 5′ E. long., and 25° 19′ and 21° 54′ N. lat., Formosa has a maximum length of 235 miles, whilst its breadth varies from 70 to 90 miles. Area, 14,978 sq. m. Forming one link in the volcanic chain that extends from the Aleutian Islands southwards to New Guinea, it constitutes the eastern escarpment of what was once the great Malayo-Chinese continent, and is connected by a submarine plateau with the Chinese mainland. The backbone of the island, extending north and south, is formed of a range of densely-wooded mountains, called by the Chinese Chu-Shan, which rise to upwards of 12,000 feet, the highest known peak, Mount Morrison, being given as 12,847 feet. Eastward of this range lies a narrow strip of mountainous country, presenting to the Pacific a precipitous cliff-wall with in many places a sheer descent of from 5000 to 7000 feet, whilst a very short distance farther east the floor of the ocean sinks to a great depth at an extremely steep gradient. The western side of the range consists of a single broad alluvial plain, stretching from north to south of the island, seamed by innumerable water channels, and terminating at the coast-line in mud flats and sand-banks. Yet on this side of the island the land is rapidly encroaching upon the sea, as the consequence of the gradual elevation of the western seaboard and the deposition in and around the embouchures of the rivers of the large amount of sediment brought down by them from the mountains. This latter process is primarily due to the heavy rainfall of the northern, central, and eastern portions of the island, where the rain-clouds of the north-east monsoon, after crossing the warm Kiosiwo or Japanese Gulf Stream, on coming in contact with the mountain barrier of the island become chilled and discharge their contents in rains of excessive violence. Apart from this heavy rainfall, the climate is not exceptional, the insular position ensuring a modification of the heat by sea-breezes. The mean of summer is 80° to 90° F.; of winter, 50° to 60°. Malarial fever is, however, prevalent in the north, and violent typhoons are very common at certain seasons.

The island is famous for the rich luxuriance of its vegetation, many of our hothouse plants growing wild on the mountain slopes and in the valleys, such as orchids, azaleas, lilies, rhododendrons, and convolvulus; besides which there is a wealthy profusion of ferns, tree-ferns, camphor and teak trees, pines, firs, wild fig-trees, liquidambars, bananas, bamboos, and palms. 'Rice paper' is prepared from the pith of a tree peculiar to Formosa. Of animal life it is noticeable that there are at least forty-three species of birds peculiar to the island, that insects are scarce, and that noxious wild animals are few, but that fish are plentiful in the waters round the coast. The principal products of commercial importance are tea, sugar, coal, turmeric, rice, sweet potatoes, ground-nuts, bamboos and rattan, grasses, tobacco, timber, the fruit lung-ngan, and sesamum-seed. In the south the staple crops are sugar and turmeric, which were exported from the port of Taiwan in 1887 to the value of £269,030 and £10,483 respectively; and in the north tea, of which 16,858,933 lb. were shipped at Tamsui in 1887, principally to America, Australia, and China, and coal, the export of which fell from 31,000 tons in 1884 to 5767 during the French occupation of Kelung, the port of shipment; but by 1886 it had again risen to 16,659 tons. The imports consist principally of opium, cotton and woollen piece goods, and lead. Sulphur, iron, and petroleum also exist, but are not worked to any extent. Camphor and indigo used formerly to be exported to a large value, but the trade in both is now almost extinct. A very large proportion of the shipping trade is carried on by means of native junks, which ply to and from the mainland; the rest is in the hands of Europeans trading with the open ports of Taiwan and Takow on the south-west, and Tamsui and Kelung on the north. None of these, however, have good harbours, the entrance to each of them being greatly impeded by bars or sand-banks. Besides this great drawback, the island suffers from deficient means of communication, although since 1887 telegraph lines have connected Tamsui with Fû-chow, with Kelung, and with Taiwan and its port Anping, and with the Pescadores Islands, a group, with 8000 inhabitants and two excellent harbours, lying some 20 to 25 miles west of Formosa. A railway was in 1888 being made to connect Kelung with Twatutia, the centre of the tea district.

The inhabitants, estimated to number between one and a half and two millions, consist of Chinese settlers and aborigines. Respecting the ethnological origin of these latter there exists some dubiety; they seem to consist of several different tribes, mainly of Malayan and Negrito descent. The Chinese distribute them into three classes, Pepohwan, a race of civilised and sinicised agriculturists; Sekhwan, settled tribes who acknowledge Chinese rule; and Chinhwan, the untamed savages of the mountains, who wage fierce and unceasing warfare against the Chinese immigrants. The administrative headquarters were formerly at Taiwan, but on the constitution of the island into an independent province of the Chinese empire in 1887—it had formerly been incorporated with Fû-chien on the mainland—they were transferred to Tai-pei or Bangka. The island was known to the Chinese before the Christian era, but does not seem to have seriously attracted their attention until the year 605 or 606 A.D. In the 14th century they established several colonies in Formosa, which, however, were withdrawn in the middle of the 17th century. Although Portuguese and Spanish navigators began to visit the island a century earlier, the first European people to establish themselves on it were the Dutch, who in 1624 built Fort Zealandia, near the modern Taiwan. They were, however, expelled in 1661 by a Chinese adventurer, Koscinga, who retained possession of the island for twenty-two years. Some years later a regular Chinese colonisation of the western half of the island was carried through, the colonists coming principally from Fû-chien and Kwang-tung. Subsequently the island became notorious for the piracy of its inhabitants and the ill-treatment they inflicted upon navigators who chanced to be wrecked on their coasts. Accordingly in 1874 the Japanese invaded Formosa; but on the Chinese undertaking to check the evils complained of they withdrew.

Ten years later the French, during their ambiguous contest with China in Tongking, seized upon Kelung, on account of its command of the coal-mines, but vacated it again on the conclusion of peace.

See, besides the older authorities, Guillemard, *Cruise of the Marchesa* (1886); A. R. Colquhoun, article in *Scot. Geog. Mag.* (1887); *Consular Reports* (1886 and 1887); Terrien de Lacouperie, in *Jour. Roy. Asiatic Soc.*, vol. xix. part iii. 1887; Girard de Rialle, in *Revue d'Anthropologie* (1885); and G. Taylor, in *Proc. Roy. Geog. Soc.*, April 1889. The *Historical and Geographical Description of Formosa* (1704), by George Psalmanazar (q.v.), is a tissue of inventions.

Formosa, a territory in the extreme north of Argentine Republic, formed in 1884, and bounded on three sides by the rivers Pilcomayo, Paraguay, and Bermejo. Estimated area, 44,490 sq. miles. Little is known, even by Argentinians, of the newly-formed territory, which is, however, described generally as a vast plain, gently sinking to the south-east, covered with forests, and in large sections liable to frequent inundations. The summer rains last from October to May. The capital is Formosa (1000 inhabitants), on the Paraguay, about 100 miles NNE. of Corrientes.

Forms of Address. See ADDRESS (FORMS OF).

Formulæ. See CHEMISTRY.

Forres, a royal burgh of Elginshire, 5 miles S. of Findhorn village, on the Moray Firth, and 25 ENE. of Inverness, with which and Nairn and Fortrose it returns a member to parliament. On its Castle Hill, a royal residence from 1189 to 1371, stands an obelisk (1857), 65 feet high, to the Crimean hero, Dr Thomson of Cromarty; whilst on the wooded Cluny Hill are a hydropathic establishment, and the Nelson tower (1806), 70 feet high. Sueno's Stone is a remarkable sculptured monolith, ascribed by Skene to the year 900; the Witch's Stone recalls Macbeth's meeting with the weird sisters near Forres. Public buildings are the town-house, Falconer museum, mechanics' institute, and Anderson's Institution. Pop. of royal burgh (1891) 2928; of parl. burgh (1881) 4030; (1891) 3971.

Forrest, EDWIN, actor, was born in Philadelphia, 9th March 1806, his father being of Scotch descent, his mother a German, and made his first regular appearance on the stage there in 1820, as Douglas in Home's tragedy. At the age of twenty he appeared as Othello at the old Bowery Theatre in New York, where his immediate success was the foundation of a popularity that survived for many years. He played in London with great success in 1836–37, but at his appearance in 1845 his Macbeth was hissed by the audience; and an unworthy and spiteful resentment that prompted him, a few weeks later, to stand up in a private box in the Edinburgh Theatre and hiss Macready, utterly destroyed his reputation in England and Scotland. A more serious result of his jealous action was the Astor Place riot in New York in 1849, which ensued on the hissing of Macready's Macbeth by Forrest's sympathisers, and which ended in the death of twenty-two men. These events, and the public scandal attendant on a suit for divorce brought by his wife, lessened his fame and embittered his temper. He retired from the stage between 1853 and 1860, when he returned to fill at Niblo's Garden, New York, the most successful engagement of his life. Later tours proved failures, and, after a long struggle against weakness and disease, he made his last appearance as an actor in the part of Richelieu, at the Boston Globe Theatre in 1871. Even then a craving for the old-time applause led him to give readings from Shakespeare in several large towns; but these, too, proved unsuccessful, and he retired to his home in his native city, where he died of paralysis, 12th December 1872. Forrest's powers as a tragedian were of a very high order; his Lear, Othello, Coriolanus, and several other parts stand out in the memory of those who witnessed them, and were justly ranked in their own day as memorable performances. With him the line of great American actors begins.

Forrest, JOHN, Australian explorer, was born at Bunbury in Western Australia, 22d August 1847, and from 1864 onwards was connected with the survey department of the colony. In 1869 he penetrated inland from Perth, in a north-easterly direction, as far as 123° E. long., between 28° and 29° S. lat., through a barren country of salt marshes and scraggy bushes. In the following year he showed that it was possible to reach South Australia from the west by travelling along the south coast of the continent. Along with his brother Alexander, he again made an eastward journey in 1874, setting out from Champion Bay and following generally the line of 26° S. lat. till he came to Peake Station, on the telegraph line connecting Port Darwin and Adelaide. Besides making these exploring journeys John Forrest surveyed that part of north-western Australia lying between the rivers Ashburton and De Grey in 1878, and four years later the Fitzroy district in the same region of Western Australia. He published *Explorations in Australia* (Lond. 1875).—His brother ALEXANDER, also an Australian explorer, was born at Bunbury, September 22, 1849. After taking part with his brother John in his journeys, he in 1879 started, along with Hill, to explore the north-western parts of the Australian continent, an expedition which resulted in the discovery of the fertile pastoral region now called Kimberley District. Besides being well watered, it was also seen to be suitable for the cultivation of such tropical harvests as sugar, coffee, and rice. At the same time the river Fitzroy was ascended for a distance of about 250 miles. This journey was described in *Journal of an Expedition from the De Grey to Port Darwin* (1880).

Forst, an industrial town of Prussia, 80 miles SE. of Berlin by rail, had in 1885 a population of 18,563, mostly engaged in manufacturing buckskins, in cloth manufactories, and in tanneries. Forst has also a trade in cattle.

Förster, FRIEDRICH CHRISTOPH, poet and historian, born near Kamburg, in Saxe-Meiningen, on 24th September 1791, devoted himself at first to the study of archæology and the history of art, but on the outbreak of the war of liberation joined the Lützow sharpshooters along with young Theodor Körner, and, like him, wrote fiery war-songs, stirring up his countrymen against the French. After his return to Berlin he taught for a while in the school of artillery and engineering, but was dismissed for writing a work criticising the Prussian constitution. In 1829, however, he was appointed a custodian of the Royal Art Museum at Berlin, where he died on 8th November 1868. He wrote several popular historical works, dealing chiefly with the war of liberation and the history of Prussia, including a collection of biographical sketches entitled *Preussens Helden im Krieg und Frieden;* and, besides these, three works on Wallenstein; a *History of Frederick William I.* (3 vols. 1835); *Urkundenbuch* (new ed. 2 vols. 1839); and *Die Höfe und Kabinette Europas im 18. Jahrhundert* (3 vols. 1836–39). His *Gedichte* appeared in 2 vols. 1838.

His brother ERNST, painter and writer, was born 8th April 1800. His passion for art was first awakened by Cornelius, under whose direction he executed various fresco pieces in Bonn and

Munich, from 1823 to 1825. An expedition to Italy for the purpose of making drawings from the old masters bore fruit in *Contributions to the History of Modern Art* (1836). From this time he abandoned painting and devoted himself almost exclusively to investigations bearing upon the history of art, his principal books being *Letters on Painting* (1838); *History of German Art* (5 vols. 1851–60); *Monuments of German Architecture, Sculpture, and Painting* (12 vols. 1853–69); *Introduction to the History of Art* (1862); biographies of Fra Angelico (1859), J. G. Müller (1851), Raphael (1867–68), and Cornelius (1874), and a translation, in conjunction with Schorn, of Vasari's *Lives of the Painters*. At the time of his death, on 29th April 1885 at Munich, Förster left two large works unfinished, a *History of Italian Art* (5 vols. 1869–78), and *Monuments of Italian Painting* (4 vols. 1870–82). He also edited the posthumous works of his father-in-law, Jean Paul (1836–38), and wrote several biographical works relating to the great humorist, the chief being the last five volumes of *Wahrheit aus Jean Pauls Leben* (1827–33).

Forster, JOHANN REINHOLD, a German traveller and naturalist, was born in Dirschau, in Prussia, on 22d October 1729. He was educated at Halle and Danzig for the clerical profession, but his favourite studies were languages, botany, and zoology. Repairing to England in 1766, he acted for a few years as a teacher at Warrington in Lancashire, until he was appointed to accompany Cook as naturalist during his second voyage in 1772. On Forster's return his son published an account of the journey from Forster's own note-books, whilst Forster himself wrote *Observations made during a Voyage round the World* (1778), chiefly on physical geography and natural history. Two years afterwards he received the appointment of professor of Natural History at Halle, where he died on 9th December 1798. He wrote also a work on *Mineralogy* (1768), one on the *Byssus of the Ancients* (1770), *Flora Americæ Septentrionalis* (1771), *Zoologiæ Rarioris Specilegium* (1781), an *Account of the South Sea Plants* (1776), and *Geschichte der Entdeckungen und Schiffahrten im Norden* (1784).—His eldest son, JOHANN GEORG ADAM, was born near Danzig, on 26th November 1754. When only seventeen years of age, he accompanied his father in Captain Cook's second voyage, and published, with the assistance of his father, an account of the expedition. After living as professor of Natural History at Cassel and at Wilna, he became librarian to the Elector of Mainz in 1788. Whilst he was on a visit at Paris in 1792, whither he had been sent to request the incorporation of Mainz with the French republic, the Prussians retook Mainz, and Forster lost all his property, including his books and manuscripts. He died at Paris, 12th January 1794. His writings, especially his *Ansichten vom Niederrhein* (1791–94) and his *Beschreibung einer Reise um die Welt* (1784), take a high rank amongst German works descriptive of nature. His Letters were published by his widow in 1829; and a complete edition of his works appeared in 9 vols. in 1843.

Forster, JOHN, an English political and historical writer, was born at Newcastle, 2d April 1812. He was educated for the bar, but early devoted himself to periodical writing. His political articles in the London *Examiner*, for which he commenced writing in 1834, attracted more attention than is usually bestowed on newspaper leaders, owing to their vigour and point, coupled with the love of truth, consistency, and outspoken honesty they displayed. Forster edited the *Foreign Quarterly Review* for some time; then for nearly a year, as Dickens's successor, the *Daily News*, and from 1847 to 1856 the *Examiner*. He was the author of many admirable biographical and historical essays, as the two volumes of *Edinburgh* and *Quarterly* articles reprinted in 1858, and an admirable series dealing with the times and statesmen of the English Commonwealth, under the titles *History of the Grand Remonstrance* (1860); *Arrest of the Five Members* (1860); *Sir John Eliot, a Biography* (1864); and *Lives of the Statesmen of the Commonwealth* (1840). His literary memoirs are *The Life and Times of Oliver Goldsmith* (1848; 2d and improved ed. 1854), accounted one of the best biographies in English literature; *Walter Savage Landor* (2 vols. 1868); *The Life of Charles Dickens* (3 vols. 1871–74); and the first volume of a *Life of Swift* (1875). His life of Dickens was assailed as having exposed with too great frankness the failings of his hero; a more valid objection is that in the method of treatment adopted the biographer is almost as prominent as his subject. Forster's style is clear and forcible. He himself was an indefatigable student and a constant and devoted friend. He was appointed secretary to the Commissioners in Lunacy in 1855, and a Commissioner in Lunacy in 1861. He died 1st February 1876.

Forster, WILLIAM EDWARD, statesman, was born at Bradpole, Dorsetshire, July 11, 1819, the son of an esteemed minister of the Society of Friends, who died while on an anti-slavery mission in Tennessee, in 1854. Educated at the Friends' School at Tottenham, he first contemplated going to the bar, but abandoned this intention for commerce, and accepted an appointment in a woollen manufactory at Bradford. He early took an interest in philanthropic and political questions, and during the terrible Irish famine of 1845 visited the distressed districts as almoner of a relief fund raised by his co-religionists. In 1850 he married Jane, eldest daughter of Dr Arnold of Rugby, and sister of Matthew Arnold. Forster unsuccessfully contested Leeds in the Liberal interest in 1859, but two years later was returned for Bradford. After serving for thirteen months as Under-secretary for the Colonies (1865–66), he became in 1868 Vice-president of the Council on Education, and a privy-councillor. He accepted from Mr Gladstone a seat in the cabinet in 1870, and the same year introduced the greatest legislative measure associated with his name, the Elementary Education Bill (see EDUCATION). His conduct of the bill was marked by great ability, but it led him into strong conflict with the Nonconformist members and the Birmingham League, who objected to the 25th clause, which enabled school boards to pay the fees of indigent children at denominational schools out of the rates. In 1872 Forster introduced the Ballot Bill, which he piloted through the House of Commons with much skill. After the resignation of the Liberal ministry in 1874, he visited the United States. His father's memory was warmly cherished by the abolitionists, and Forster himself, who had always been a staunch supporter of the Union, and an uncompromising enemy to slavery, received an enthusiastic welcome. He had counted among his personal friends Emerson, Adams, and Sumner. On the retirement of Mr Gladstone from the leadership of the Liberal party in January 1875, Forster and Lord Hartington were named for the post, but the former wrote withdrawing from candidature, on the ground that he could not hope to unite the various sections of the party. In the ensuing November he was elected Lord Rector of Aberdeen University.

In the Gladstone administration of 1880 Forster accepted the office of Chief-secretary for Ireland, at that time the most onerous post in the government. He had not coveted the appointment, but assumed it patriotically, in the hope of being able

to grapple with the Irish problem. An agrarian and political agitation was then disturbing a large portion of Ireland. Forster was attacked unceasingly in parliament by the Irish members, and his life was threatened by the 'Invincibles,' who afterwards assassinated his successor, Lord Frederick Cavendish, together with Mr Burke. More than one thousand evictions having taken place in Ireland during the first six months of 1880, Forster carried through the House of Commons the Compensation for Disturbance Bill, intended for the relief of deserving tenants evicted for non-payment of rents which they were unable to discharge. The measure was rejected by the Lords; and this proved a great blow to Forster, who believed that by its aid the government would have been able to cope with the rising influence of Mr Parnell, and with the growing agitation among the Irish peasantry. A land act was passed in 1881, but a coercion act was also necessary for the suppression of agrarian crime; and, when the Land League issued its 'No Rent' manifesto, Forster replied by a proclamation declaring the League illegal. Mr Parnell and several members of his party were arrested. Induced to adopt a change of policy by the continued disturbed condition of Ireland, in April 1882 a majority of the cabinet determined to release the 'suspects,' whereupon Forster and Lord Cowper (the Lord-lieutenant) resigned. Considerable excitement arose over what was known as 'the Kilmainham Treaty,' and Forster was much applauded by the Conservatives for his policy in this matter, and for his attitude on the Irish question generally. Forster subsequently condemned the government for their action in Bechuanaland and also in the Soudan; and he supported the unsuccessful vote of censure upon them, proposed after the death of General Gordon. Forster took a profound interest in the Imperial Federation Scheme, being anxious to strengthen the bonds between Great Britain and her colonies. With regard to Home Rule, he believed that 'a parliament in Dublin would be fraught with danger to both England and Ireland.' At the general election of November 1885 he was again returned for Bradford, in his absence through illness, by a majority of 1543 votes. He died in London, April 5, 1886. In character Forster was loyal, honest, unselfish, and courageous. He was an effective parliamentary speaker, from his straightforwardness and earnestness of conviction, but he had none of the shining gifts of oratory. His undoubted patriotism, his great abilities, and his sturdy independence will give him an honourable place amongst British statesmen. See Life by Wemyss Reid (1888).

Forsyth, Sir Thomas Douglas, an Indian civilian, was born in Liverpool in 1827, entered the Company's service in 1848, and was employed in the administration of the Punjab until 1870, being created C.B. for his services during the mutiny. In 1870 he conducted a mission to Yarkand in eastern Turkestan, and in 1874, having crossed the great ranges that separate Kashgar from India, he concluded a commercial treaty with the emir. The reports of these missions contain much valuable geographical information. On his return Forsyth was made K.C.S.I. and a member of the Legislative Council of India; and in 1875 he succeeded, acting as envoy, in averting a possible war with Burmah. He died 17th December 1886.

Fort Augustus, a village on the Caledonian Canal, at the head of Loch Ness, 33 miles SW. of Inverness. A barrack built here in 1716 to awe the disaffected clans was enlarged in 1730 by General Wade, who named it Fort Augustus, out of compliment to William Augustus, Duke of Cumberland. The rebels captured and dismantled it in 1746, but it was soon restored, and garrisoned down to the Crimean war. In 1857 it was sold to Lord Lovat, whose son nineteen years afterwards presented it to the Benedictines (q.v.); and by them during 1876–82 it was converted into a stately abbey, college, and hospice.

Fort de France (formerly *Fort Royal*), capital of Martinique, in the French West Indies, lies on the west coast, has an excellent harbour, and is defended by several forts. Its pop. of 8000 is principally made up of the military and officials.

Fortescue, Sir John, judge and writer on English law, was born in Somersetshire towards the close of the 14th century, and educated at Exeter College, Oxford. Called to the bar at Lincoln's Inn, he was in 1441 made serjeant-at-law, and in the following year Lord Chief-justice of the Court of King's Bench. In the struggle between the Houses of York and Lancaster he steadily adhered to the latter, and was attainted by the parliament under Edward IV. He accompanied Margaret of Anjou and her young son, Prince Edward, on their flight into Scotland, and is there supposed to have been appointed Lord Chancellor by Henry VI. In 1463 he embarked with the queen and her son for Holland. During his exile he wrote his celebrated work, *De Laudibus Legum Angliæ*, for the instruction of Prince Edward, who was his pupil. But on the final defeat of the Lancastrian party at the battle of Tewkesbury, 1471, where he is said to have been taken prisoner, Fortescue submitted to Edward IV. He died in about the ninetieth year of his age. The *De Laudibus Legum* was not printed until the reign of Henry VIII.; another valuable work by Fortescue is *The Governance of England; otherwise called the Difference between an Absolute and Limited Monarchy*, written in English (1714; new ed. by Plummer: Clarendon Press, 1886). His collected works were printed for private circulation by Lord Clermont in 1869.

Forteviot, the ancient capital of the Picts (q.v.). Its site is about 7 miles SW. of Perth.

Fort Garry. See Winnipeg.

Fort George, a fortress 12 miles NE. of Inverness, on a low sandy projection into the Moray Firth, here only 1 mile broad. Built in 1748 at a cost of £160,000, it covers 12 acres, and can accommodate 2180 men. It is the depôt of the Seaforth Highlanders.

Forth, a river and firth of Scotland. The river is formed by two head-streams, Duchray Water and the Avondhu, which, rising on and not far from Ben Lomond, at altitudes of 3000 and 1900 feet, run 14 and 9 miles to a confluence near Aberfoyle, the Avondhu traversing Lochs Chon and Ard. From their confluence, 80 feet above sea-level, the Forth itself winds 39 miles to Stirling, then 12½ (the 'Links of Forth') to Alloa, the distances in a straight line being only 18½ and 5⅝ miles. It receives the Teith, Allan Water, and Devon, and traverses or divides Stirling, Perth, and Clackmannan shires.

The Firth of Forth extends 51 miles eastward from Alloa to the German Ocean, between Clackmannanshire, Perthshire, and Fife on the north, and Stirlingshire and the Lothians on the south. It has a width of ½ mile at Kincardine, 3 miles above Bo'ness, 1¼ at Queensferry, 5 between Granton and Burntisland, 17 at Prestonpans, and 8¼ at Elie. Its waters, 3 to 37 fathoms deep, encircle the islands of Inchkeith (fortified 1878–81), Inchcolm (with a ruined abbey), Cramond, &c., whilst at the entrance are the Bass Rock (q.v.) and the Isle of May, on which last and on Inchkeith are lighthouses. Rivers falling into it are the Carron, Avon, Almond, Water of Leith, Esk, and Leven.

White fish are plentiful. In 1882–89 a great railway bridge was erected across the firth at Queensferry (see BRIDGE), above which is St Margaret's Hope, one of the safest roadsteads in the kingdom.

Fortification is the art of strengthening a locality by various means against the attack of hostile troops. It has two distinct branches, called Field and Permanent fortification. The former comprises such slight *entrenchments* or *field defences* as can be executed by the troops themselves during the few hours which precede an engagement in the open field, as well as the more deliberate *field-works* requiring days or weeks to construct, which are found to be tactically necessary as the campaign progresses. The latter deals with engineering works of a widely different character, though based on the same principles, constructed in time of peace to secure points of which the importance in time of war can be foreseen. Years may be spent in perfecting them, and durable materials, such as iron and masonry, are largely used in their construction. Fortification includes also the operations connected with SIEGES and military MINES, which are described under those articles.

FIELD FORTIFICATION, while aiming at giving to the defenders of a chosen position all the advantages of cover from the enemy's fire, and obliging him to advance over open ground completely swept by their fire, must also allow of free movement in counter attack of considerable bodies of troops. It follows that such defences are made of slight profile throughout the greater part of the front, so as to be no impediment to the advance, and the introduction of the far-ranging breech-loading rifle has given such power to the defence that this can safely be done if a wide front of fire is maintained. The preparation of a position consists in arranging for defence any buildings which exist on it and are favourably situated, loopholing them and the walls enclosing them, improving the cover given by hedges and ditches along the front, and, where these do not exist, digging shelter trenches 18 inches deep and 5 feet wide for the accommodation of the shooting line, deeper trenches in rear for supports, and gun pits or epaulements for the artillery. Parts of this line would be traced so as to flank the general front, and no cover would be left for the enemy during his advance. Hollows which cannot be seen into from the shooting line would be filled up with brushwood, obtained by clearing away the hedges in the front, and obstacles would be placed so as to confine the enemy to the least favourable lines of advance, or to detain him under fire. Besides *Abattis* (q.v.), the chief obstacles thus used are: *entanglements*, either of brushwood cut half through and woven together with wire run through it, or of several lines of barbed wire attached to stakes about 4 feet high and 6 feet apart; *military pits* or *trous-de-loup*, 2 feet 6 inches deep and staked at the bottom, sometimes also covered with wire entanglement; and, if possible, *inundations*.

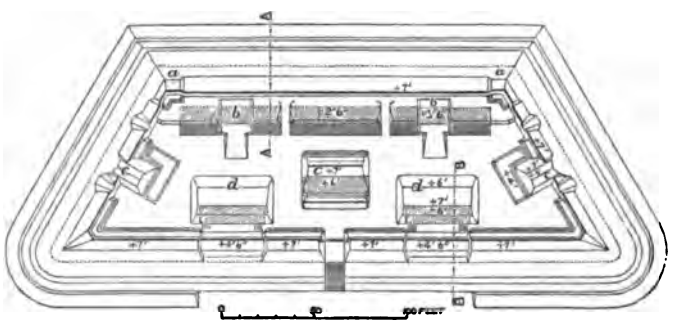


Fig. 1.—Plan of Field Redoubt:

aa, bonnettes; *bb*, barbettes; *cc*, traverses; *dd*, parados. The diagonal shading indicates the position of casemates. NOTE.—In this and in figs. 2, 5, and 6 the reliefs are given in feet relatively to the plane of site (+ above, − below).

The more important points only of such a position would be really fortified by the erection of field redoubts, generally of the type shown in fig. 1, forming strong points in the main line, advanced posts in its front or a second line of works in rear, 500 to 2500 yards apart, and probably each garrisoned by half a battalion with two or four guns. A redoubt of the shape shown in fig. 1 is called a *blunted redan*; a *redan* or *flèche* has two faces only, meeting at an angle of something over 60°, while a *lunette* has five, two faces, two flanks, and a *gorge* or rear face. The faces and flanks of all such works are formed by parapets (Ital. *parapetto*; *parare petto*, 'guard the breast') 12 to 16 feet thick, to resist artillery, while their gorges would simply be closed by a light parapet 3 feet thick, or a *stockade* (wall of bullet-proof timber), unless likely also to be exposed to artillery fire, when they are the same as the other faces. Like the *fosse* and *vallum* in Roman Camps (q.v.), the ditch of a field redoubt forms an obstacle to the assault, and is necessary to provide earth for the parapet, its dimensions depending upon the amount required. Its sides (*escarp* and *counterscarp*) are made as steep as the earth will stand. Sometimes strong palings called *palisades* are planted in the bottom, and similar ones called *fraizes* made to project over the ditch from the counterscarp and from the *berm*, or space often necessarily left to prevent the scarp giving way under the weight of the parapet. These increase the value of the ditch as an impediment to the assault, and a wire entanglement is often placed in it to hinder the assailants from using the cover afforded by it to re-form before rushing over the parapet. The *exterior* (front) *slope* of the parapet is left at the natural slope of the ground to minimise the effect of artillery projectiles upon it. The *superior* (top) *slope* inclines at 1 in 6 to enable the men firing over it to see the ground in front of the ditch without unduly weakening the *crest* or highest point of the parapet. The *interior* (rear) *slope* is revetted with *gabions*, *sandbags*, *sods*, *hurdles*, or other materials, and stands at a slope of ½ or ¼. The men stand on a *banquette* 4 feet 6 inches below the crest, approached by steps or a slope. The height above the ground of the crest of the parapet, called its *command*, would never exceed 12 feet in a field redoubt. Field Casemates (q.v.) of timber are made under the banquettes and under the traverses or *parados* (Italian, 'protect the back') which defend the men on the rear face against fire coming from the front. The guns in the flanks fire through *embrasures*, and are protected from enfilade fire by traverses alongside them. Those on the faces are mounted on gun banks, called *barbettes*, firing over the crest and in several directions. The work is made shallow, so that the flanks may be short and not easily enfiladed. The gorge parapet is lowered in two places in order to lessen the necessary height of the traverses, and it may be flanked by a small redan of earth, or a *tambour* (stockade work) projecting from its centre; the entrance is covered by a few riflemen mounted on one of the traverses. The front faces are flanked by fire from collateral

works, and the ditches sometimes defended by *caponiers* (stockade work roofed with earth) placed in them at the *shoulders* or angles between the faces and flanks. The parapets at the shoulders are raised for a short distance, to give better cover, by an arrangement called a *bonnette*. Such a redoubt would not take more than 18 to 24 hours to complete, and yet would be capable of withstanding the fire of field-guns. The redoubts for which sites were selected in 1889 round London would be of this type, but probably of larger size. They would not be commenced until war was declared or imminent, could then be rapidly completed, and are well adapted to form strong points or pivots in the line of defence taken up by the field army, especially as the enemy would not be likely to have landed any but field-guns. Field redoubts having an all-round defence may be of any shape best suited to the ground, but have never less than three sides. If

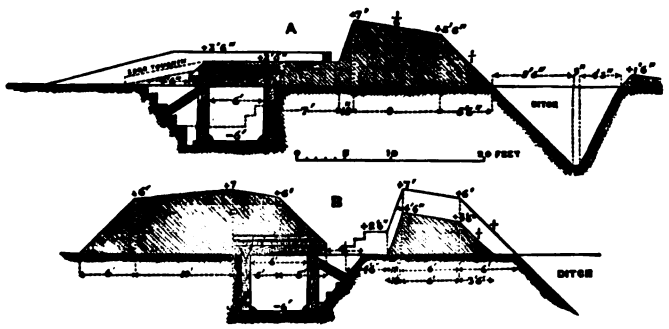


Fig. 2.
A, section through face, AA, fig. 1; B, section through gorge, BB, fig. 1.

square or circular, their fire is much dispersed. The Plevna redoubt, so celebrated in the Russo-Turkish campaign of 1878, was square; but some sort of polygon is more usual. The *Bastion* (q.v.) and *star* traces have been abandoned as too complicated for field fortification. Continuous lines of parapet would sometimes still be used to connect two redoubts, and might be *indented* so as to increase the flank defence, but these require no detailed description. *Blockhouses* (q.v.) would only be used in mountain warfare, where artillery could not be brought to the attack, and where timber was plentiful.

PERMANENT FORTIFICATION, for the protection of cities, harbours, tracts of country, bridges (see BRIDGE-HEAD), roads, &c., dates from the earliest ages. Its aim formerly was to keep out the enemy by passive resistance unaccompanied by counter attacks, except in the form of sorties to destroy his siege-works and batteries. Since 1859, however, the same principle of detached works and free manœuvring ground between them for counter attack which has been applied to field fortification has been adopted for permanent works. This is due to the vast improvements in artillery and small-arms, the former easily destroying the strongest works at long distances, and the latter, on the other hand, increasing the power of armies in the open field. The change has been gradual but progressive. In Greek history we read of cities surrounded with walls of brick, stone, and rubble. Babylon had a wall of prodigious circuit—100 feet high, 32 feet thick, and surmounted by towers. Jerusalem, at the time of Vespasian's siege, had similar walls, with masonry of enormous solidity. But the square and round towers, which had formed sufficient flanking defence against arrows, and the walls which had resisted battering-rams, were soon found to be useless against artillery, and other devices had to be resorted to.

Bastion System.—Early in the 15th century the Italians commenced to flank their walls with small bastions. Those at Verona, built by Micheli in 1523, are usually looked upon as the oldest extant. Tartaglia and Albert Dürer, painter and engineer, Marchi, an Italian, who died 1599, Errard Bois-le-Duc and De Ville, under Henry IV. and Louis XIII. of France, and the Count de Pagan, whose treatise appeared in 1645, did much towards laying the foundation of that science which Vauban subsequently brought almost to perfection. Born in 1633, this great engineer was equally distinguished in peace and in war. After having taught how

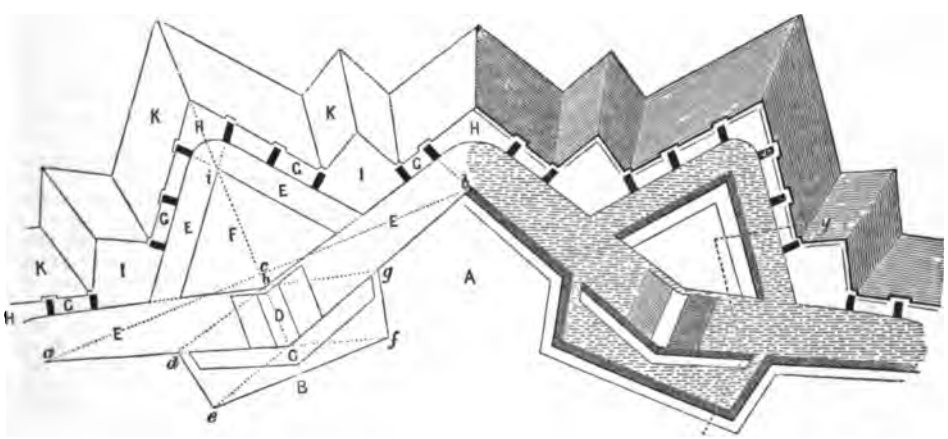


Fig. 3.—Vauban's First System (ground-plan):
A, bastion; B, curtain; C, tenaille; D, caponier; E, ditch; F, ravelin; G, covered way; H, salient place of arms; I, re-entering place of arms; K, glacis.

fortresses could be rendered almost impregnable, he was led by the restless ambition of his master, Louis XIV., to demonstrate that the reduction of any work was a mere question of time and powder, so that even he himself could not construct a rampart that should withstand the fire brought

against it by his system of attack. He constructed thirty-three new fortresses, improved above one hundred, and conducted personally more than fifty sieges. Coehoorn, director-general of the fortresses of the United Provinces, was the contemporary, rival, and opponent of Vauban; his masterpiece was Bergen-op-Zoom. Cormontaigne, Belidor, Bousmard, and Carnot may also be mentioned as conspicuous followers of Vauban's principal theories. Their works all begin by surrounding the place with a continuous polygon, on each side of which a bastion front, covered by outworks, is constructed.

Fig. 3 shows *Vauban's first system* in plan; fig. 4 in profile. All the others, and the so-called modern French system, are merely elaborations of it.

The *enceinte*, or main body of the place, is traced as follows, if the polygon taken is an octagon. The *exterior side*, about 380 yards long, *ab* (fig. 3), is bisected in *c* by the perpendicular cC, which is made one-sixth of *ab*; aC, *b*C are joined and produced, and the faces of the bastions *ad*, *bg*, each equal to two-sevenths *ab*, are measured along them. Next, from *a* and *b* as centres, with radius *ag*, arcs are described cutting *a*C, *b*C, produced in *f* and *e*; *de*, *fg* form the flanks of bastions, and *ef* the curtain. The rampart is formed from the earth excavated from the ditch, and the parapet built on it. Fire from the

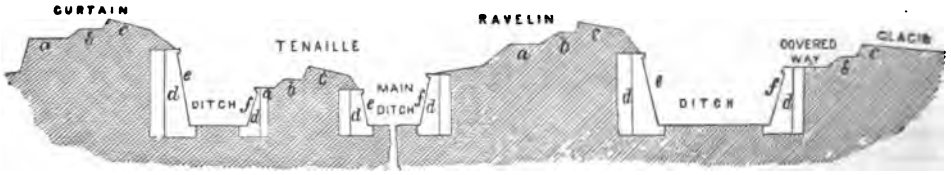


Fig. 4.—Vauban's First System (profile):
a, rampart; *b*, banquettes; *c*, parapet; *d*, revetment; *e*, escarp; *f*, counterscarp.

faces of the bastions and curtain covers the entire front, while that from the flanks sweeps along the faces of adjoining bastions and the curtain. The fire upon the salient angle of each bastion is, however, very oblique, and, as this is the most favourable line of advance for the besieger, it is further flanked by a ravelin (F), sometimes called a *redan* or *demi-lune*, which forms an outwork on the far side of the main ditch. This ditch, if dry, is 30 yards wide, and, if wet, 36 yards at the angles of the bastion, and its counterscarp is thence directed upon the opposite shoulders, *d* and *g*.

The capital, *hi*, of the ravelin is set off 100 yards along the perpendicular, and its faces traced from *i* to points situated in the faces of the bastions, 10 yards from the shoulders, so as to protect them from guns firing along the ditch of the ravelin, which is 20 yards wide, with counterscarp parallel to the escarp. The covered way, G, 10 yards wide, is covered by the *glacis*, K, 8 or 10 feet high, and sloping gradually towards the country. Traverses in it prevent its being enfiladed. The *tenaille*, C, is a low parapet sweeping the interior of the ravelin and the ditch; it also protects the scarp revetments of the bastions and curtain.

The *caponier*, D, forming a communication between the tenaille and the ravelin, consists of a passage between two low parapets, each with a glacis sloping towards the ditch, which is swept by their fire. At the re-entering angles of the covered way *places of arms*, I, are formed by setting off 30 yards along each counterscarp for the gorge, and making the faces enclose a salient angle of 100°. These, and the *salient place of arms*, H, are convenient for preparing sorties.

Vauban's second and third systems adapted old walls to his improvements. He placed counterguards in front of the existing corner-towers, thereby making hollow bastions, and avoiding the necessity of entirely rebuilding, and added a redoubt to the ravelin.

Coehoorn's system had counterguards in front of the bastions and parallel to them. The angle of his ravelin was always 70°, and his flanks were protected by curved shoulders called *orillons*.

Cormontaigne widened the gorge of his ravelin, thereby reducing the length of the bastion face exposed to breaching. He also revived the step-like formation of the covered way, originally seen in the system of the great German engineer, Speckle (died 1589), which gives defenders a continued line of fire from each traverse along the covered way; and he placed redoubts in the re-entering places of arms.

The modern French system differs but little from that of Cormontaigne. The re-entering places of arms have circular fronts instead of angular; the angle of the ravelin is 60°, has traverses in its ditch, and ditches called *coupures* are cut through its faces so that it need not be entirely surrendered when the salient is captured. Many additions were made as new fortresses were built, such as *Horn-works* and *Crown-works* (q.v.) in advance of the ravelins, *fausses brayes* or lower parapets outside the bastions, and *cavaliers* or elevated retrenchments inside them. As the increased power of artillery made itself felt, various methods of covering the masonry of the scarp were devised; these were called *counterguards*, *couvre faces*, or *envelopes*, and did for the faces of the bastions what the tenaille does for the curtain.

The *tenaille* or star trace consists of alternate salient and re-entering angles, the latter being not less than 90°. Ravelins and other outworks are added as in the bastion trace. It was chiefly used by Montalembert (1714–1800), but has many defects—e.g. the salients are easily enfiladed; the interior space is confined; the defence of the main ditch from the ramparts is very imperfect; and if casemates are used at the re-entering angles to remedy this defect, they can be destroyed by the enemy's fire passing along the ditch.

The Polygonal System.—Early in the 19th century the German engineers had recognised that the 'polygonal system' of fortification invented by Montalembert was better adapted to the increased range and accuracy of artillery fire. This system placed the parapets of the enceinte along the sides of the polygon, sometimes broken slightly outwards or inwards, and always flanked by strong casemated caponiers projecting from their centres. These caponiers mount thirty to forty guns in two or three tiers, firing through *masks* or *tunnels* in many cases, and are themselves protected by counterguards and ravelins, besides being flanked from batteries in rear. Fig. 5, a half-front of the Antwerp enceinte (1859), as fortified by General Brialmont of the Belgian Engineers, is perhaps the best example of this system. Besides simplicity, each front has greater length (1200 yards as against 400), better bombproof cover, communications, retrenchments, and flank defence. It is more easily adapted to the site. Its ravelins are wider, but

support one another less, and it is more vulnerable to attack by mining.

But the fortifications of Antwerp also illustrate

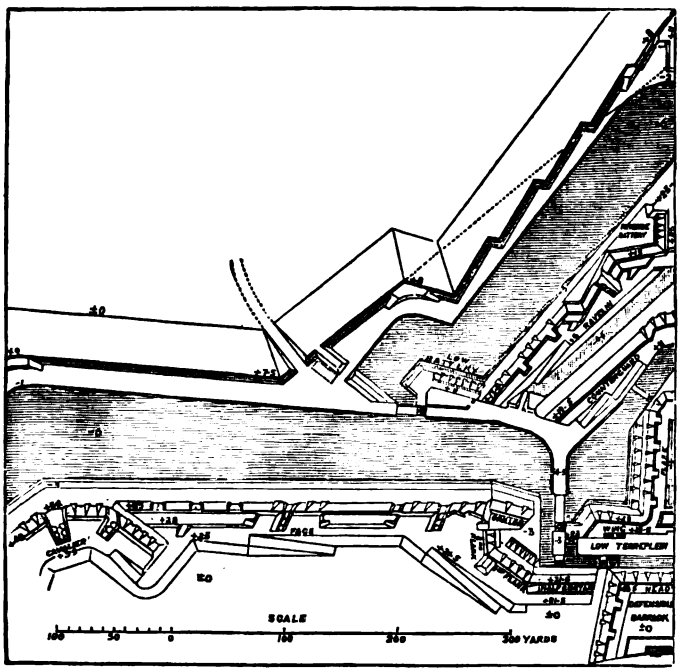


Fig. 5.—Half-front of the Enceinte of Antwerp.

another change in this science, by which advanced works close to the enceinte were replaced by a chain of detached forts 3 to 5 miles from it. The value of a chain of redoubts was proved at Pultowa, Fontenoy, Torres Vedras, and Dresden. D'Arcon first, and Rogniat after him in 1816, both of the French Engineers, strongly advocated the 'camp-fortress,' as it is called by the Austrians, and it soon became the only recognised system of fortification. It has been applied to Portsmouth, Plymouth, Paris, the Rhine fortresses, throughout the Franco-German frontier, and wherever modern defences have become necessary.

At Antwerp the forts are about 1½ mile apart, and 2 to 3 miles in front of the enceinte. Each has 700 yards of front, 120 guns, 15 mortars, and a garrison of 1000 men. They are blunted redans like fig. 1, flanked in front by strong caponiers mounting 14 guns, and in rear by a casemated keep and earthen redan. If attacked, supporting batteries would be thrown up between them, and before the enceinte could be reached at least two must be captured, an operation which would be extremely difficult in face of the army that would be collected within the area (some 200 sq. m.) enclosed by the chain of forts. Connection between them is maintained by a circular railway.

Since the war of 1870-71 the whole of France has been converted into a 'camp-fortress.' Paris has a triple line of works extending over a perimeter of some 90 miles. Outside this are the entrenched camps of Epinal, Belfort, Langres, Besançon, La Fère, Rheims, Verdun, Toul, the plateau of Haye, Nancy, Dijon, and Lyons, while farther to the front the chain of *forts d'arrêt* along the eastern frontier bars every road or railway.

Fig. 6 shows a detached fort, with the interior battery adopted in the British type. The heavy guns are placed in this battery, and are protected by the outer parapet, which is made a little higher and intended for rifles and field-guns repelling an assault only; but a few heavy guns in Moncrieff Pits (q.v.) may be placed at its angles. This device is another tribute to the power of the attacking artillery. Masonry can no longer be exposed to its fire, and even iron shields and cupolas are not satisfactory. Iron turrets are too expensive for general use, but are applied to confined spaces and in coast defences—e.g. on the Admiralty Pier at Dover.

The conditions to be considered in the fortification of a dockyard or seaport differ from those applicable to the case of an inland town, inasmuch as the very heaviest guns can be brought against it by the hostile ships, and it can be now bombarded with effect at immense distances (8000 to 10,000 yards). The first line of fixed defence would consist of submarine mines laid chequerwise in the channels of approach. To prevent the enemy's boats removing these or destroying them by countermines, shore batteries must be thrown up able to resist the attacks of a landing party, and armed with quick-firing (see CANNON) and Machine Guns (q.v.), while guard-boats similarly armed constantly patrol the neighbourhood. Position-finding stations must be selected, and electric lights provided, as well as swift steamers to scout in front, and torpedo boats to make counter-attacks supported by any available war-ships. For the inner defence the heaviest available guns should

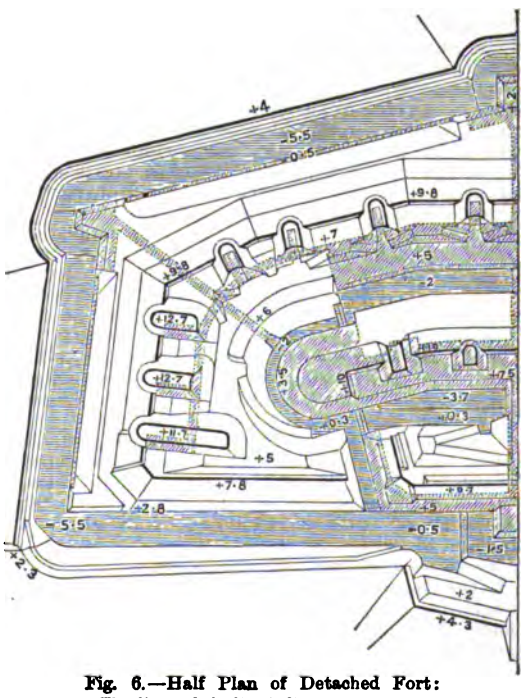


Fig. 6.—Half Plan of Detached Fort:
The diagonal shading indicates casemates.

be mounted on hydro-pneumatic disappearing carriages, or in wrought-iron turrets supported by

howitzers and mortars. The fortifications would consist on the sea front of these batteries, and on the land front of detached forts similar to those already described.

An estimate prepared in 1886 by Colonel Schaw, R.E., for an 'ideal defence of the entrance to Plymouth harbour,' amounts to £833,000, and includes four 68-ton guns, two in a turret; eighteen 10-inch and eighteen 6-inch guns; twenty heavy howitzers; four Brennan torpedoes; three Nordenfeldt submarine boats; submarine mines; electric lights; and a flotilla for laying and guarding the mines. The new fortifications of Antwerp are believed to have cost £3,000,000; the German alterations on Strasburg and Metz cost £4,000,000; several of the new eastern French fortresses cost each about £3,000,000. In peace Metz has a garrison of 10,000 men; Strasburg about 9000.

See works by General Brialmont (Brussels, 1869); Captain Wagner (Berlin, 1872); Captain Brunner (3d ed. Vienna, 1880); Captain Phillips, R.E.; Major Sydenham Clarke (1891); and the *Textbook of Military Engineering* used at Woolwich.

Fortiguerra, NICCOLO, an Italian poet, was born at Pistoia in 1674. He proceeded to Rome at an early period, and was speedily raised to the dignity of bishop and papal chamberlain by Clement XI. The greater part of his attention was given to letters; but he is now remembered only as the author of a satirical epic entitled *Il Ricciardetto* (1738), which is praised by his countrymen for its natural humour, grace of style, and elegance of versification. The best edition is one published at Milan in 3 vols. in 1813. Fortiguerra died at Rome, 17th February 1735.

Fort Madison, capital of Lee county, Iowa, on the Mississippi River, 19 miles SW. of Burlington by rail, with a state prison, and manufactures of chairs, farming implements, and boots. Pop. (1890) 7901.

Fortrose, a watering-place of Ross-shire, on the inner Moray Firth, 10 miles NNE. of Inverness. It is one of the Inverness burghs; and its two portions, Chanonry and Rosemarkie, were constituted a royal burgh in 1590. The seat of a Columban monastery in the 6th century, of the bishopric of Ross from 1124, it retains the south aisle and chapter-house of a fine cathedral, demolished by Cromwell to furnish materials for his fort at Inverness. There are capital links, good bathing, and a new steamboat pier. Pop. (1851) 1148; (1891) 980.

Fort Royal. See FORT DE FRANCE.

Fort Scott, capital of Bourbon county, Kansas, on the Marmiton River, 98 miles S. of Kansas City. A railway junction, it has foundries, machine-shops, flouring and woollen mills, and an extensive trade in bituminous coal. Pop. (1880) 5372; (1890) 11,946.

Fort St David, a ruined fortress on the coast of Madras presidency, 100 miles S. of Madras, on the outskirts of Cuddalore. It became British in 1690, along with all the land round about to the distance of a 'randome shott,' and was an important place during the struggle with the French, forming the chief of the English settlements on the Coromandel coast from 1746 to 1752. It is of interest also from associations with Clive (q.v.), who became governor in 1756.

Fort St George. See MADRAS.

Fort Sumter. See SUMTER.

Fortuna, called by the Greeks *Tychē*, was in classical mythology the goddess of Chance. According to Hesiod, she was a daughter of Oceanus; according to Pindar, a sister of the Parcæ. She differed from Destiny or Fate in so far that she worked without law, giving or taking away at her own good pleasure, and dispensing joy or sorrow indifferently. She had temples at Smyrna, Corinth, and Elis. In Italy she was extensively worshipped from a very early period, and had many titles, such as *Patricia, Plebeia, Equestris, Virilis, Primigenia, Publica, Privata, Muliebris, Virginensis*, &c., indicating the extent and also the minuteness of her superintendence. Particular honours were paid to her at Antium and Præneste; in the temple of the former city two statues of her were even consulted as oracles. Greek poets and sculptors generally represented her with a rudder, as a symbol of her guiding power; or with a ball, or wheel, or wings, as a symbol of her mutability. The Romans proudly affirmed that when she entered their city she threw away her globe, and put off her wings and shoes, to indicate that she meant to dwell with them for ever. See Dreschler's exhaustive article in part ix. (1886) of Roscher's *Lexicon der Mythologie.*

Fortunate Islands. See CANARY ISLANDS.

Fortunatus is the title of one of the best people's books (*Volksbücher*) ever written. It originated about the end of the 15th century, though many of the tales and legends included in it are of much older date. The opinion that it was worked up into German from a Spanish or English original may safely be set aside. The substance of the book is that Fortunatus and his sons after him are the possessors of an inexhaustible purse of gold and a wishing-cap, which however, in the end, prove the cause of their ruin. The moral is that worldly prosperity alone is insufficient to produce lasting happiness. The oldest printed edition of the book now extant bears the date 1509. Later German editions mostly bear the title, *Fortunatus, von seinem Seckel und Wunsch-hütlein.* It has been reprinted in the third volume (1846) of Simrock's *Deutsche Volksbücher.* Versions of the story have appeared in French, Italian, Dutch, Danish, Swedish, and even Icelandic. The first to dramatise the subject was Hans Sachs, in *Der Fortunatus mit dem Wunschseckel* (1553), after whom comes the English Thomas Dekker, with his *Pleasant Comedie of Old Fortunatus* (1600), a work which had the honour to make its reappearance in German about the year 1620. The most poetical edition of the story is that given by Tieck in his *Phantasus.* See Schmidt, in Ersch and Gruber's *Encyklopädie* (sect. 1, vol. xlvi.).

Fortune, ROBERT, a botanist and traveller in China, was born in the county of Berwick in 1813. After serving an apprenticeship as a gardener, he obtained employment in the Royal Botanic Garden at Edinburgh, and afterwards in the gardens at Chiswick. His real life-work began, however, in 1843, with the first of his journeys to China, on behalf of the Botanical Society of London. The results of this journey, the fruits of his observation of the flora of the country, its tea and cotton culture, appeared in 1847 in *Three Years' Wanderings in Northern China.* He subsequently visited China on three separate occasions, to study the methods of tea-cultivation, to carry plants from that country to India, and to collect seeds and plants for the government of the United States. *Yedo and Peking* (1863) was written after his fifth and last journey to the East. His other two books are *A Journey to the Tea Countries of China* (1852), and *A Residence among the Chinese* (1857). Fortune was for a few years director of the Botanical Gardens at Chelsea. He died 16th April 1880.

Fortune-telling. See PALMISTRY, and see Turner's *History of Vagrants and Vagrancy.*

Fortuny y Carbo, MARIANO, an eminent Spanish painter, was born at Reus in Tarragona, in 1839, and studied in the Academy of Barcelona and in Italy. When Spain declared war against the sultan of Morocco, Fortuny followed the army

to Africa, and filled his portfolios with studies of Eastern life. He received a commission for his 'Battle of Tetuan,' which now hangs in the Chamber of Deputies, Barcelona; but the subject was little to his taste; and, disputes having arisen, this large work was never quite completed. It was the domestic and ceremonial aspects of Eastern life that Fortuny chose to portray, and these mainly for their purely artistic possibilities; the painter treating his subjects simply as colour-schemes made up of dusky countenances, and gorgeous draperies, and vivid sunlight. His touch was particularly incisive and dexterous, and the effects he aimed at were those depending on the sparkle and brilliancy of points of potent, infinitely varied colour. He afterwards stayed much in Paris, Granada, and in Madrid, where he studied the great Spanish masters, and married the daughter of Madrazo, the director of the Academy. The preliminaries of his own wedding suggested to the painter his celebrated picture of 'The Spanish Marriage,' and among other of his later works are his 'Book-lover in the Library of Richelieu' and 'Academicians choosing a Model.' He also left some etchings of Eastern subjects. He died at Rome, 21st November 1874. See monographs by Davillier (illus. Paris, 1875) and Yriarte (Paris, 1885).

Fort Wayne, capital of Allen county, Indiana, at the confluence of the St Joseph and St Mary's rivers, which form the Maumee, and on the Wabash and Erie Canal, 148 miles ESE. of Chicago. It is an important railway centre, and has several railway workshops, foundries, and manufactures of organs, woollens, and engines. It is the seat of a Catholic bishop, and contains a Catholic hospital, convent, and academies, besides Methodist (1846) and Lutheran (1850) colleges. Pop. (1870) 17,718; (1880) 26,880; (1890) 35,393.

Fort William, a police-burgh of Inverness-shire, near the head of salt-water Loch Linnhe, the west base of Ben Nevis, and the south end of the Caledonian Canal, 66 miles SSW. of Inverness. A fort, built here by Monk in 1655, and rebuilt in 1690, was vainly besieged by the Jacobites in 1746, and about 1860 was dismantled. Fort William, long one of the keys of the Highlands, is now a great centre for tourists. Its four churches are all modern, built between 1868 and 1889. Here was erected in 1889 a meteorological observatory near sea-level, in connection with the high-level station on the summit of Ben Nevis. The fort made way in 1890 for the railway station of a line from Glasgow. Pop. (1841) 1026; (1881) 1594; (1891) 1856.

Fort William (INDIA). See CALCUTTA.

Fort Worth, capital of Tarrant county, Texas, on the west fork of the Trinity River, 33 miles W. of Dallas by rail, with several mills, and a trade in cotton. Pop. (1880) 6663; (1890) 23,076.

Forty. This number seems to have been, time out of mind, regarded with superstitious veneration alike by Jews and Moslems, since it prominently figures in the Bible and in Mohammedan writings. To cite some interesting examples from the notes to Mr W. A. Clouston's *Group of Eastern Romances and Stories* (privately printed, 1889): The Flood continued 40 days (Gen. vii. 17); Isaac was 40 years old when he took Rebekah to wife (Gen. xxv. 20), and Esau was of the same age when he wedded the two Hittite damsels (Gen. xxvi. 34); Joseph and his kinsmen fasted 40 days for their father Jacob (Gen. l. 3); thrice Moses fasted 40 days (Exod. xxiv. 18, xxxiv. 28; and Deut. ix. 9–25); during 40 days the Hebrew spies searched Canaan (Numb. xiii. 25); the Israelites were condemned to wander in the wilderness 40 years (Numb. xiv. 33); Eli judged Israel 40 years (1 Sam. iv. 18); Goliath defied the Hebrew army 40 days (1 Sam. xvii. 16); David and Solomon each reigned 40 years (2 Sam. v. 4; 1 Kings, ii. 11, xi. 42); Elijah fasted 40 days (1 Kings, xix. 8); Nineveh was to be destroyed after 40 days (Jonah, iii. 4); Ezekiel bore the iniquities of the house of Judah 40 days, a day for a year (Ezek. iv. 6); Christ was tempted by Satan in the wilderness after having fasted 40 days (Matt. iv. 2, and Mark, i. 13), and continued 40 days on earth after his resurrection (Acts, i. 3). For further biblical instances, see Exod. xxvi. 19; Josh. xiv. 7; Judges, iii. 11, viii. 28, xiii. 1; 2 Sam. xv. 7; 1 Kings, vi. 17, vii. 38; 2 Kings, viii. 9; Ezek. xxix. 11, 12; Acts, xxiii. 21; 2 Cor. xi. 24.

Moslems mourn 40 days for their dead, and they deem a woman ceremoniously unclean during 40 days after childbirth; among the Israelites the period was 40 days when she had given birth to a male child, and twice 40 in the case of a female child. In Moslem fictions the number 40 very frequently occurs; for instance, in the well-known Arabian 'Tale of the Third Calender,' his voyage is prosperous for 40 days; he is entertained by 40 fairy damsels who absented themselves for 40 days. In the ever-fresh tale of 'Aladdin and his Lamp,' when the magic palace has disappeared the sultan allows him 40 days to find it and the fair princess. In the Persian romance of *Nâsir*, the hero is directed by the 'last will' of a pious hermit, whom he found dead in his cell, to spend 40 days in prayer for the restoration of the fairies' fountain; he shoots an arrow through a suspended finger-ring 40 times in succession; but his too expert archery caused an accident to the king, from which his majesty did not recover until he had been 40 days under medical treatment. In a subordinate story in the same romance poor Shah Mansur was in the power of a cruel sorceress for nearly 40 days: and in another interwoven story a young prince was tossed about in the sea in a boat for 40 days. The general number of a gang of robbers in Eastern tales is 40: we have a very familiar instance of this in the Arabian tale of 'Ali Baba and the Forty Thieves,' and another example is afforded us in the story of 'Ahmed the Cobbler' (Malcolm's *Sketches of Persia*), where the king's treasury is plundered by 40 robbers.

In Wales 40 loaves of bread and 40 dishes of butter are a common quantity in the records of rent paid to the Bishop of Llandaff. The fee of a bard for his song was 40 pence when he was a disciple, and twice forty for a master. The unthrifty 'Heir of Linne,' according to the fine old ballad, tried to borrow 40 pence of John o' the Scales, who had become the owner of his lands. A ship suspected of being infected with cholera, yellow fever, &c., is placed under *quarantine*—prohibited from landing passengers and discharging cargo for 40 days.

Forty-shilling Freeholder. See article PARLIAMENT, Vol. VII., page 775, section *Electors*.

Forum, the name applied by the Romans to a public space, especially the market-place in a city, as the principal place of meeting where public affairs were discussed, courts of justice held, and money transactions carried on. In Rome the name applied particularly to the famous *forum* or *forum magnum*, the low level space extending from the foot of the Capitoline Hill to the north-east part of the Palatine. Unlike the *fora* of the emperors this was a slow growth, and was only possible after the valley had been drained by the great *cloacæ*. The central space was the meeting-place of the plebs, *Comitia Tributa;* while the patricians, *Comitia Centuriata*, met on the Comitium, adjoining the Forum. See ROME.

Forum Competens, in Law, is the court to the jurisdiction of which the party is amenable.

Fos'cari, FRANCESCO, Doge of Venice during the most flourishing period of the Venetian power. Born about 1370, and elected doge in 1423, his ambition speedily involved the state in a conflict with Milan, which, however, in consequence of the doge's great military ability resulted in the aggrandisement of Venice by the Treaty of Ferrara (1433). The last years of the doge were embittered by the misfortunes that overtook his son, Giacopo, who was, by authority of the Council, three times tortured in his father's presence and banished, on the first two occasions on false charges, on the third occasion for having besought foreign intercession against the injustice to which he was being subjected. Giacopo died in Candia shortly after his last cruel torturing and banishment. The old doge was allowed to resign office in 1457, and died seven days later, on 1st November. Byron made the tragic history of father and son the subject of *The Two Foscari*.

Fos'colo, UGO, originally NICCOLO, an Italian author, was born in Zante, one of the Ionian isles, on 26th January 1778. His education was begun at Spalato, and completed at Padua, where Cesarotti inspired him with his first love for literature. A man of passionate temperament, and withal an ardent patriot, Foscolo was bitterly disappointed when by the Treaty of Campo Formio Venice was given to Austria, and his disappointment found vent in the *Lettere di Jacopo Ortis* (1802), a sort of political Werther. Still, believing that France was destined to liberate Italy, he served in the French armies, and was present at the battle of the Trebbia and the siege of Genoa. But, becoming finally undeceived as to Napoleon's intentions with regard to his native land, he returned to Milan, where he published in 1807 his best poem, *I Sepolcri*, a work composed in the spirit of the ancient classic writers, and remarkable for its smooth and polished versification. About this time he wrote a translation of Sterne's *Sentimental Journey*, and two tragedies, *Ajace* and *Ricciarda*, both showing political tendencies. In 1809 he was appointed to the chair of Eloquence in Pavia, and occupied the post until the professorship was suppressed in all the colleges of Italy. His inaugural address, *Dell' Origine e dell' Ufficio della Letteratura*, although full of the same love of classic beauty which marks the *Sepolcri*, is turgid and affected in style, like the man himself. When in 1814 the Austrians entered Milan, Foscolo withdrew to Switzerland, and in 1816 he went on to London. There some of his best writings were published—viz. *Essays on Petrarca*, *Discorso sul testo del Decamerone*, *Discorso sul testo di Dante*, and various papers in the *Quarterly* and *Edinburgh Reviews*. His last years were embittered by poverty and neglect. He died October 10, 1827, of dropsy, near London. His remains were finally deposited in the church of Santa Croce, Florence, in 1871. His works and letters were published at Florence in 12 vols. by Le Monnier (1850–62). See Lives by Pecchio (1836), Carrer (1842), Artusi (1878), Antona Traversi (1884), and De Winckels (2 vols. 1885–86).

Foss, or FOSSE (Lat. *fossa*, from *fodio*, 'I dig'), in Fortification, is a ditch or moat, either with or without water, the excavation of which has contributed material for the walls of the fort it is designed to protect. The foss is immediately without the wall, and offers a serious obstacle to escalading the defences. See FORTIFICATION.

Fossa et Furca. See PIT AND GALLOWS.

Fossano, a town of Piedmont, North Italy, picturesquely situated on a hill over the Stura, 15 miles NE. of Cuneo by rail, with a cathedral, a 14th-century castle, and remains of the old town walls. Its streets have an antique and gloomy appearance, the houses being built over low arcades, under which run the footways. It has an academy of sciences, a seminary, technical and veterinary schools, and manufactures of silk, leather, and hemp. Pop. 7959. See BORGOGNONE.

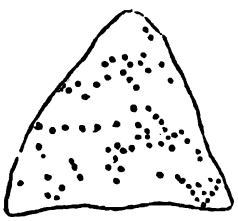
Fossil (Lat. *fossilis*, 'dug out of the earth'), a term formerly applied, in accordance with its derivation, to whatever was dug out of the earth, whether mineral or organic. The term is now restricted to remains and relics of plants and animals which have become embedded by natural causes. These fossils may consist of the harder and more durable parts of animals and plants, or they may be merely the casts or impressions of such remains, or the footmarks or tracks which animals may have left behind them on some soft surface which has been subsequently covered up and consolidated. They occur in nearly all the stratified aqueous rocks, which have on this account been called Fossiliferous strata. It is difficult or impossible to detect them in metamorphic aqueous rocks, for the changes that altered the matrix have also affected the organisms, so as either almost or altogether to obliterate them. In the archæan schists they have escaped notice, if ever they existed; but recently they have been detected in schistose rocks of Silurian age in southern Norway.

The conditions in which fossils occur are very various. In some Pleistocene beds the organic remains are but slightly altered, and are spoken of as sub-fossil. In this state are the shells in some raised sea-beaches, and the remains of the huge struthious birds of New Zealand, which still retain a large portion of the animal basis. In the progress of fossilisation every trace of animal substance disappears; and if we find the body at this stage, without being affected by any other change, it is fragile and friable, like some of the shells in the London clay. Most frequently, however, a petrifying infiltration occupies the cavities left in the fossil by the disappearance of the animal matter, and it then becomes hardened and solidified; hence fossils were formerly, and still often are, called *petrifactions*. Sometimes the whole organism is dissolved and carried off by water percolating the rock, thus leaving a cavity which may be filled up with calcite, pyrite, gypsum, flint, chalcedony, or some other mineral; and we thus obtain the form of the organism, with the markings of the outer surface, but not exhibiting the internal structure. Not infrequently, as in the case of shells of molluscs, &c., after the soft parts of the organism have been removed and replaced by inorganic matter (either before or after burial), the shell itself may be dissolved out so as to leave a cavity which shows the mould of the outer surface of the shell, and a cast of the interior. If the shell-space is not subsequently filled up by introduced mineral matter, the internal cast lies loose in the cavity like the kernel of a nut. Most commonly, however, the shell itself is replaced by hydrated mineral matter. The most advanced and perfect condition of fossilisation is that in which not only the external form, but also the most minute and complicated internal organisation, is retained; in which the organism loses the whole of its constituents, particle by particle, and as each molecule is removed its place is taken by a molecule of another substance, as silica or pyrites. In this way we find calcareous corals perfectly preserved in flint, and trees exhibiting in their silicified or calcified stems all the details of their microscopic structure—the cells, spiral vessels, or disc-bearing tissue, as well as the medullary rays and rings of growth.

FOSSIL FERNS. As far as has been yet determined from the rocky tablets of the earth's crust, ferns first appeared in the Devonian period, and these comprised both herbaceous and arborescent species.

In the immediately succeeding Coal-period they appear to have reached their maximum development. The dense forests and the moist atmosphere of this period were so suited to their growth that they formed a large bulk of the vegetation. Several hundred species have been described, some of them tree-ferns of a size fitting them to be the companions of the immense Sigillarias and Lepidodendrons whose remains are found associated with theirs in the Carboniferous rocks. In the Permian rocks comparatively few ferns have been met with, but these rocks are as a whole not rich in organic remains. Numerous new forms appear in the Trias, and their number is increased in the Jurassic. The Cretaceous strata being chiefly of marine origin, land-plants are not abundantly met with. But the evidence supplied by the Wealden beds of England and strata on the same geological horizon in Germany shows that ferns were at that time prominent forms in the vegetable life of the globe. In the Tertiary strata ferns are rather rare.

FOSSIL FORESTS have been frequently observed in the Coal-measures. The seams of coal having in general been formed from the vegetation of the locality where they occur, it is to be expected that when the coal is removed the stools and roots of the trees will be observed in the immediately subjacent bed of clay or shale—the ancient soil. Such a forest was laid bare in an open work at Parkfield Colliery, near Wolverhampton, in 1844. In the space of about one-fourth of an acre the stumps of 73 trees, with their roots attached, appeared as shown in the annexed ground-plan. The trunks, broken off close to the root, were lying prostrate in every direction, often crossing each other. One of them measured 15, another 30 feet in length, but they were generally shorter. They were invariably converted into coal, and flattened to the thickness of 1 or 2 inches. The upright stems show that some of them had a circumference of more than 8 feet. A fossil forest was uncovered near Glasgow in 1887. Similar fossil forests have been observed in the coalfields of Nova Scotia, and have been carefully described by Lyell, Logan, and Dawson. The usual height of the trees observed by Lyell was from 6 to 8 feet; but one tree was about 25 feet high, and 4 feet in diameter. Brongniart describes the remains of a fossil forest preserved in an upright position, in strata of micaceous sandstone, belonging to the Coal-measures at St Etienne, near Lyons. Though most abundant in strata of the Carboniferous period, fossil forests have been observed in other formations. The Dirt-bed (q.v.) of the Lower Purbeck series is the remains of an ancient forest. Instances are also abundant in strata of later age.



Ground-plan of the Fossil Forest at Parkfield Colliery.

The remains of ancient forests belonging to a geologically recent period are to be found in and underneath beds of peat. There is good evidence that some kinds of peat had their origin in the destruction of forests. Trunks and branches of oak, hazel, fir, &c. are found in them, and the roots of the trees may be traced in the underclay. Round the coasts of the British Islands and the opposite shores of the Continent remains of ancient forests are frequently to be seen at low-water, the stools of the trees evidently occupying the place of growth. The occurrence of these so-called 'submerged forests' shows that within recent times there has been a loss of land in north-western Europe. See GEOLOGY, PALÆONTOLOGY, PLEISTOCENE SYSTEM, &c. The discussion of fossil footprints, the tracks of animals or other moving things, on mud or sand now indurated into rock, is sometimes called Ichnology.

Fossombrone, a town in the Italian province of Urbino-Pesaro, on the Metauro, which is here spanned by a fine modern bridge, 10 miles E. of Urbino, with a cathedral, mineral spring, and manufactures of silk. Here stood the ancient *Forum Sempronii*, of which interesting remains have been found. Pop. 4266.

Foster, BIRKET, artist, was born at North Shields, of Quaker parentage, 4th February 1825, but from his sixth year was brought up in London. He could draw before he could speak, and, as pupil to Landells, the wood-engraver, from 1841 to 1846, he produced a large number of subjects for wood-engravings, the earliest for Mr and Mrs S. C. Hall's *Ireland* (1843), and many for the *Illustrated London News*. Afterwards, in conjunction with John Gilbert, he illustrated *Evangeline* and many of the poets, his share being dainty poetic landscapes and rustic scenes, nowhere better exemplified than in his *Pictures of English Landscape* (1862). Between them the two did more than any others to educate popular taste. In 1859 Foster exhibited the first of many water-colours, and in 1860 was elected an associate, in 1861 a member of the Water-colour Society. See E. Walford's *Representative Men in Literature and Art* (1867).

Foster, JOHN, 'the essayist,' was born in the parish of Halifax, Yorkshire, 17th September 1770. Elder son of a yeoman-weaver, he was trained for the ministry at Brierly Hall and the Baptist College in Bristol, but, after preaching for twenty-five years with very indifferent success to small congregations at Newcastle, Dublin, Chichester, Frome, &c., in 1817 he finally relinquished the pastoral office, to devote himself wholly to literature. His *Essays, in a series of Letters* (1805), were only four in number —the best known that 'On Decision of Character' —yet they showed him, said Mackintosh, 'to be one of the most profound and eloquent writers that England has produced.' In 1808 Foster married the Miss Maria Snooke to whom they were originally addressed. In 1819 appeared his celebrated *Essay on the Evils of Popular Ignorance*, in which he urged the necessity of a national system of education. Between 1806 and 1839 he contributed 184 articles to the *Eclectic Review*, 59 of which were edited by Dr Price in 1844. He died 15th October 1843, at Stapleton, Bristol, his home for twenty-two years. Foster was a man of deep but sombre piety. The shadows that clouded his spirit were due, however, to an inborn melancholy; they had nothing of bigotry or fanaticism. His thinking is massive and original; and at times, when his great imagination rouses itself from sleep, a splendour of illustration breaks over his pages that startles the reader by its beauty and suggestiveness. See his *Life and Correspondence*, by J. E. Ryland (2 vols. 1846; reprinted in Bohn's Standard Library, 1852).

Foster, STEPHEN COLLINS, an American song-writer, was born in 1826 in Pittsburg, Pennsylvania, and was a merchant's clerk in Cincinnati when, in 1842, the success of his first song determined his profession. His compositions, many of them enormously popular, number about 125; nearly a fourth are negro melodies, the remainder chiefly sentimental ballads. The best known are 'The Old Folks at Home,' 'Nelly Bly,' 'Uncle Ned,' 'Old Dog Tray,' 'Gentle Annie,' 'Old Kentucky Home,' 'Willie, we have missed you,' and 'Come where my Love lies dreaming,' the airs and words of

which alike were his own composition. He died in New York, 13th January 1864.

Fosterage, the relation which arises when children are nursed and brought up by others than their own parents, may anywhere establish a very close bond between foster-parents and foster-children. But in ancient Ireland, under the Brehon Laws (q.v.), the systematic fosterage of the children of the wealthy in poor families, and their education there from infancy till the age of thirteen in the case of daughters and seventeen in the case of sons, was recognised and organised in the most elaborate manner, the respective duties and privileges being carefully specified and guarded. Thus, the foster-parents were entitled not merely to the fosterage fee, but to support in their old age from the foster-child; the foster-father was liable to mulcts incurred by the foster-child; and, if the foster-child was found to have been improperly or imperfectly educated in any of the specified branches, the foster-father had to refund the fees in due proportion.

Fotheringhay, a village of England, in Northamptonshire, on the river Nen, 9 miles SW. of Peterborough. Pop. 225. In the ancient castle of Fotheringhay, founded shortly after the Conquest, Mary, Queen of Scots, was beheaded in 1587. It was allowed to fall into decay after the accession of James I. to the throne of England.

Foucault, JEAN BERNARD LÉON, French physicist, was born in Paris, 18th September 1819. His first work in the physical sciences was the improvement of Daguerre's photographic processes, and his next a series of investigations, conducted in co-operation with Fizeau, on the properties of light. Continuing his optical inquiries, he was enabled to demonstrate in 1850 that the velocity of light is greater in air than in water, and that in different media the velocity varies inversely as the refractive indices of the respective media. For his remarkable proof in 1851 of the rotation of the earth by means of a freely-suspended pendulum, see PENDULUM. Two years after his appointment (1855) as physical assistant in the observatory at Paris Foucault invented his polariser; and two years later (1859) his reflector for the great telescope at Paris was completed. Foucault also invented apparatus for the better application of the electric light, and showed that the sun may be viewed without injury to the eyesight if the object glass of a large telescope be covered with a thin film of silver. He died at Paris on 11th February 1868. Foucault edited the scientific part of the *Journal des Débats* from 1845, and was elected a foreign member of the Royal Society of London in 1864. His papers were printed in *Comptes Rendus* (1847–69). Compare also *Recueil des Travaux Scientifiques de Foucault* (ed. by Gariel and Bertrand, 1878).

Fouché, JOSEPH, Duke of Otranto, minister of Police under Napoleon, was born at Nantes, 29th May 1763. Although educated for the church, he hailed the Revolution with extravagant delight; and, on being elected to the National Convention in 1792, attached himself to the extreme party of the Mountain, and voted for the execution of Louis. He was commissioned by the Committee of Public Safety to castigate the obdurate city of Lyons (1794), and in that business rivalled his associates, Collot d'Herbois and Couthon, in cruelty and bloodthirstiness. In 1794 he was expelled from the National Convention as a dangerous Terrorist. Yet in September 1799 he had so far recovered ground that he was appointed minister of Police, a post which he held, though with several interruptions, down to 1815. Having made himself indispensable to Napoleon, whom he materially assisted during the revolution of 18th Brumaire (5th November 1799), he proceeded to organise a system of police espionage; but this soon grew intolerable to the First Consul, who in 1802 abolished the ministry. In compensation Fouché was nominated senator of Aix, and rewarded with a large sum of money. Yet two years later Napoleon found it necessary to reinstate him in the office. Once more dismissed by the emperor in 1810, Fouché, after a period of flight in Tuscany, received the appointment of governor-general of Laibach and Rome (1813), and then of ambassador at Naples. Once more he was restored to his former post by Napoleon after his return from Elba, but seeing the downfall of the latter to be inevitable, he made terms with the Bourbons. Under Louis XVIII. he retained his position until the king was constrained by the popular voice to dismiss him in September 1815. Appointed ambassador to Dresden, he was there struck in 1816 by the decree of banishment pronounced against the executioners of Louis XVI.; and henceforward he led an exile's life at Prague, Linz, and Trieste, where he died, 25th December 1820. Fouché was a man with one aim only, his own political success. Unscrupulous, yet politic and sagacious, crafty, and fond of intrigue, he made an admirable head of police in the troublous days of Napoleon's reign, and by the firmness and skill which he displayed in the internal government of France, which was left almost entirely in his hands during the emperor's absence on his many campaigns, he was largely instrumental in preserving his country from anarchy. The *Mémoires de J. Fouché*, published in 4 vols. at Paris in 1828–29, have been declared not genuine by his sons. Nevertheless Fouché is known to have composed *mémoires* during his last years of banishment.

Fougasse, in military science, an explosive mine so arranged as to hurl a volume of stones in the faces of an attacking force.

Fougères, a town in the French department of Ille-et-Vilaine, 23 miles by rail N. of Vitré (on the main line from Paris to Brest). It has a picturesque old castle, a college, and considerable manufactures of bootmakers' materials, sailcloth, and leather, besides granite-quarries. Here the Vendean royalists defeated the republicans in November 1793. Pop. (1886) 15,133; (1891) 17,621.

Foula, a lonely island of Shetland, 16 miles WSW. of the nearest point of the mainland. Measuring 3½ by 2½ miles, it is 5 sq. m. in area, and attains in the Sneug a maximum altitude of 1372 feet. Foula is chiefly remarkable for the Old Red Sandstone cliffs on its north-west side, which, rising almost sheer from the sea to a height of 1220 feet, are unmatched for grandeur in the British Isles. They are denizened in the breeding season by myriads of seafowl—puffins, kittiwakes, and the rare great skua or 'bonxie' (*Lestris cataractes*), which formerly was preserved by the islanders to keep down the eagles. The only landing-place is at the fishing hamlet of Ham, on the south-east. Foula was the last island where the old Norse tongue lingered on into the 19th century. It has Congregational and Established chapels. Pop. (1861) 233; (1881) 267; (1891) 239. See Tudor's *Orkneys and Shetlands* (1883).

Foulahs. See FULAHS.

Fould, ACHILLE, French financier and politician, was born in Paris, 31st October 1800, of Jewish parents. Early in life he was initiated into financial business in his father's bank. His political career began in 1842 by his election to the Chamber of Deputies for the Basses-Alpes. After the revolution of 1848 Fould accepted the new régime of the republic, and rendered considerable service to the provisional government in its financial

affairs. During the presidency of Louis Napoleon he was four times minister of Finance between 1849 and 1852. Whilst in office Fould gave the first impulse to the foundation of the *Crédit Mobilier*. Early in 1852 he finally resigned, in consequence of the confiscation of the property of the Orleans family. The same day, however, he was created a senator, and shortly afterwards returned to power as minister of state and of the imperial household, which position he held until 1860. In 1861 he was reappointed finance minister, and retained that post until 1867. On the 5th October following he died at Tarbes.

Foulis, ROBERT and ANDREW, Glasgow printers, were born the one in 1707, the other in 1712. Robert for some years practised as a barber, but meanwhile attended Professor Hutcheson's lectures on moral philosophy. Andrew had been bred for the ministry. In 1741, after two tours with his brother in England and France, Robert set up as a Glasgow bookseller, in 1743 was appointed printer to the university, and between 1742 and his death published 554 works—classics, translations, poetry, plays, &c. The most celebrated are the 'immaculate' *Horace* (1744), which contains, however, six misprints, and the splendid folio *Homer* (4 vols. 1756–58). With the view of promoting the fine arts in Scotland, Robert, after a fourth visit to the Continent, established in 1753—fifteen years before the foundation of the Royal Academy—an academy at Glasgow for engraving, moulding, modelling, and drawing. During the first ten years of its existence this institution produced 1112 prints, besides statues, busts, oil-paintings, and crayons; David Allan owed to it his early training. But the heavy attendant expense led to the decline of the printing business, and the death of the quiet, unwearying Andrew on 18th September 1775 proved the finishing blow. Eight months later Robert sold off his collection of 'old masters' at Christie's in Pall Mall; when all costs were defrayed the balance in his favour was just fifteen shillings. He died suddenly in Edinburgh, on his way back to Glasgow, 2d June 1776. For a full account of this *par nobile fratrum*, the 'Scottish Elzevirs,' see Richard Duncan's *Literary History of Glasgow* (Maitland Club, 1831; new ed. 1886).

Foundation. By this term is generally meant the ground on which the walls of a building rest. But of the walls themselves, whether of brick or stone, the lower courses, or those under the surface of the ground, are called foundation courses. The first thing to determine regarding the site for a building is whether the ground is natural or artificial. By the latter is understood some deposit of waste material, such as loose earth or builder's rubbish, which has been used to level up a piece of ground or put down for some other purpose. It is always necessary to sink the foundation trenches or tracks through made-up ground till the natural surface is reached. Supposing that on the site chosen there are no springs of water, and that it is well drained, then there is a likelihood that whatever the natural foundation, whether of rock, clay, sand, or gravel, it will be a safe one. Sometimes, however, even with these, some means has to be taken to prevent unequal yielding under the pressure of the walls. There may, for example, be hard and soft parts on a piece of ground of the same general character.

In the case of compressible soils of whatever nature the walls require a sufficiently thick bed of Concrete (q.v.) underneath them. More rarely Piles (q.v.) are driven in to support a platform upon which the walls rest, and sometimes inverted arches are used for distributing pressure over a foundation where it would otherwise come only on a few points.

Except where a building is erected on solid rock, what are called 'footings,' or, in Scotland, 'scarcements,' form the first or foundation courses of the walls. Stone footings consist of large flat-bedded stones, which in the lowest course are generally twice as broad as the wall above is thick. Two or more of these projecting courses are first laid, which give a stepped section to those portions of the walls underground. Brick footings resemble those of stone, only in them there are, of course, more joints from the smaller size of bricks. For foundations under water, see CAISSON, COFFERDAM.

Foundations. See under Charities, CHARITY COMMISSIONERS; also the article CORPORATION.

Founder, also called LAMINITIS, consists of inflammation of the vascular sensitive laminæ of the horse's foot. It is also met with in cattle, but rarely in sheep, the corresponding structures being in them less developed. Occasionally the laminæ are strained from severe exertion; more frequently they suffer from the morbid effects of cold, which is especially injurious after excitement and overfatigue. Very commonly also they become inflamed from their close sympathy with diseases of the digestive organs, often following engorgement of the stomach or bowels. All the feet are sometimes affected, more usually the forefeet only. They are hot and tender; the animal stands as much as possible upon his heels; trembles and groans when moved; and is in a state of acute fever and pain. Except when following superpurgation or internal disease, bleeding is useful. The shoes must at once be removed, and the toes, if long, reduced, but no further rasping or cutting is permissible. The feet must be enveloped in hot bran poultices, and kept off the hard ground by a plentiful supply of short litter. Soap and water clysters, repeated if necessary every hour, usually suffice to open the bowels, which are very irritable; and physic, if required, must therefore be used with extreme caution. Two drachms of aloes is an ample dose in founder. Have the strain taken off the inflamed laminæ by getting the animal if possible to lie down, or, if he be afraid to do so, let him be 'cast' and kept down. As a rule when once down he will, from the relief to pain, often remain in the recumbent position; he should then be turned twice a day, and his bedding kept dry and clean to prevent chafing of the skin or 'bed-sores.' After the acute symptoms pass, thin heeled shoes, barred or plain, as suit the feet, should be put on; cold applications should be made to the feet, and afterwards a mild blister put round the coronet.

Founding, or METAL-CASTING, is the art of working metals by pouring them, while in a fluid condition, into moulds in which they solidify and harden into the form of the mould which they fill. In general the terms are restricted to metal-work; but glass, plaster, cement, wax, gutta-percha, &c. are cast in moulds precisely in the same manner as the metals.

Casting is the most important of all the operations by which metals are fashioned into useful or ornamental forms; but there are certain metals which cannot be in practice treated by this process. It is essential that the metal employed should be meltable at a temperature which can be reached in foundry practice, that it should flow freely, and should fill the mould well without forming air-bubbles in the mass. Malleable iron cannot be treated by casting, on account of the excessive temperature at which it becomes fluid; and neither copper nor aluminium become sufficiently limpid to flow and fill a mould properly. Iron-founding, in which the special form of pig-iron known as 'foundry pig' is used, is the greatest of metal-

casting industries; after which come brass-founding, bronze-casting, zinc, German silver, gold and silver casting, and typefounding and stereotyping. The last two will be dealt with under their own proper heads, and the casting of the minor metals will receive such notice as they require in connection with the metals themselves.

The general process of founding or casting embraces numerous and complex operations connected with (1) the preparation of a mould or form into which the molten metal is run, (2) the melting of the metal or alloy, and (3) the pouring of the molten metal into the mould, in which it solidifies and hardens. According to the form, size, and intricacy of the object to be cast, and the nature and value of the metal used, the variations of working are very many, and it will not be possible here to describe more than two or three typical processes.

Bronze-casting is the most ancient of all metallurgical arts, and an outline of its development may serve to illustrate the processes employed in dealing with that alloy. The earlier forms of bronze axe used by prehistoric man were solid castings made in moulds, which consisted of two flat stones, having in the faces of each hollowed-out depressions which corresponded to two equal halves of the axe. The stones, when placed accurately face to face, had thus between them a hollow space which represented the form of a perfect axe, and into that hollow from the outer surface a channel or 'gate' was formed, by which the molten metal was poured in, till the hollow or mould was filled up. In later times, with the view of saving valuable metal, the practice was introduced of forming a core within moulds of large objects, around which the bronze was poured, which thus formed only an outer surface or skin. Iron appears to have been the material at first selected as suitable for such cores. But at a very early period the Greek sculptors discovered the art of casting their figures, &c. so that the core around which the metal flowed was removable, thus forming hollow castings. By whatever process the early artists worked they were able to produce castings which for beauty of surface, intricacy of pattern, size of casting, and economy of metal cannot be excelled with all the resources of modern ingenuity. Their process was probably that employed to the present day for the finest products of bronze-casting, known as *cire perdue*. In this process a rough model of the statue or other object to be cast is formed slightly smaller than the work to be cast. This model is coated over with beeswax; and to the wax surface the most finished form and touches of the artist are given. The whole surface then receives two or three coatings of a potter's slip or fine cream of ground brick, clay, and ashes, which forms a closely adherent skin around the wax. Then the mould is built up of clay, packed around all the parts to form a solid mass, which is clamped up within a strong iron framework. At certain intervals iron pins are stuck through the clay and wax into the central core, and suitable 'gates' are made for pouring in the bronze and allowing the wax to escape. The clamped-up mass is now placed in the furnace, and slowly heated up till all the wax runs out, and the clay of both mould and core are dried and sufficiently baked. The space at first occupied by the wax is now vacant, and it only remains to pour in molten bronze to occupy the space and assume the form and the thickness of the original wax. In modern bronze-casting for which the *cire perdue* process is not employed, objects of large size, such as heroic figures, are cast in sections, which have afterwards to be fused together at their edges. Models in plaster of the separate pieces are first made, from which moulds in sand and plaster are obtained. Within these moulds cores are cast, and these when baked and dry are uniformly scraped down all over according to the thickness desired in the finished object. The cores so reduced are again placed and supported within the moulds, and thus there is a space between mould and core into which the molten bronze is poured. The various pieces are subsequently brazed together and finished. Some of the recorded works of early Greek sculptors were cast of gigantic proportions. The Colossus of Rhodes is variously stated at from 90 to 120 feet in height. There yet remains in the Hippodrome at Constantinople a pillar of bronze in the form of three twisted serpents, cast 479 B.C., which in its perfect condition was 20 feet high. Schwanthaler's figure of 'Bavaria' in Munich, finished in 1850, stands 67 feet in height, and contains nearly 63 tons of bronze. 'La Vierge du Puy,' by Bonnassieux, is 51 feet high, and contains about 100 tons of bronze. For Bartholdi's 'Liberty' and other famous bronze figures, see COLOSSUS.

Iron-founding, from the nature of its operations and the gigantic scale on which it is carried on, may be regarded as a separate and distinct industry. The large-grained, gray pig-iron, on account of the highly fluid condition into which it can be brought, is the material principally employed; but according to the size of the castings required and the purposes for which they are to be used mixtures of finer grained pig are also melted up. The metal is melted with coke in a round firebrick furnace called a *cupola*, the heat being urged by means of a powerful blast created by fanners revolving at a high speed. The molten metal is run from a tap at the bottom of the furnace into a malleable iron ladle lined with clay, from which it is poured into the mould through holes called *runners* or *gates*. When the mould is newly filled numerous jets of blue flame issue from as many small holes pierced in the sand. These perforations are necessary for the escape of air and other gases produced by the action of the hot metal on the mould. Care must also be taken not to have the mould too damp, otherwise steam is generated, which may cause holes in the casting, or even force part of the metal out of the mould. The casting remains covered up for a time in order to cool slowly, and is then removed by breaking away the sand and drawing out the core.

In the case of a fluted or otherwise ornamented pillar the pattern would require to be in at least four pieces instead of two, because it is only a plain pattern that will come out of the mould in halves without tearing away the sand. When a pattern is necessarily made in several pieces it is drawn out of the mould bit by bit, to the right or left as the case may be, and so parts from the sand without breaking it.

Suppose that a small ornamental vase were to surmount the pillar, the founder would prepare the pattern of this in a more elaborate manner. He would first mould it in wax or clay, from which a cast in plaster of Paris is made; from that again a cast is taken in an alloy of tin and lead, which, after being sharply chased and divided into the required number of pieces, is used as a pattern to cast from. All ornamental patterns, such as figures, scrolls, leaves, enriched mouldings, and the like, are made in this way, whatever metal the ultimate casting is to be produced in.

Very large engine cylinders, pans, and such vessels are cast in loam-moulds, which are built of brick, plastered with loam, then coated with coal-dust, and finally dried by means of a fire. This method is adopted with large plain objects where a pattern would be expensive, and when few castings

of one kind are required. Iron moulds, coated with blacklead or plumbago, are now used for water and gas pipe founding, which forms an extensive special industry. They are greatly more expensive than any other kind, but they enable the founder to dispense with a pattern, as, when once made into the required form, they are not destroyed like moulds of sand or loam at each casting.

For *chilled* castings, also, metal moulds or moulds partly metal and sand are employed. In these the molten iron solidifies and cools with great rapidity, owing to which it acquires extreme hardness, a quality of peculiar value for shot and for many purposes where wear-resisting properties are of more importance than toughness. In *malleable* castings the opposite effect of rendering the metal soft, tenacious, and partially malleable is obtained. For this end the finished casting is embedded in powdered hematite ore or other iron oxide, packed in an iron chest, and exposed for two or three days to a red heat in a furnace. Thereby the cast-iron parts with its carbon, and assumes the softness, tenacity, and infusibility of malleable iron. The process may be continued till the effect is produced throughout the mass acted on, or it may be stopped when merely a skin is decarbonised, leaving the core of unaltered cast metal.

In iron-casting, and especially in steel-casting, bubbles of carbonic oxide and other gases are formed, which partly escape and partly remain imprisoned in the mass, tending to render it vesicular and less sound than it might otherwise be. Various means have been adopted to promote the escape of imprisoned gases, and thereby to render the casting more homogeneous and strong. In Krupp steel the addition of silico-spiegeleisen to the cast metal acts favourably by stopping the evolution of the gases. To force out the gases the late Sir Joseph Whitworth in casting steel adopted the expedient of casting under pressure. While the metal was in a fluid condition he applied pressure of as much as from 6 to 9 tons per square inch over its surface, and by preventing the formation of air-bubbles he thereby obtained a remarkable increase in the strength of the castings so operated on.

The variety of articles produced by founding or casting are very numerous. Besides others incidentally alluded to, we may mention cylinders, cisterns, paper-engines, beams, boilers, pumps, and the heavy parts of machinery generally, gates, railings, lamps, grates, fenders, cooking-vessels, and the like in iron; cannon, many portions of machinery, and numerous ornamental objects in brass, bronze, and the more costly metals. See Mullin, *Modern Moulding and Pattern Making* (1886); Overman, *The Moulder's and Founder's Guide* (1880); Wylie, *Treatise on Iron Founding* (1884), &c.

Foundling Hospitals, strictly speaking, are institutions in which children that have been deserted by their parents or guardians are received to be nourished and cared for by private charity or at the public expense. Their primary purpose is to serve as a preventive of infanticide and the wilful procurement of abortion, and to counteract the temptation on the part of unmarried women to abandon their illegitimate offspring, and of married women to leave exposed on the streets children they are themselves either unwilling or unable to nurture and support. Although the practice of infanticide was largely prevalent amongst some of the nations of antiquity, especially the Greeks and Romans, amongst whom the father of a family possessed an almost absolute right of life and death over his children, even to selling them into slavery or to slaying them, nevertheless the state was not altogether careless of the preservation of foundlings and abandoned children. Private persons were encouraged to take care of deserted infants, and to educate them, by decrees which assigned them as slaves to those who should thus adopt them. Of the rest—such as were not thus taken charge of—many were educated at the public expense. The ancient Egyptians, Jews, and Thebans (in Greece), however, looked upon infanticide as a crime; and this also was the sentiment of the ancient Germans. But from the time when Christianity became the state religion of the Roman empire a sensible change began to show itself amongst its leading peoples in relation both to infanticide and to the exposure of children. The more enlightened emperors, as Constantine, Valentinian, and Justinian, devised legislative measures for the prevention of both offences. But it was only when the church turned its attention to the matter seriously that the preservation of those unfortunates began to be carried out in a systematic way. In spite, however, of imperial edict and ecclesiastical exhortation, exposure and the selling of offspring, especially in times of public calamity or distress, still continued to be largely practised, more particularly in the Western empire. The germ of the modern foundling hospital may perhaps be found in an institution which owed its existence to the Bishop of Treves in the 6th century: in the cathedral porch a large marble basin was built, in which children might be placed, to be afterwards reared by members of the church under the superintendence of the ecclesiastical officers. Similar arrangements are mentioned in some of the capitularies of the Frankish kings. But the first well-authenticated instance of a foundling hospital, as we now understand the term, is one that was established at Milan in 787. From the end of the 11th to the end of the 14th century several institutions of a similar character were founded in some of the chief towns of France, Italy, and Germany. It is, however, in the first-named country that they have received the most attention and been most thoroughly studied and organised.

At Paris foundlings were generally deposited in the porch of Notre Dame. For the reception of children so exposed Marguerite de Valois opened a special home in 1536, and nine years later the government afforded shelter to 136 orphans in the Trinity hospital. But, no provision being made for their sustenance, they were dependent upon the alms which their nurses begged on the streets or which they themselves could collect when old enough to go a-begging; till in 1552 the parliament of Paris set apart for their maintenance the proceeds of a special tax. Amongst these children the mortality averaged 90 per cent. About the same time the Bishop of Paris built another house of refuge for foundlings picked up within his diocese; this was known as the *Couche*. But the accommodation was insufficient, and children were selected for admission by lot, those who were not elected being generally left to die on the street. Subsequently the inmates of the Couche became the objects of a brisk traffic, children being sold to professional beggars, acrobats, and others at the fixed price of 20 sous each. These evils at length attracted the attention of St Vincent de Paul, who in 1638 established a more satisfactory home and a humane system of treatment. Out of this grew the celebrated Foundling Hospital of Paris, which was incorporated in 1670. With it the Couche, reformed and enlarged, was joined in 1688, and Marguerite de Valois's orphanage in 1772. Under the Revolution all illegitimate children and foundlings were virtually adopted by the state, which in 1793 issued a decree bestowing a premium upon all girls who should declare themselves to be the mothers of illegitimate children, and, as the Emperor Trajan had

done, proclaiming all such infants 'children of the country.'

At the Foundling Hospital of Paris children are admitted (since 1886) under conditions which allow any person to leave a child openly without giving an account of it; in fact, the system in vogue is that of indiscriminate admission under the cover of secrecy. The infants admitted belong to the following categories: foundlings proper—i.e. children deserted by parents who are unknown; children who are abandoned by parents who are known; and orphans left destitute, the general designation for them all being not *enfants trouvés*, but *enfants assistés;* besides these, the hospital also takes in children *moralement abandonnés*—i.e. incorrigible children sent by the law-courts, by the prefecture of police, or by their parents. The scope of the institution is not, however, confined to this; it also gives presents of money, baby-clothes, and cradles to mothers who are poor, and sends out nurses to give suck to the infants of such women as cannot themselves perform that service for their offspring. As a rule infants only remain in the establishment at Paris a short time—the average is four days; when adjudged strong enough to travel, they are sent with their nurses into the country, to be boarded with peasants or artisans. For the custody of each child the government pays a monthly subsidy, decreasing from 15 francs during the first year to 6 francs during the twelfth. Once that age is reached nothing further is paid; the child is then generally apprenticed to its foster-father if he is an artisan, or becomes his domestic servant if he is a peasant engaged in agriculture. The central administration, however, still keeps its eye upon these children through its provincial inspectors, nor does it lay down its guardianship or cease its surveillance of them until after they have attained twenty-one years of age. These inspectors also keep the provincial hospitals and the central hospital at Paris supplied with wet-nurses, recruited from the women of the countryside. Parents are allowed to reclaim a child at any time on satisfactorily establishing their title to it, and that without recouping the expense of rearing it. Also, persons who prove to the satisfaction of the hospital administrative authorities that their motives are sincere and laudable are allowed to adopt a child from amongst those whose parents are altogether unknown. On an average about 12,500 children pass through the hands of the authorities of the Paris hospital annually. Of these nearly 4000 are *enfants assistés*, and 1200 *enfants moralement abandonnés*, amongst whom the mortality is about 3 per cent. Besides these some 7000 children are assisted outside; and amongst them the mortality is 16 per cent. The provincial statistics show an average number of 36,000 children annually under the surveillance of the authorities, of whom 27,000 are *enfants assistés;* of these children about 3 per cent. die annually, though of the children under one year of age about 22 per cent. die every year. Besides these there are between 3000 and 4000 incorrigible children. The administration has established a savings-bank for the benefit of its wards, with the result that at the end of 1886 there stood to the credit of each *enfant assisté* an average of 179 francs, and of each incorrigible child an average of 20 francs.

In the United Kingdom and Germany the care of foundlings is for the most part left to the active ministrations of the charitable or to the operations of the poor-law administration. For instance, the Foundling Hospital of London, established in 1739 by Captain Thomas Coram (q.v.), is not, strictly speaking, a foundling hospital at all, nor does it receive any governmental or parochial subsidy; it is reserved exclusively for illegitimate children, the offspring of mothers who have previously borne a good character, and who themselves make personal application for the admission of their infants. The institution supports constantly about 500 children, of whom some 140 under four years of age are boarded out in the country. Of the remainder the girls continue in the hospital until they are fourteen years of age, when they are sent out into domestic service; the boys on reaching their sixteenth year are apprenticed to trades, or enter the army, or become clerks. But, as in France, they remain up to their twenty-first year under the charge of the hospital authorities, who receive annual reports of their behaviour, and reward the most deserving with donations of money. The mortality of the inmates in the country is about 4½ per cent.; in the city hospital there is about one death annually. The real foundlings of Great Britain, together with the waifs and strays, are received either into the workhouses or into private charitable establishments, like Dr Barnardo's homes or the infant orphan asylum at Wantage.

Russia possesses two large foundling hospitals, one at Moscow, admitting 13,000 children per annum, and the other at St Petersburg, which accommodates an annual average of 7500. Here the rules of admission are so lax that it is no unusual thing for a woman to expose her own child at the hospital, and then get herself put on the staff of wet-nurses to nurse it. This is done for the sake of the good living and the small daily wage granted to nurses in the hospital; after they take the child home with them the daily wage is changed for a monthly gratuity that is continued until the child reaches ten years of age. Indeed, many cases occur in which married women leave their own infants of tender age at home, where they are not properly attended to, and go to serve as wet-nurses in the hospitals. This evil it was sought to counteract in France by putting the infants out to nurse in a different department from that in which they had been exposed; but this system of *déplacement* was soon abandoned on the ground of expense and loss of control. At St Petersburg and Moscow infants prematurely born are reared in 'frames very like those used for melon culture,' padded inside, and surrounded outside with a jacket of hot water, so that the temperature may be kept uniform. Foundling hospitals exist in most of the countries of Europe, particularly in Italy, Austria, Spain, and Scandinavia.

In the United States deserted children are for the most part sent to the almshouses, or are taken care of in private charitable institutions, like the foundling asylum of the sisters of charity, for instance, in New York city, established in 1869; the infants' hospital, established in 1868; the nursery and child's hospital; and the infant asylum, organised in 1871—all at New York. There are large foundling hospitals at Mexico, Rio de Janeiro, and at Buenos Ayres (founded in 1774, with an annual average of about 1200 to 1300 inmates). China, it should be stated, has admirably conducted establishments for the care of destitute and abandoned children in nearly all the large cities of the empire.

During the early part of the 19th century it was customary for foundling hospitals to be provided with a revolving pillar or basket or wheel, a contrivance by means of which a child could be deposited at a foundling asylum without the person who left it there being seen or any questions asked. This apparatus, which was indeed first used at Marseilles about the beginning of the 13th century, was largely employed in France, Belgium, Italy, and elsewhere; and, though it has been almost entirely abolished, it still survives in a few foundling hospitals of Italy. And the new regulation put in force at the Paris hospital in 1886 is virtually

a return to the principle underlying the use of this apparatus—viz. secret and indiscriminate admission. The revolving box was condemned on the ground that it acted as an encouragement to parents to abandon their offspring, and thus weakened the sense of parental responsibility.

Foundling hospitals have been condemned on the ground of the great mortality which takes place in them. For instance, the Dublin hospital, which for several years from 1704 received from 1500 to 2000 children annually, was finally closed in 1835 on account of the excessive mortality, the death-rate being 4 in 5. Again, the asylums of Russia have for many years lost 50 to 60 per cent. of the infants annually sent to them; at Buenos Ayres the mortality is 50 per cent.; in Vienna it rose even as high as 75; and it stood at a high figure in France, Italy, and Portugal. But in the case of France and London at least a great improvement has been effected, the percentage for each being less than 4, except in the case of children under one year of age boarded in the rural districts in France. Another system of rearing, and sometimes killing off, illegitimate children is that known as baby-farming.

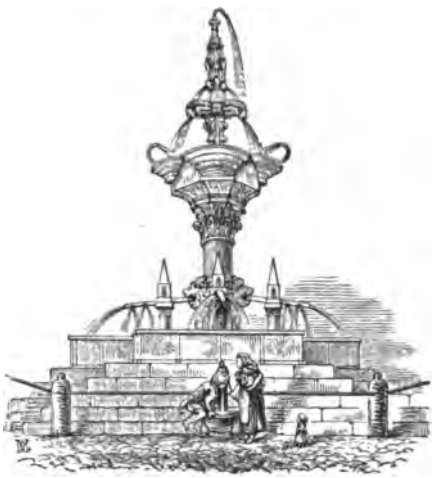
See Ferme and Montfalcon, *Hi toire Statistique et Morale des Enfants Trouvés* (Paris, 1837); Epstein, *Studien zur Fraye der Findelanstalten* (Prague, 1882); *Revue des Deux Mondes* (Esquiros in 1846; Bailleux de Marisy in 1864; and Du Camp in 1870); a lecture by Dr S. Osborn (1886); and *Annuaire Statistique de Paris*.

Found Property. See LOST PROPERTY.

Fountain, a basin or an artificial structure for the supply or the ornamental display of water. There are fountains of every form and variety, from simple springs with their natural basins to the most elaborate monumental structures, in which ornamental jets and artificial basins are combined. In civilised countries fountains have at all times been considered as public monuments of the greatest importance; and, where the source of their supply has not been provided by nature on the spot, immense labour and expenditure have been incurred to make up for the deficiency. The splendid Aqueducts (q.v.) of the Romans are instances of the important light in which they regarded the fountains of their cities. Every Roman town had at least one aqueduct, the water from which was distributed to as many fountains as the population required.

In early times utility was the first object of a fountain, and the ornamental features of the structure into and through which the water was led were strictly developments of their original utilitarian purpose. Springs were highly valued, especially in lands where water was scarce; many of them were associated with the names of saints, and sacred traditions accumulated around them. Sometimes, therefore, such springs were built around for protection, statuary figures of their patron saint were placed in niches, and artificial basins were provided to contain the water. In towns where a number of persons might require to draw at one time a large basin was erected with a pillar in the centre, from which pipes radiated all round —each with its separate jet to supply the running water—while the basin was used for washing the pitchers. Many examples of this kind of fountain remain throughout Italy and in the older German towns, of which the fountain at Viterbo and the Schöner Brunnen at Nuremberg may be mentioned as examples. The pillar is sometimes surmounted by a statue, or has one or more smaller basins with ornamental streams and jets of water falling from tier to tier. A beautiful fountain of this nature existed in the royal palace at Linlithgow, and a modern reproduction of it may be seen in front of Holyrood Palace at Edinburgh.

Where modern views of water-supply and sanitation are carried out, under which water is led into each household by gravitation, great public fountains have become purely ornamental structures.



Fontana Grande, Viterbo.

Small pillar fountains are yet commonly placed on streets and places of public resort for wayfarers, and similarly basin fountains are provided for horses and other animals. The Metropolitan Drinking Fountain Association was formed in London in 1859. Of ornamental fountains the most magnificent display is at Versailles. Paris also contains several very remarkable fountains, and in England the display at the Crystal Palace, Sydenham, is very fine. Chatsworth is remarkable for its fountains, one of which is said to throw a jet of water 267 feet high. Although Rome has lost four-fifths of the aqueducts which so lavishly supplied her with fresh water in the time of the Empire, she is still unsurpassed for the number, beauty, and utility of the public fountains which adorn her streets and palaces.

In connection with recent international exhibitions, a method of artificially controlling and illuminating fountain jets has been elaborated, by which a great variety of effects and chromatic combinations are obtained. Within a large basin a series of jets are arranged, and under the basin is a subterranean chamber with plate-glass discs under each jet. Powerful electric lights are provided in the chamber, so that the jets are illuminated from below, each with one or more lamps. By a mechanical contrivance slips of coloured glass can be at will interposed between the arc-light and the jet, and it is the duty of an operator in the chamber to vary and change the glasses in accordance with signals sent to him. The jets are forced and controlled by one or more pumping engines in a station apart, in which the requisite engines and dynamo-machines for producing the electric light also are placed. In a separate manipulating tower there is a system of levers, pushes, and signals, by which the operator has direct control of the water-jets, and the means of giving signals to the officer in the subterranean chamber to produce such combinations and change of colours as he may desire. In this way the height and combination of jets and the colour of the light illuminating them can be instantaneously varied; and the effects by night are very striking.

Fountains Abbey, one of the largest and best-preserved monastic edifices in England, in the West Riding of Yorkshire, 3 miles SW. of

Ripon. Founded for Cistercians in 1132, it was not completed till the 16th century, so offers every variety of style, from Norman to Perpendicular. See Wallran's *Fountains Abbey* (Surtees Soc. 1863).

Fouqué, FRIEDRICH HEINRICH KARL, BARON DE LA MOTTE, German romanticist, was of Huguenot ancestry, and grandson of the Prussian general of this name (1698–1774) distinguished in the Seven Years' War. Born at Brandenburg, 12th February 1777, Fouqué served as Prussian cavalry officer in the campaigns of 1794 and 1813. The interval between these campaigns was devoted to literary pursuits in the country, and the rest of his life was spent alternately in Paris and on his estate at Nennhausen, and after 1830 at Halle. He died in Berlin, 23d January 1843. Fouqué appeared first under the pseudonym Pellegrin, as author of *Dramatische Werke* (1801). But Norse legend and old French and German poetry attracted him most strongly; one sees this in his long series of romances, both prose and verse, which picture the life of medieval Europe. These include *Sigurd* (1808)—the first work to which Fouqué attached his real name—*The Magic Ring*, *Thiodulf the Icelander*, *Aslauga's Knight*, *Sintram and his Companions*, *The Two Captains*, and *Undine*, of all of which and of several other romances English translations appeared soon after Fouqué's death. His masterpiece is *Undine* (1811); its tender grace and fairy glamour are exquisite. Otherwise Fouqué is too often chargeable with all the extravagances of the romantic school. Straining after fantastic conceits, he seems fascinated by the antique life which he pictures, rather merely from its quaint contrast with modern manners than as a form into which the life of actual living men had shaped itself in bygone days. He himself edited a selection of his works (*Ausgewählte Werke*, 12 vols. Halle, 1841). His second wife, Karoline (1773–1831), is also known in Germany as the author of innumerable romances and stories.

Fouquet, NICOLAS, Viscount of Melun and of Vaux, and Marquis of Belle-Isle, finance minister under Louis XIV. of France, was born at Paris in 1615. Attaching himself closely to Mazarin, he received in 1650 the important appointment of *procureur-général* to the parliament of Paris, and three years later was advanced to be superintendent of finance. His rapid advance made him ambitious of succeeding Mazarin as first minister, and in order to secure himself friends and a party he distributed money with a lavish hand; but he had a formidable rival in Colbert. Fouquet's plans were, however, brought to nought; for in the first place Louis himself took the reins of power into his own hands when they slipped from the grasp of the dead cardinal, and in the second place, instigated thereto by Colbert, he suddenly arrested Fouquet in September 1661. After a trial extending over three years, Fouquet was sentenced to perpetual exile and the loss of all his property, but the sentence was afterwards altered to life-long imprisonment in the fortress of Pignerol, where he died 23d March 1680. As an example of the extravagance and gorgeous display made by Fouquet, it may be mentioned that shortly before his arrest he entertained the king at a banquet which cost 120,000 livres in his castle of Vaux, erected by him on a plan very similar to that afterwards embodied in the royal palace at Versailles. From the circumstance of his imprisonment at Pignerol, Fouquet, in spite of the fact that he died in 1680, has been identified with the Man with the Iron Mask (q.v.), who, however, lived until 1703.

Fouquier-Tinville, ANTOINE QUENTIN, one of the most notorious actors in the French Revolution, was born in the village of Hérouelles, in the department of Aisne, in 1747. Originally an attorney of dissolute habits, he ranged himself, on the outbreak of the Revolution, in the ranks of the most violent among the democrats. Appointed by Robespierre and Danton public prosecutor to the Revolutionary Tribunal on 10th March 1793, he superintended during the Reign of Terror, until 28th July 1794, all the political executions decreed by the tribunal. His performance of his duties was characterised by pitiless rigour, brutality, and callous indifference. He apparently regarded it as his mission to supply the guillotine with a regular supply of victims, and no bribes were able to turn him from his purpose. And he sent his friends, among them Robespierre, Danton, and Hébert, to execution in the same spirit in which he sent their enemies. On the overthrow of the Reign of Terror he was himself guillotined on 7th March 1795.

Fourchambault, a town in the French department of Nièvre, 5 miles NNW. of Nevers, near the right bank of the Loire, which is here crossed by a suspension bridge. There are large iron-foundries, nail-works, and wire-works. Pop. 5949.

Fourcroya, a neotropical genus of Amaryllidaceæ, nearly allied to Agave (q.v.), and yielding a similar fibre.

Fourier, FRANÇOIS MARIE CHARLES, a French socialist, was born at Besançon, 9th April 1772. His father, a prosperous draper, had him educated in the academy of his native town. The boy excelled in the studies of the school, especially geography, and was passionately fond of flowers and music. He regretfully abandoned his studies for a business career, which he followed with zeal and integrity in various towns of France. As a commercial traveller he also visited Holland and Germany, where with remarkable insight and accuracy he took note of everything interesting in climate, productions, and manners. From his father Fourier inherited a fortune of about £3000, but, having started business for himself at Lyons, he lost nearly all he had at the siege of that city by the Jacobins during the Reign of Terror (1793). He was even thrown into prison, and narrowly escaped the guillotine. After his release and two years' experience as a soldier he returned to a commercial career.

At a very early age Fourier had his attention called to the abuses of commerce. When only five he was punished for speaking the truth about certain goods in his father's shop; and in 1799, while employed in a house at Marseilles, he had to superintend the destruction of an immense quantity of rice held for higher prices, in the midst of a scarcity of food, till it had become unfit for use. Believing that a system which involved such abuses and immoralities must be radically evil, Fourier set himself to discover an entirely new social theory, which he elaborated chiefly in three considerable works. In 1808 he published his *Théorie des Quatres Mouvements et des Destinées Générales;* in 1822 his *Traité d'Association Domestique Agricole;* in 1829 *Le Nouveau Monde Industriel et Sociétaire.* Written under the most discouraging circumstances, these works for many years found few readers and scarcely any disciples; only the most ardent faith in his own principles could have carried him through so many difficulties. For the last ten years of his life he waited at noon every day in his apartments for the coming of the wealthy capitalist who should furnish means towards the realisation of his schemes. It was chiefly after the decline of the Saint-Simon movement that he gained a hearing and a little success. A small group of enthusiasts gathered round him; a journal was started for the advocacy of his views; an attempt to establish a society on his principles was made

in 1832 near Versailles, but without success. At Paris, October 8, 1837, Fourier died, poor, but warmly appreciated by a circle of devoted disciples. In his private life he seems to have been a model of kindness, simplicity, and integrity.

The great aim of Fourier is to reconstruct society on principles which are entirely new. But his social system is more or less moulded and coloured by his peculiar views on cosmogony and psychology. His views of God incline, though not decidedly, to pantheism. The will of God pervades the world as a universal attraction. Whereas Newton proved that this universal attraction governs one movement of the world, Fourier shows that it rules the world in all its movements, which are four—material, organic, animal, and social. From this law of universal attraction there follows a universal analogy, according to which everything in one department of the world has its parallel elsewhere.

Fourier believed that the world has scarcely yet reached the adult stage, having existed only seven thousand years, whereas it is destined to last for eighty thousand years, a long period of progress being followed by a corresponding period of decline. At present mankind is oppressed by an endless variety of evils, which he sums up in one obnoxious word, *civilisation*, and which are due to the fact that we have run counter to the Creator in pronouncing passions to be bad that are simply natural. To effect the passage from social chaos to universal harmony there is but one way—to give a free and healthy development to the human passions.

This brings us to the psychology of Fourier, who recognised twelve radical passions, with three points of attraction; five sensitive (tending to enjoyment), sight, hearing, taste, smell, and touch; four affective (tending to groups), friendship, love, ambition, and familism or paternity; three distributive (tending to series), the emulative, alternating, and composite. The meaning of the first nine is obvious enough. The emulative passion leads to intrigue, the alternating involves love of change; and the operation of the two might cause jealousy, disharmony, and war, were they not controlled by the composite passion and by a higher unity. Out of the free play of all the passions harmony is educed, like white from the combination of the colours.

But for the realisation of this ideal new social arrangements are necessary. These are provided in the *phalange*, an institution in which the interests of social union and individual liking are to be thoroughly reconciled. Each *phalange* was to consist of 1800 persons, a number sufficient to include the whole circle of human capacities, adequately various, and yet not too large for a convenient common life. The individuals constituting the *phalange* were to be arranged in groups of seven or more persons; from twenty-four to thirty-two groups were to form a series, and a number of series united to form a *phalange* of the requisite size. The pervading idea of the whole organisation was a harmonious social life combined out of the free play of the most varied likings and capacities. The dwelling of the *phalange* was the *phalanstère*, a vast, beautiful, and commodious structure in the centre of a highly cultivated domain, a square league in extent, where life would be arranged to suit every one, common or solitary, according to preference. As regards the institution of marriage Fourier would permit a freedom which would be subversive of such social order as now exists.

It is an obvious deduction from Fourier's principle of universal attraction that human life generally, and labour in particular, should be attractive. In the *phalange* labour is accordingly made attractive by constant regard to the likings and capacities of every one, and by continual change of occupation. The results of labour were to be distributed in the following manner. Out of the common gain of the *phalange* a very comfortable minimum was apportioned to each member, and the remainder was divided into twelve shares, of which five went to labour, four to capital, and three to talent. In distributing the reward to labour, the reverse of the present method was to be followed—i.e. necessary labour would be best paid, useful labour would come next, and pleasant labour would be worst paid.

So convinced was Fourier of the beauty and practicability of his social system that he believed it only required to be understood in order to be universally appreciated, and that in a very few years his *phalanges* would cover the whole world. The *phalanges* would arrange themselves in convenient groups with a common chief, and all would finally be united in a great federation, with Constantinople as capital. There never has been the least symptom of the realisation of such a dream. The system of Fourier has so little touch with fact and reality that it is hardly worthy of serious discussion. His road to the social millennium is far too easy. Yet his works are full of ingenious suggestion; and his criticism of the existing social order is often most searching and pungent. His theories may still be very profitably studied by the social economist.

Fourier's complete works were published at Paris (6 vols. 1840–46; new ed. 1870). The most eminent expounder of Fourierism was Victor Considérant, *Destinée Sociale* (1835); Gatti de Gamond's *Fourier et son Système* is an excellent summary. See also SOCIALISM; Pellarin, *Ch. Fourier, sa Vie et sa Théorie* (5th ed. 1871); L. Reybaud, *Études sur les Réformateurs Modernes;* and Sargant, *Social Innovators* (1859).

Fourier, JEAN BAPTISTE JOSEPH, BARON DE, French mathematician, was born at Auxerre, 21st March 1768. He became a pupil, and in 1789 a professor, in the military school of his native place; was afterwards removed to the normal school in Paris, and then to the Polytechnic, and accompanied Bonaparte to Egypt in 1798. On his return to France he became a contributor to the *Description de l'Égypte*, and also wrote the historical introduction. At the same time (1802) he was made prefect of the department of Grenoble, an office which he held till 1815, and was created baron in 1808. After Napoleon's escape from Elba Fourier took up his abode in Paris, and devoted himself exclusively to science, becoming a member of the Academy of Sciences in 1816, and afterwards secretary for life, conjointly with Cuvier. He died at Paris, 16th May 1830. His most famous work is the *Théorie Analytique de la Chaleur* (Paris, 1822), in which he applied new methods of mathematical investigation. An allied subject is discussed in his treatise on the temperature of the globe (1827). His analysis of Determinants, distinguished both for its substance and manner of exposition, and left unfinished at his death, was completed and published by Navier (Paris, 1831).

Four Lakes, a chain of deep lakes (Mendota, Menona, Waubesa, and Kegonsa) in Dane county, Wisconsin, connected by short outlets. Madison, the state capital, stands on an isthmus between Mendota and Menona.

Four Masters, ANNALS OF THE, an historical work composed in the Irish language, at the monastery of Donegal, by Michael O'Clery, a Franciscan monk, who enjoyed some reputation as a trained antiquary and historical writer. The work, which covers the history of Ireland from 1172 to 1608, with additions bringing the narrative down to 1616, was begun in the year 1632 and completed in 1636. Michael O'Clery was assisted in the work

of compilation and copying by his brother, Conary O'Clery, by a relative, Cucogry O'Clery, and by Cucogry O'Duigenan; hence the title of the book. See J. O. Donovan, *Annals of the Kingdom of Ireland by the Four Masters*, Irish text and English translation (3 vols. Dublin, 1848).

Four o'clock Plant. See SALSIFY.

Fourth Dimension. See DIMENSION.

Fourth Estate. See ESTATES OF THE REALM.

Fowey, or FOY, an old town of Cornwall, on the right bank of the river Fowey, 11 miles SSE. of Bodmin. It has a good harbour with a narrow entrance, and was formerly one of the chief seaports of England. Pilchards are cured, and 'china-stone' and iron ore exported. To the siege of Calais by Edward III. in 1347 it sent several ships. It was defended against the Parliament in 1644, and against the Dutch in 1667. Pop. 1656.

Fowl. See POULTRY.

Fowler, SIR JOHN, civil engineer, born at Sheffield in 1817, assisted in the construction of the London and Brighton and other railway lines, and was afterwards engineer of the Manchester, Sheffield, and Lincolnshire group of railways, besides many other lines, including the original 'underground' or Metropolitan Railway, London. River improvement and the construction of large docks have also occupied his attention, and he was made K.C.M.G. in 1885 for his services as consulting engineer in the public works in Egypt; but his greatest work is the Forth Bridge, designed by him and Mr B. Baker. See BRIDGE.

Fowler, THOMAS, English philosopher, was born at Burton-Stather, in Lincolnshire, 1st September 1832. He graduated at Merton College, Oxford, in 1854, and has ever since been closely connected with that university, first as tutor of Lincoln College, afterwards as professor of Logic from 1873, and as president of Corpus Christi College from 1881. His principal works are *Elements of Deductive Logic* (1867; 8th ed. 1883); *Elements of Inductive Logic* (1870; 4th ed. 1883); Bacon's *Novum Organum*, with notes and an introduction (1878); an edition of Locke's *Conduct of the Understanding* (1881; 2d ed. 1882); *Progressive Morality* (1884); and *Principles of Morals* (1887). Others are *Locke* in 'English Men of Letters,' as well as *Bacon*, and *Shaftesbury and Hutcheson* in 'English Philosophers.'

Fowler's Solution. See ARSENIC.

Fowling. See WILD-FOWL.

Fox, the name of a number of species of the family Canidæ (q.v.), most of which are now referred to the genus Vulpes, distinguished from the genus Canis (see DOG) by certain minute differences in the form of the skull and of the teeth, the more elongated body, slender, pointed muzzle, elliptical, somewhat oblique pupil, and bushy tail. Representatives of the genus are found in the greater part of the northern hemisphere, but are conspicuously absent from South America.

The following species demand separate notice: (1) The Common Fox (*Vulpes alopex*) measures on an average 4 feet in length, of which 16 inches are occupied by the tail; and 14 inches in height; the weight is from 15 to 22 lb. The head is broad, the brow flattened, and the muzzle rapidly tapering, long, and slender; the mouth is furnished with 42 teeth. The body, though apparently thick, owing to its hairy coat, is really lank, but strong and mobile; the legs are slender. The anal glands are strongly developed, giving the animal its well-known odour. The colour above is reddish-brown; the brows, shoulders, and posterior portion of the back, as far as the root of the tail, are shot with white, the hairs in these regions having white tips. The hair on the lips, cheeks, and throat is white, and a streak of the same colour runs down the legs; the breast and belly are ashy and the flanks whitish gray, the feet red, the ears and toes black, and the tail reddish shot with black, and usually with a white tip. These various tints blend gradually into each other, and produce a *tout ensemble* which renders the animal remarkably inconspicuous.

Sportsmen have an extensive technical vocabulary for all that concerns the fox: the female is a 'vixen,' the young, 'cubs;' his head, a 'mask' or 'pate,' his feet 'pads,' and his tail a 'brush;' his dung is known as 'billet,' and his home is a 'kennel,' or, if underground, an 'earth.'

Common Fox (*Vulpes alopex*).

Foxes occupy burrows in the ground, generally utilising those which have been made by badgers, while occasionally they live in company with these animals. These dens are preferably on the sides of hills, the apertures leading downwards and outwards, and consist of a central chamber with several means of exit. When suitable burrows are wanting, hollows under piles of stones, or even hollow trees have been used.

The fox's food embraces a wide range of nutriment, from a fawn or a lamb to beetles, or even vegetables or fruit; nothing comes amiss. Mice form a large percentage of his diet, and when half-sated he will play for long with his food before eating it. He hunts almost exclusively by night, and in his wanderings chooses the most secluded ways and takes advantage of every particle of shelter which the nature of the ground affords when passing from one covert to another. He is fond of warmth, and if undisturbed will bask for long in the sunshine; he runs rapidly and with great endurance, swims well, and has been known to climb trees in the search after eggs. The usual cry is a short bark, most commonly heard at the pairing season; the young ones use their voices freely when hungry. The pairing takes place in February, and the period of gestation is 60–63 days. Before the birth of the young, of which there are usually 4–7, the vixen pulls out the hair from her belly, partly to provide a soft bed for her offspring and partly to expose her nipples ready for their use. When born they are very helpless (both eyes and ears being closed) and covered with smooth brown fur. At six weeks old they appear outside the burrow, and at three months go hunting either alone or with the mother, who tends them with the utmost solicitude, and will face any danger or run any risk in their defence. A vixen has more than once been caught with no more than a mouse in her own stomach carrying home a plentiful supply of larger game to her young.

The fox's mental qualities are of a very high order. His cunning is proverbial, and his knowledge of localities and ability to profit by experience

have been highly developed in an arduous struggle for existence. 'More elegant than his relatives in mien and bearing; sharper, more prudent, calculating, and adaptive; of strong memory and sense of locality, resourceful, patient, resolute; equally skilled in jumping, slinking, crawling, and swimming, he seems to unite in himself all the qualifications of a perfect highwayman, and, when his lively humour is also taken into consideration, produces the impression of a highly educated artist in his own line.' When taken very young the fox has been successfully tamed, but he does not exhibit that capability for domestication for which his congener the dog is so remarkable. With this latter, however, he agrees in the parasites by which he is infested and the diseases to which he is liable. Even hydrophobia has been known to attack him, and to have been by him communicated to human beings. He has many enemies; the wolf and dog attack and kill him even when they do not devour; the hawk and eagle take the cubs, and the latter sometimes the adults. His chief foe is man. In northern countries where he is abundant the fox is slaughtered for his fur. The skins are brought from Poland, Russia, and the whole of Siberia. The black variety is much rarer and consequently more valuable than the red.

In Britain the fox has a factitious value as the object of a time-honoured sport, which, though it leads to his being pursued to the death by horse and hound, is still the sole reason why he has not long ago shared the fate of the wolf (see FOXHUNTING). In former days many foxes were dug out of their holes in Germany for the sport of 'tossing.' Long, narrow nets were spread out in front of the holes, the opposite ends of each being held by a lady and gentleman; as soon as reynard in his attempt to escape ran upon the net this was suddenly tightened and the unfortunate creature hurled aloft like a schoolboy in a blanket; and this was repeated until he happened to fall upon solid ground and eluded his tormentors.

Several varieties of the common British form are known to sportsmen; the *Greyhound Fox*, which occurs in the mountainous parts of England and Scotland, is tall, long-limbed, and strong; the *Mastiff Fox* is shorter and stouter, whilst the *Cur Fox* is known by his black-tipped tail. In addition to these several more conspicuous variations have received names and been by some regarded as distinct species. The Coal Fox (*V. alopex*) is found in Switzerland and Bavaria, and has a black-tipped tail. The Cross Fox (*V. crucigera*) is distinguished by a longitudinal dark line down the back and a transverse one over the shoulders. The Black-bellied Fox (*V. melanogaster*) is restricted to the south of Europe, and is sufficiently described by its name.

The Red Fox of North America (*V. fulvus*) is very little removed from its European congener: it is not so enduring, but runs with great speed for about 100 yards. Its skin is eagerly sought, and no less than 60,000 come annually to the London market.

(2) The Gray Fox (*Vulpes cinereo-argentatus, V. virginianus;* sometimes made the type of a distinct genus Urocyon) is somewhat smaller than his European relative, and has comparatively longer legs and a shorter tail; the colour is a peculiar speckled gray, due to the hairs being white at the roots and black with white rings in the distal portions. It is abundant in the southern United States, but does not occur north of Maine. It is not so swift as the red fox, but is even more cautious and timid, though its habits are in general similar. It has been seen to stalk game like a pointer.

(3) The Corsac or Steppe Fox (*Vulpes corsac*) is the Asiatic representative of the common fox; than this it is decidedly smaller, measuring at most 3 feet in length; it is also somewhat taller, and shorter in the tail, and has a rounder pupil. The colour in summer is reddish, but in winter it becomes paler owing to the development of a white ring round the individual hairs near their extremities. The throat, lower surface of the body, and inner surfaces of the legs are yellowish-white, and there is a three-cornered, dark-gray patch in front of each eye. The tail is dark above, and has a black tip. This species extends from the Caspian Sea to Mongolia, wherever there are extensive steppes, but it never occurs in forests or mountains. Its habits are like those of the European form. It is eagerly pursued by the Kirghiz and Turcomans for the sake of its fur: all the ordinary means are employed for its capture, and in addition eagles are trained to hunt it, and it is forcibly dragged from its earth by an apparatus resembling a magnified corkscrew. About 50,000 skins are said to come into the market annually.

(4) The South African Desert Fox (*Vulpes caama*) is only about half the size of the European fox, and is said to live almost entirely on ostrich eggs, which it rolls from the nest to its burrow and then breaks against a stone.

(5) The Fennec (*Vulpes zerdo* or *V. cerdo*) is a delicately-formed little creature, remarkable for its large eyes and enormous ears, which have led some authorities to place it in a special genus (Megalotis). It is found in the deserts of northern Africa and the adjoining parts of Asia, and lives in burrows in the ground, usually near the roots of shrubs. Unlike the common fox it excavates its own home, and is able to dig so rapidly that it can often hide in this manner when pursued. Small birds are its favourite food, but it will also eat lizards, beetles, and grasshoppers, or even vegetable products such as dates or melons: fennecs have been supposed by some to be 'the little foxes that spoil the vines' of Scripture. They produce three or four young ones at a birth, which are tenderly cared for by the mother. When taken young they soon become very tame; they are captured by snares fastened at the entrance of their burrows, and, strange to say, they make no attempt to bite the nooses, though they struggle hard to break them.

(6) The Arctic Fox (*Vulpes lagopus*) is very well characterised by its short, blunt snout, rounded ears, short legs, and hairy covering to the soles of the feet, whence the specific name. The summer coat is brownish or gray above and on the sides, and white below; but as winter approaches the colour of the whole becomes pure white, although individuals are occasionally observed which have not changed their hue. The species is distributed over the polar regions of both the Old and New Worlds, as well on islands as on continents: it only wanders exceptionally south of the 60th parallel of latitude. The cubs are born in the latter half of June, the vixen choosing a cleft in the rock or some similar position for her nursery. Its food consists of any animals which it is strong enough to overpower, especially mice and lemmings; but in case of need it will eat creatures of any kind that may be cast up by the sea, and will even venture into the huts of the Eskimo and steal whatever it can carry away, whether edible or no. When food is abundant it will conceal it and return to its store in time of need. In character it presents a curious mixture of cunning and of impudence. Steller records that during his stay on Behring Island the foxes would come and try to take the meat from the hands of himself and his comrades, gnaw their boots, or sniff around their faces as they lay asleep; and also that in spite of numbers being slain they did not become shy. That this was not entirely due to lack of acquaintance with human beings is shown by their exhibiting the same characteristics in

Norway. When young they can be easily tamed, and as pets have the advantage of being free from the disagreeable odour associated with most foxes. The fur is a marketable article, though not so valuable as that of the other species. About 10,000 skins are brought to Britain yearly.

Fox, CHARLES JAMES, Whig statesman, was a son of Henry Fox, first Lord Holland, by Lady Georgiana Carolina, eldest daughter of the Duke of Richmond. He was born on the 24th January 1749, and was educated at Eton and Oxford, spending part of his vacations on the Continent in the gayest and wittiest circles of the French capital, and visiting Switzerland and Italy. Notwithstanding the irregular life which he led even as a schoolboy, he was very distinguished for ability both at school and college; and so high was his father's opinion of his talents that at the age of nineteen he had him brought into parliament as member for the borough of Midhurst, a step to which he is said to have been further incited by the fact that, even at this early age, Fox's energies had found an outlet in gambling and other forms of dissipation. His precocity in vice, as well as in intellectual development, is said to have been the result of the injudicious fondness of his very unprincipled but very gifted father. Till he attained his majority Fox prudently kept silent in the House, but immediately thereafter he appeared as a supporter of the administration of Lord North, and was rewarded with the office of one of the lords of the Admiralty. In 1772 he resigned that office owing to a difference with Lord North, but the following year was named a commissioner of the Treasury. From that post he was dismissed two years afterwards, in consequence of another quarrel with Lord North, and passed over to the ranks of the opposition. During the whole course of the American war he was the most formidable opponent of the coercive measures which were adopted by the government, and the most powerful advocate of the claims of the colonists; acting, to this extent at least, in accordance with the views which for many years before had been urged upon the country by the great Lord Chatham. The difference between them was that, whereas Lord Chatham urged conciliation in order to preserve the connection between the two countries, Fox foresaw and foretold the necessity and the advantages of complete separation.

In 1782, on the downfall of Lord North, Fox was appointed one of the secretaries of state, which office he held till the death of the Marquis of Rockingham. On the dissolution of the Shelburne administration in 1783 the North and Fox coalition was formed, and Fox resumed his former office; but the rejection of his India Bill by the House of Lords soon after led to the resignation of his government. It was now that Pitt came into power, and that the long and famous contest between him and Fox, who occupied the position of leader of the opposition, commenced. In 1788 Fox enjoyed a short respite from his public labours. Accompanied by his wife, he visited the Continent, and after spending a few days at Lausanne in the company of Gibbon, who was there engaged in writing his famous history, he set out for Italy. The sudden illness of the king, however, and the necessity of constituting a regency rendered it undesirable that he should be longer absent from England, and he hastened back to his post. The regency, the trial of Warren Hastings, the French Revolution, and the events which followed it gave ample scope to the talents and energies of Fox, and on all occasions he employed his influence to modify, if not to counteract, the policy of his great rival. He was a strenuous opponent of the war with France, and an advocate of those non-intervention views which find greater favour in our day than they did in his. After the death of Pitt in January 1806, Fox was recalled to office, and endeavoured to realise his doctrines by setting on foot negotiations for a peace with France, the results of which he did not live to witness. He was on the point of introducing a bill for the abolition of the slave-trade, when he died at Chiswick, on the 13th September 1806, in his fifty-ninth year. In private life Fox was a genial companion, kindly and sincere in the closer relations of friendship, whilst his conduct to those to whom he was opposed in public was generous, and free from every trace of malignity or enmity. Lord John Russell, in the preface to his *Memorials and Correspondence*, speaks of the singular candour, boldness, simplicity, and kindness of his character; and of his oratorical powers it is enough to record that Burke called him 'the greatest debater the world ever saw,' and Sir James Mackintosh, 'the most Demosthenian speaker since Demosthenes.' His remains were interred in Westminster Abbey, near to those of Pitt.

See, besides the *Life and Times* and the *Memorials and Correspondence*, by Earl (then Lord John) Russell, the *Character of the Late C. J. Fox*, by Dr Parr (1809), and the interesting *Early History of C. J. Fox*, by Sir George Trevelyan (1880).

Fox, GEORGE, the founder of the Society of Friends (q.v.), commonly called Quakers, was born in July 1624, at Drayton, near Rockingham, Leicestershire. His father, a woollen-weaver, apprenticed him at an early age to a man who combined the trades of shoemaking, wool-dealing, and farming. With him George was principally employed in tending sheep—an occupation which suited his meditative disposition. When about nineteen years of age his religious convictions deepened to such an extent as to make him believe he was the subject of a special divine call to leave his native place and his friends, 'to forsake all, young and old, to keep out of the way of all, and to be a stranger to all.' Bible in hand, he wandered about the country, spending even his nights in the open air, a small competency he had supplying his slender wants. From his clothing he became known as 'the man in the leather breeches.' He soon began to attend meetings, and often to interrupt divine services, especially when these were conducted by 'professors,' persons whom he believed to be formalists and not genuine Christians, and when held in 'steeple-houses' and called together by church-bells, to which he had a special antipathy. The church he held to be the pillar and ground of truth, made up of living stones and lively members, a spiritual house of which Christ is the head. He was not, he said, the head of a mixed multitude, or of an old house composed of lime, stone, and wood. The 'inner light,' in which all orthodox Christians now believe, though to him it seemed a special revelation which he afterwards found in the Scriptures, was the central idea of his teaching. He was not only a great religious, but a great social reformer. As the former he inveighed against everything approaching to sacerdotalism and formalism. As the latter he ran a tilt against all social conventionalism. Not only priests, but lawyers and soldiers, were obnoxious to him as the embodiment of principles which he hated. Everywhere he went he was a marked man: his dress, his mode of speech, his manners, were different from those of others. 'The Lord' forbade him 'to put off his hat to any, high or low,' and 'he was required to *thee* and *thou* all men and women, without any respect to rich or poor, high or low, great or small. And as he travelled up and down, he was not to bid people *good morning* or *good evening*, neither might he bow or scrape with his leg to any one.' He saw the evils of intemperance, and denounced all public

amusements. He thus came into collision with all sorts of people, and his life is indeed little else than a record of insults, persecutions, and imprisonments, to which his zeal and indiscretions subjected him. His experiences of prison were numerous, and of such a nature as to make him one of the earlier of prison reformers. Arrested on one occasion by Colonel Hacker, he was taken to London to be examined by the Protector, who became convinced of his sincerity and of the harmlessness of his tenets. This, however, did not prevent the continued persecution of himself and his followers, who in 1656, the year after they refused to take the oath of abjuration, had increased to such an extent that there were nearly one thousand of them in gaol. He visited Wales and Scotland, and after his marriage to the widow of Judge Fell he went to Barbadoes, Jamaica, America, Holland, and various parts of Germany. In these later wanderings he was accompanied by Penn, Barclay, Keith, and others of the more eminent of the second generation of Quaker ministers. He died 13th November 1690. Amongst his last words were: 'All is well. The seed of God reigns over all, and even over death itself.' Full of personal peculiarities, guilty of many indiscretions, he was yet an amiable and Christ-like man, with a heart full of love for his fellows, and a mind so capable and comprehensive as to enable him to institute the admirable systems of registration, poor relief, education, and self-help, which have made the sect he founded a real social power. His preaching and writings were often turgid, incoherent, and mystical. As a writer he will be always remembered by his *Journal*, full of heart and intellect, valuable as giving with extreme simplicity and an unflinching regard for truth a record of his own life, and of the manners and customs, especially of the poorer classes, in the stormy times in which he lived. His writings were collected and published in 3 vols. (1694–1706). In 1852 an edition in 8 vols. was published at Philadelphia, United States. The exhaustive list of his writings in Joseph Smith's *Descriptive Catalogue of Friends' Books* (1868) occupies no less than fifty-three pages.

See Sewell's *History of the Quakers*; *The Quakers*, by Principal Cunningham; Neal's *Puritans*; Marsh's *Life of Fox* (1848); Lives by Janney (Phila. 1853) and John Selby Watson (Lond. 1860); and *George Fox and the Early Quakers*, by A. C. Bickley (Lond. 1884).

Fox, WILLIAM JOHNSON, orator and political writer, was born in 1786 near Southwold, Suffolk, the son of a small farmer, who afterwards settled as a weaver at Norwich. Sent to Homerton College to be trained for the Independent ministry, he subsequently seceded to Unitarianism, and ultimately delivered a series of prelections at his chapel in South Place, Finsbury, which marked him out as the leader of English rationalism. When the Anti-corn-law League enlisted the ablest platform orators of the day in the service of free trade, his bold and impassioned rhetoric greatly contributed to arouse and intensify public feeling. M. Guizot quotes his speeches as the most finished examples of oratory which the great conflict produced. Their effect upon the vast metropolitan audiences to which they were addressed was electric. Fox also contributed by his pen to the success of free trade, and his *Letters of a Norwich Weaver Boy* were largely quoted and read. From 1847 till 1863 he sat as an advanced Liberal for Oldham in parliament, where his success was hardly equal to the oratorical promise of his platform and pulpit career. His best parliamentary speeches were upon the education of the people. One of the earliest contributors to the *Westminster Review*, he edited for many years the *Monthly Repository*, and published many lectures, &c., collected in the Memorial Edition of his works (12 vols. 1865–68). He died 3d June 1864.

Fox Channel, the northern portion of Hudson Bay, washing the western shores of Baffin Land, takes its name from Luke Fox, an English navigator, who was born about 1585, explored Hudson Bay in 1631, and died subsequent to 1635.

Foxe, JOHN, the martyrologist, was born of respectable parents in 1516, at Boston, in Lincolnshire. At sixteen a fellow of Brasenose College brought him to Oxford, apparently as a private pupil. He seems to have attended Magdalen College School, and to have become an undergraduate of Magdalen College. He took his bachelor's degree in 1537, his master's in 1543, and was elected a fellow of Magdalen in 1538. He had already acquired a reputation by his Latin verses, but soon gave himself to the study of the Fathers, and of the theology of the Reformers, with the result that he found his position among less advanced colleagues at Magdalen irksome, and voluntarily resigned his fellowship in 1545. For some time he was employed as tutor to the children of William Lucy of Charlecote, Warwickshire; there he married early in 1547, and afterwards was engaged by the Duchess of Richmond as tutor to the children of her brother, the Earl of Surrey, who had been executed, 19th January 1547. During the reign of Mary, for safety's sake he retired to the Continent, and at Strasburg, Frankfort, or Basel met all the leading Reformers, including Knox, Grindal, and Whittingham. At Basel he was employed as reader for the press in the printing-office of Oporinus. He returned on the accession of Elizabeth, was pensioned by his old pupil, now Duke of Norfolk, and received, in May 1563, a prebend in the cathedral of Salisbury. He lived chiefly in Cripplegate, London, and often preached. For a year he held a stall at Durham. But he was prevented from further preferment by his conscientious objection to wearing the surplice and other practices of the establishment. To his credit it must be said that he pleaded for religious toleration when some Dutch Anabaptists were condemned to the flames in London in 1575. He interceded for them with Queen Elizabeth and other persons in authority, but without effect. He died in 1587, and was buried in London, in the chancel of St Giles's, Cripplegate. Foxe published numerous controversial treatises and sermons, besides an apocalyptic Latin mystery play, called *Christus Triumphans* (Basel, 1556). But the work that has immortalised his name is his *History of the Acts and Monuments of the Church*, popularly known as *Foxe's Book of Martyrs*, the first part of which was published in Latin, in an octavo volume, at Strasburg in 1554, reprinted along with five other books at Basel in a folio volume in 1559. The first English edition appeared in 1563, in one volume folio. Sanctioned by the bishops, it was ordered by a canon of the Anglican Convocation meeting in 1571 to be placed in the hall of every episcopal palace in England; and it went through four editions in Foxe's lifetime, and numerous others since his death. Apart altogether from the vexed question of its historical value, it will survive as a noble monument of English. Foxe's statements cannot be accepted as trustworthy evidence, if unsupported from other sources. His story is doubtless substantially true, although his credulity and bitter prejudice hardly suggest critical capacity in the selection of his authorities.

He was warmly commended by Strype (who came into possession of Foxe's MSS.), Whitgift, Camden, Burnet, and Thomas Fuller. Apart from

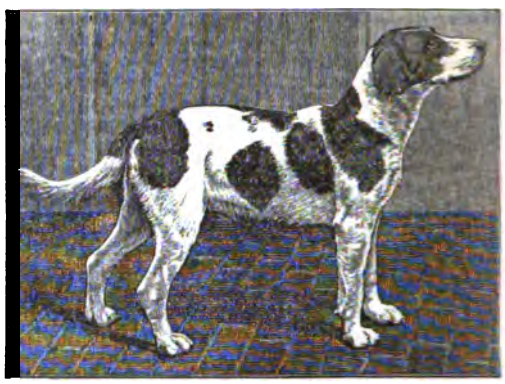
Roman Catholic critics, many of whose attacks are justifiable, Foxe's exaggerations and want of historical precision have been best exposed by the Rev. Dr S. R. Maitland, in a series of pamphlets issued between 1837 and 1842. The biography of Foxe, attributed to his son Samuel, and published in both Latin and English in the 1641 edition of the *Acts*, is certainly apocryphal, although it has formed the basis of numerous popular memoirs.

The best edition is that in the 'Reformation' series of the Ecclesiastical Historians of England, edited by R. R. Mendham and Josiah Pratt (8 vols. 1853 *et seq.*), with Canon Townsend's vindication against the attacks of Romanists.

Foxglove, a species of Digitalis (q.v.). The Common Foxglove (*D. purpurea*) is a native of Britain, and a familiar and conspicuous ornament in woods and hedgerows, its flowering stem reaching a height of from 2 to 4 feet, or even more. It flowers from June to August. Both it and its white-flowered variety are frequently planted in gardens and shrubberies. Its English name, the German name Fingerhut ('thimble'), and the botanical name Digitalis (Lat. *digitale*, 'the finger of a glove') refer to the form of its flowers. The foxglove was a favourite with the fairies, and was called in Ireland Fairy-cap, and in Wales Elf-glove, elsewhere Fairy-fingers, Fairy-petticoats. But there seems no good ground for the attempt to make out that foxglove is a corruption of Folk's-glove, for Good-folk's Glove, or Fairy-glove. Another English provincial name is Fox-fingers.

Common Foxglove (*Digitalis purpurea*).

Foxhound. On no breed of dog, with the possible exception of the greyhound, has the same care and attention been spent as on the modern foxhound, with the result that hardly any four-footed animal, certainly no domestic animal, combines in the same degree speed and lasting qualities. This is probably the result of a cross between the old southern hound and the greyhound, which combined the nose and tongue of the former with the speed of the latter. When the large woods began to disappear, and more 'blood' was used in our hunters, the pace of the hound was found to be still too slow. The foxhound continued to be bred for speed, until now we have a hound possessing a dash wholly unknown to the original foxhound, and capable of getting away from a large field of horses. The head of the foxhound should be large, deep through the muzzle, but without throatiness or heaviness; teeth, strong and even; shoulders, oblique and muscular; back, short and strong; legs, with great bone perfectly straight in front; hocks, well let down behind; feet, round with arched toes; ears, naturally long and graceful, but always 'rounded' or shortened to prevent tearing when working in coverts; colour, white, with black or tan markings, sometimes to a great extent; height, 22 to 24 inches. In addition to the necessary amount of speed the foxhound must possess staying powers of a high order, a good nose, and be without a tendency to 'babble' or 'run mute'—i.e. to give tongue when not on a scent, or the opposite fault, to refuse to speak to a scent.



Foxhound.

In breeding a pack of foxhounds the individual hound must not be considered, but the speed of the whole pack must be increased or reduced as necessity demands, so as to have the whole pack hunting together.

Foxhunting. References to early foxhunting prove no more than that the fox was hunted, though in a manner vastly different from that which obtains at the present day. Of details there is a lack; it will therefore be sufficient to cite shortly a few excerpts from antiquity introductory to foxhunting as indulged in for amusement. To begin with, we find that William de Foxhunte looked after the six couple of foxhounds, William Blatherwick, two boys, and a horse to carry the nets, all of which constituted the foxhunting establishment of Edward I. In the *Records of the Chase*, 'Cecil' mentions an old treatise on hunting, ascribed to Edmund de Langley, one of the sons of Edward III., who began to reign in 1327, in which the 'ffox' is enumerated as a beast of the chase. Richard II., whose reign commenced in 1377, granted permission, by charter, to the Abbot of Peterborough to hunt the fox; and at the beginning of his reign Henry IV. (1399–1413) confirmed to Henry de Popham in fee his lands at Farringdon, and granted him leave to have his braches for taking hares and foxes in the county of Southampton. Up to this time, however, and for more than a couple of centuries later, the fox was not hunted in modern style; he was simply hunted for extermination, and was driven into nets, or run to ground and dug out; and in Gervase Markham's work, entitled *Country Contentment*, published in the year 1615, the fox is given only inferior rank as a beast to be hunted; while about 1639 Oliver St John, in a speech against Strafford, compared him to a fox, 'a beast of stinking flight,' whose death might be encompassed by any means, fair or foul. Soon after this period foxhunting appears to have attained to greater dignity, and, at least in some parts of England, to have become a distinct branch of sport. Theophilus, fourth Earl of Lincoln, who died in 1667, hunted round about Retford; but his were no doubt staghounds, the change to foxhounds taking place at a later period. In the fifteenth volume of

the Sussex archæological collections there appears at page 74 an account of the Charlton Hunt (now the Goodwood) in Sussex. According to Mr Bennett, the writer of the article, the Duke of Monmouth and Lord Grey kept a pack of foxhounds which were managed by Mr Roper, a native of Eltham in Kent, for some time prior to Monmouth's abortive attempt to seize the crown; and when that took place Mr Roper had to flee to France; whence he returned on the accession of King William III., by which time the hounds, the management of which he resumed, had become the property of the Duke of Bolton and himself. Mr Roper died in the hunting-field at the age of eighty-four, in the year 1715. The Duke of Bolton kept the hounds for a short time longer, and then made them over to the second Duke of Richmond, and they remained in the family till 1813 or 1815, when the fourth duke gave them to the Prince of Wales, and they became the royal staghounds. At what precise date the Charlton Hunt was established is not known, but it was obviously prior to 1689, the year of William III.'s accession. The Sinnington (Yorkshire) hounds are said to be the descendants of the Duke of Buckingham's pack, which hunted the old Hambleton country in 1686; while in 1698 Mr Boothby was hunting what is now the Quorn country. The Brocklesby (Lincolnshire) were founded in 1713, though it is evident that the packs which then amalgamated were in existence earlier. In 1720 Mr Bright was hunting the Badsworth country in Yorkshire; and in 1730 Mr Thomas Fownes of Stapleford, Dorset, hunted there, and eventually sold his pack to go into Yorkshire. The famous Belvoir pack was founded by the third Duke of Rutland about 1740; as early as 1750 Mr Noel must have had the Cottesmore; and in the same year Lord Spencer became first master of the Pytchley. Sir Thomas Gascoigne hunted a large district in Yorkshire, including what is now Lord Middleton's country, about the year 1762, and about that time the fifth Duke of Beaufort changed from staghound to foxhound. In the middle of the 18th century, too, foxhunting was carried on in the New Forest by Sir Philip Jennings; and in 1757 a certain Sir John Millar sold his hounds to the third Duke of Richmond, but in what part of England Sir John hunted cannot be discovered. Mr Gobsall had kennels at Bermondsey in 1750, and hunted a great deal of Surrey; while about the same time Mr John Elwes, the miser, kept hounds at Stoke, in Suffolk, and, in the exercise of the rigid economy which he always practised in connection with everything save the purchase of his horses, compelled his huntsman to discharge, in addition to the duties of the kennel, those of valet, cook, cowman, and farm-bailiff.

Of the details of the majority of the above-mentioned packs little is known beyond the fact that they existed. Occasionally passing mention is made of them in the papers of the date; and, if the master happened to be a man of more than ordinary note, his hunting establishment was mentioned in connection with his biography. Moreover, in early times hounds were kept in an unpretentious sort of way, and were probably deemed no more worthy of record than the possession of a brace of greyhounds or a small kennel of pointers or setters for shooting purposes. It was not until the first number of the *Sporting Magazine* made its appearance in October 1792 that a publication chiefly confined to sporting matters existed, and by that time foxhunting had increased in importance; there was scarcely a quarter of England at the close of the last century which was not hunted over, though the several countries were of far greater extent than at present. To give a few instances: the Brocklesby country at first took in not only that portion of Lincolnshire now hunted by Lord Yarborough's hounds, but the district afterwards occupied by the Burton, Southwold, and Blankney as well. The Berkeley country extended from Bristol to London; the Cottesmore comprised a great deal more of Leicestershire than it does now; and the Duke of Beaufort hunted from Badminton to Chipping Norton, in Oxfordshire, where he had outlying kennels. Of the above-mentioned packs several have preserved an unbroken existence from the time of their foundation down to the present day. Among them are the Duke of Beaufort's, the Belvoir, the Cottesmore, the Brocklesby, Lord Middleton's, the Sinnington, the Badsworth, Quorn, Pytchley, New Forest, and Surrey; though in some cases the names under which they now figure on the list did not attach till a later period; while in other instances the change in the boundaries and extent of various hunts has been so great as to preclude us, on the score of accuracy, from saying that they ever had a common ancestor. It would be an injustice to the sporting spirit and liberality of masters past and present to omit mention of the fact that from the earliest times many packs have been kept up at the sole cost of the owner, the Duke of Beaufort's and the Belvoir standing out as special examples of generosity and unselfishness. Two Sir Watkin Wynns have found their friends and neighbours in gratuitous sport; and when the late Lord Middleton in 1861 found it necessary to ask the country-side to assist him with a subscription, he stated that his family had expended nearly £100,000 in maintaining the pack. The Blackmoor Vale is another hunt to which no one has been asked to subscribe, and the Fitzwilliam pack was for a long time kept up free of cost to its followers, just as Earl Fitzwilliam's are now. The majority of packs, however, are maintained by subscription, the money contributed being expended in the purchase and keep of horses, wages of hunt-servants, helpers, and kennel-men, keep of hounds, and, in hunts in which breeding is not carried out on a sufficiently large scale to maintain the strength of the kennel, in the purchase of hounds. Coverts are also rented, and the damage caused by foxes to poultry is made good; but for this purpose there is usually a special fund, called the 'poultry fund.' The cost of keeping up a pack of foxhounds in good style may be roughly set down at about as many times £600 as a pack hunts in a week—e.g. a two-days-a-week pack would cost about £1200; £1800 would be needed for one hunting three days a week, and so on. But no hard and fast line can be drawn, because in some hunts the above estimate is not reached, while in the maintenance of others it is largely exceeded.

The subdivision of countries, consequent upon the multiplication of packs of hounds, has necessarily enabled persons living at such places as Rugby, Cheltenham, Oxford, or Melton Mowbray to hunt with several packs of hounds; and, as pretty nearly every country has its good and bad side, the result often is that the same faces are seen out with each of the packs on the good days. Then again railways convey persons from convenient hunting centres and from towns at comparatively small cost, so that in one way and another fields sometimes attain to such proportions as to threaten sport and to cause infinite damage to those whose land is ridden over. In the Whaddon Chase Hunt (Mr Selby Lowndes's) it has long been the custom to expect every one coming out with the hounds to contribute at least £25; but so far as those living beyond the confines of the hunt are concerned the Essex were, it is believed, the first to legislate. In 1886 a rule was passed providing that every stranger should subscribe at

least 30 guineas to the funds; and in the course of the season 1888–89 the committees of the Bicester and Pytchley hunts enacted that all not living in those countries or in the immediate neighbourhood should subscribe a minimum of £25; and these examples will no doubt be largely adopted in the future in countries which attract strangers.

At the commencement of the season 1888–89 there were in England 154 packs of foxhounds; in Scotland, 9; and in Ireland, 17. Exclusive of those which had not been entered, there were 11,612 hounds in England, 584 in Scotland, and 1166 in Ireland; and the number of hunting fixtures in each week were: in England, 447; in Scotland, 25; and in Ireland, 44. If, then, each of these days be estimated to cost £600, as an approximate way of arriving at the total expenditure, it will be found that masters of hounds in England spend, roughly speaking, £268,200; in Scotland, £15,000; and in Ireland, £26,400. To these large sums must be added the amount expended on rent, stabling, horses, forage, harnessmakers, blacksmiths, and others by those who follow the different packs of hounds, and it will then be seen that foxhunting causes the circulation of a great deal of money, while it also finds employment for a large number of men in the capacities of hunt-servants, feeders, and helpers in the stables.

When hunting first came to be regarded as an amusement for country gentlemen, the hounds met early in the morning, soon after daylight in fact, and found their fox by tracking him to his kennel by means of his 'drag'—that is to say, the line he had taken in the small hours of the morning on returning from his search after food; and this custom still obtains in some of the moorland countries like those of the Coniston and Border hunts, where hounds hunt over open ground, and where there are scarcely any regular coverts for foxes. In countries like these it might take two or three days to find a fox in the ordinary way; but as the pack traverse the open in the morning they generally come across the drag, which they hunt until they come up to their game. In more fashionable hunts, however, the hour of meeting is at 10.30 or 11 o'clock, and the hounds are at once taken to draw the various woods, spinnies, or gorses of the district, whither the fox will have retired after his night's prowl. When he is found, the time which elapses before he 'goes away' depends partly upon the size of the covert, and partly upon his own inclinations. When, however, he does break covert he is allowed to travel some little distance before the whipper-in, or whoever may happen to see him, announces the fact by hallooing, the reason being that if he were not permitted to get some little way from the covert the noise would certainly cause him to turn back again. The huntsman and hounds with all speed make their way to the spot whence the halloo proceeded, and what subsequently happens is to a great extent a matter of chance. There are several circumstances which combine to bring about a bad run. The first is the absence of scent; and of the laws which govern scent we know no more to-day than our grandfathers did. It frequently happens that hounds will run well in the morning, and cannot, in foxhunting parlance, 'run a yard' in the afternoon, or *vice versâ;* while sometimes scent fails suddenly in the course of a run. On days which appear highly favourable for hunting hounds are often unable to follow their fox; and, *per contra*, excellent runs are often enjoyed under what would seem to be highly adverse conditions. The poet who wrote 'a southerly wind and a cloudy sky proclaim a hunting morning' could not have been a practical foxhunter, as in almost every country in the United Kingdom sport is best when the wind has some east in it. Secondly, the fox may 'run short,' as it is termed—that is to say, instead of at once making for some distant point, he may be ignorant of all except the country immediately surrounding the covert in which he was found, and may keep turning and twisting, with the result that the hounds are often baffled. Or, again, the fox may be headed and turned back into the mouths of the hounds; while another fruitful cause of bad sport is the overriding of the hounds by the field.

A hunting establishment comprises, in the first place, the master; or, if it be found impossible to induce one gentleman to undertake the duty, the hunt is managed by a committee. Next comes the huntsman, who may be either a professional or an amateur; in the latter case he is almost invariably the master. When an amateur hunts the hounds, the first whipper-in usually discharges the duties of kennel huntsman—that is to say, he supervises the management of the pack in kennel. Some packs have one whipper-in, others have two. With a few packs there is a third hunt-servant, whose duty commonly consists in riding the master's or huntsman's second horse. In addition to the above there are feeders, a stud-groom to supervise the stable, and the helpers who do their work under him. In former times an earth-stopper or two was on the strength of every hunt, but the modern practice is to delegate this duty to the gamekeepers on the different estates, and they are paid a stipulated sum, usually £1 or £1, 10s., for each fox found in the coverts of which they have charge; but this reward is forfeited should the fox get to ground in an earth or hole which ought to have been stopped. The earth-stopping takes place in the small hours of the morning, while the fox is abroad in quest of food. Notice is sent to the gamekeepers a few days in advance, and so much of the country is stopped as is considered likely to suffice for the day's draws. The time for cub-hunting varies in different countries, and is governed by the time of harvest. In the course of September, however, all packs make a commencement, and regular foxhunting dates from about the 1st of November. In some countries the season is prolonged into May, but in the majority of places the farmers are glad to see hounds confined to kennel after the end of March.

Although the United Kingdom is the chief home of foxhunting, the sport is followed with the utmost zeal in other quarters of the globe. In Montreal a pack have preserved an unbroken existence since 1826; in Manitoba Englishmen have introduced their favourite sport; and in Florida a new departure is taken by foxhunting by moonlight. At the Cape and in Bechuanaland packs of foxhounds have been established. In New Zealand is a pack which hunt foxes and run a drag; military enterprise has transplanted foxhunting to Alexandria and Cyprus; and wolf-hunting is pursued in the Dakotas. In India the Peshawur Vale hounds are as famous as the Quorn or the Belvoir in England; the Maharajah of Mysore devotes no little attention and money to the maintenance of a pack of hounds; the Ootacamund hunt is a next-door neighbour; while the Dhariwal pack pursue the jackal.

See works by 'Nimrod' (1837; new ed. 1871); Radcliffe (1839; new ed. 1874); 'Scrutator' (1865); 'Stonehenge' (new ed. 1876); and that in the Badminton Library on *Hunting* (1885), by the Duke of Beaufort and Mowbray Morris.

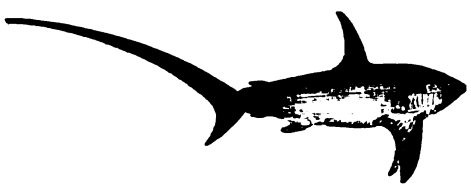
Fox Indians, a turbulent North American tribe of the Algonquin family, prominent in the wars of the 18th century, when its warriors sided alternately with the French and English. They also appeared as allies of the English in the war of 1812–14. A number now farm lands acquired by purchase in Iowa; but most of the tribe are settled, with the

kindred Sacs, on a reservation in Indian Territory, between the Canadian and Arkansas rivers.

Fox Islands. See ALEUTIAN ISLANDS.

Fox River, the name of two streams rising in Wisconsin. (1) The Fox River, or Pishtaka (220 miles), flows south to Aurora, then south-west to the Illinois, which it enters at Ottawa.—(2) The Fox River, or Neenah, after a tortuous but generally north-east course of about 250 miles, falls into Green Bay in Lake Michigan. It is divided into two sections by Lake Winnebago, the upper one being connected by a canal with the Wisconsin, so as to link together the Mississippi and the Great Lakes.

Fox-shark, or THRESHER (*Alopecias vulpes*), the commonest of the larger sharks occasionally seen off British coasts. It is the only species of its genus, and is widely distributed in the Atlantic and Mediterranean, also occurring off California and New Zealand. It is much smaller than the basking shark (*Selache maxima*), but attains a length of over 12 feet, of which half goes to the enormously elongated upper lobe of the tail, to the length and splashing activity of which the fish owes its names. The pectoral limb and the first dorsal fin are large; the snout is conical; the mouth and gill-apertures are moderately wide; the teeth are triangular and not serrated; the skin is bluish above, flesh-coloured below. The fox-shark follows

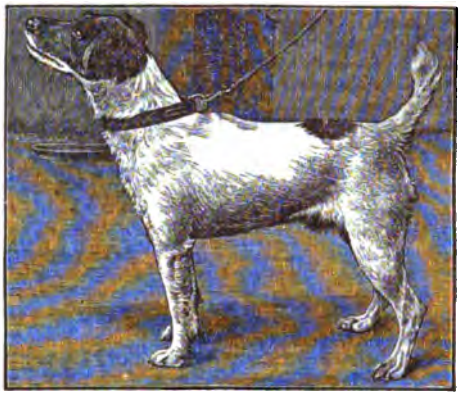


Fox-shark (*Alopecias vulpes*).

shoals of herrings, pilchards, and the like, threshing the water with its tail as it swims round its victims, which it destroys in great numbers. In spite of its size it is not dangerous to man, and Günther says that stories of its attacking large Cetaceans are erroneous. The flesh is said to have a salmon flavour. See SHARK.

Foxtail Grass (*Alopecurus*), a genus of Grasses, of which some species are much valued, particularly the Meadow Foxtail Grass (*A. pratensis*). This is one of the best meadow and pasture grasses of Britain, but does not arrive at full perfection till the third year after it is sown. It bears mowing well, and is reckoned a good grass for lawns. This, with Sweet Vernal Grass, is the earliest of British meadow grasses; it bears drought well, and thrives under trees. The Jointed Foxtail Grass (*A. geniculatus*), with an ascending culm bent at the joints, is very common in moist places, and cattle are fond of it, but it is a small grass. The Slender Foxtail Grass (*A. agrestis*) is an annual or biennial, of little value, although occasionally sown on very light sandy soils. See GRASSES, PASTURE.

Fox-terrier. The origin of the fox-terrier is somewhat obscure. From the earliest days of hunting a small dog has been used to follow the fox to its earth, but it is difficult to say when this dog became identical with the modern fox-terrier. The terriers which ran with hounds until the middle of the century were of all colours and coats; their owners, acting on the adage 'handsome is as handsome does,' bred solely for work and not for appearances. The white terrier with hound marking being found most suitable, it was bred with care, and became a distinct breed. Some smooth fox-terriers were exhibited about the year 1865, and, speedily catching the public taste because of their handy size and suitability to the house, soon became the most popular breed of the day. The wire-haired fox-terrier was not exhibited in public until



Fox-terrier.

the year 1872, the breed having a class set apart for it at Glasgow in that year. As the coat of this variety of the fox-terrier requires some attention, especially when kept for exhibition, it is not so common as the smooth section, though rapidly increasing in popularity. The chief points of the fox-terrier are: head, long, flat, rather narrow, but with powerful jaws and teeth; ears, small, V-shaped, and drooping forward; nose, black; eyes, small; back, short and strong; tail, generally cut short, set on high, carried gaily; fore-legs—an important point—must be straight, showing no ankle, good bone; hind-legs, rather straight, with long and powerful thighs; feet, round with arched toes; colour, white with black or tan markings—a point of little importance; weight, not more than 17 lb.; coat, in the smooth variety, short, hard, and dense; in the rough variety it should be half-an-inch long, but without any silkiness. The expression of the fox-terrier should be keen and hard, full of life and fire. Though the fox-terrier should not be quarrelsome, he should be ready to face anything in the way of his legitimate work. He is unequalled as a companion; and, as many fox-terriers have been kept for generations merely as companions, soft and degenerate specimens of the breed are common. But a genuine fox-terrier is of a bright and cheerful disposition, a splendid vermin-killer, fast enough to hunt, and small enough to enter an earth. See R. B. Lee, *History of the Fox-terrier* (1889).

Foy, MAXIMILIEN SÉBASTIEN, French general, was born at Ham, 3d February 1775. During the early wars of the Revolutionary period he served as an artillery officer in Belgium, and on the Moselle and Rhine, till by 1800 he had risen to the rank of adjutant-general. In 1801 he commanded a brigade during the Italian campaign, and in 1805 a division of artillery in the Austrian campaign. Two years later Napoleon sent him to Turkey to assist Sultan Selim against the Russians and British, and his defence of the Dardanelles obliged Duckworth, the British admiral, to retire with loss. From 1808 to 1812 he commanded, as brigade-general, in Portugal and Spain, and was present at all the battles of the Pyrenees, being dangerously wounded at Orthez in 1814. In 1815 he was again wounded at Waterloo, where he commanded a division under Ney. In 1819 he was elected deputy by the department of Aisne. In the chamber he was the constant advocate of constitutional liberty, and distinguished himself particularly by his eloquence in opposing

the war against Spain in 1823. Foy died at Paris, November 28, 1825. Madame Foy published in 1827, from her husband's papers, a *Histoire de la Guerre de la Péninsule*. In the previous year appeared his *Discours*, with a biography by Tissot.

Foyers, a stream of Inverness-shire, running 9 miles northward and falling into the east side of Loch Ness, nearly opposite Mealfourvonie and 10½ miles NE. of Fort Augustus. During the last 1¼ mile of its course it makes a total descent of 400 feet, and forms two magnificent cascades, 40 and 165 feet high. The lower, called specially *The Fall of Foyers*, is one of the finest in Britain.

Foyle, LOUGH, an inlet of the Atlantic, on the north coast of Ireland, between the counties of Londonderry and Donegal. It is 15 miles long, 1 mile wide at its entrance, and 10 miles broad along its south side; but a great part is dry at low-water, and its west side alone is navigable. Vessels of 600 tons ascend the lough, and, as far as Derry, its principal tributary the Foyle, which, formed near Lifford by the confluence of the Finn and the Mourne, has a north-north-easterly course of 72 miles.

Fra Angelico. See ANGELICO.

Fra Bartolommeo. See BARTOLOMMEO.

Fracas'toro, GIROLAMO, an Italian physician and poet, famous for the universality of his learning, was born at Verona in 1483. At the age of nineteen he was appointed professor of Logic in the university of Padua. He afterwards practised successfully as a physician, and it was by his advice that the Council of Trent moved from Trent to Bologna to avoid the plague. Some years before his death, which occurred at Casi, near Verona, on 8th August 1553, Fracastoro abandoned medicine for letters, and became intimate with some of the leading scholars of the age. The chief of his numerous writings are: *Syphilidis, sive de Morbo Gallico, Libri Tres* (1530; Lond. 1720); *De Vini Temperatura* (1534); *Homocentricorum sive de Stellis Liber* (1535); and *De Sympathia et Antipathia Rerum* (1546). His collected works appeared at Venice in 1555, and his poetical works at Padua in 1728.

Fraction. In Arithmetic, when a unit of any kind is divided into any number of parts, each is termed a *fraction* of the whole unit—e.g. one foot (lineal measure) is divided into inches; one inch is thus a fraction of one foot. The usual notation employed to denote the value of a fractional quantity is to place under a horizontal line the number of equal parts into which the whole unit has been divided; above the line is placed the number of these parts actually contained by the fraction. The former number is known as the denominator, the latter as the numerator of the fraction. Thus, 7 inches is expressed as the fraction of one foot by $\frac{7}{12}$. Quantities expressed in this way are termed vulgar fractions; they are *proper* or *improper* according as the numerator is less or greater than the denominator; and when the numerator and denominator have no common factor the fraction is said to be in its lowest terms. When the denominator is 10, or a power of 10, the quantity is termed a Decimal Fraction (q.v.). In Algebra the term fraction, while including the sense of the arithmetical definition, is generally used to mean that any quantity affected by it is to be multiplied by the numerator and divided by the denominator. The addition, subtraction, multiplication, and division of fractions are performed according to rules which are practically the same both in arithmetic and algebra. Such rules will be found in any competent text-book on these subjects.

Continued Fractions.—Any expression of the form $a + \cfrac{1}{b + \cfrac{1}{c + \cfrac{1}{d + \&c.}}}$ is termed a *continued fraction*. This expression is usually for convenience abbreviated to $a + \frac{1}{b+}\,\frac{1}{c+}\,\frac{1}{d+}$, &c. Such fractions may be terminating or non-terminating. A series of quantities which successively approach towards the actual value of such a quantity are termed *successive convergents* to the value of the fraction; they are alternately smaller and greater than its actual value. Such a series for the fraction above given is: a, $a + \frac{1}{b}$, $a + \cfrac{1}{b + \cfrac{1}{c}}$, &c.

Vanishing Fractions.—When, by giving to one of the terms in a fractional algebraical expression a particular value, both the numerator and denominator become zero, the expression is said to be a *vanishing fraction*. Such is the case in the quantity $\frac{x^3 - 1}{x - 1}$, when $x = 1$; and in $\frac{x}{\sqrt{a + x} - \sqrt{a - x}}$, when $x = 0$. But in the first case, by dividing both numerator and denominator by $x - 1$, the true value of the expression is $x + 1$, which is equal to 2 when $x = 1$. In the second example, by multiplying above and below by the complementary surd—viz. $\sqrt{a + x} + \sqrt{a - x}$, the fraction becomes equal to $\sqrt{a}$, when $x = 0$. Such methods for finding the true value of vanishing fractions are all more or less tentative. For a general process by which their value may be found, reference may be made to Williamson's *Differential Calculus*, chap. iv.; also article CALCULUS (DIFFERENTIAL and INTEGRAL).

Fractures, in Surgery, are classified in several different ways. As regards the fractured bone itself, it may be merely broken across, either transversely or obliquely, the commonest injury; or broken into several pieces (*comminuted* fracture); or only cracked (*fissured* fracture, the most usual fracture of the skull); or partly broken, partly bent (*greenstick* fracture, occurring in the bones of the limbs in children); or one part of the bone may be forcibly driven into the other (*impacted* fracture). But the most important classification of fractures is concerned with their relation to the surrounding parts. In a *simple* fracture there is no wound of the skin communicating with the fracture; in a *compound* fracture there is such a wound; in a *complicated* fracture there is some other injury (e.g. a flesh-wound not communicating with the fracture, a dislocation, a rupture of a large blood-vessel). The distinction between simple and compound fractures is of special importance, as the latter are very much more serious than the former, chiefly on account of the risk of pyæmia or septicæmia, and their repair much more tedious; though the dangers attending them have much diminished since the introduction of the antiseptic method. See ANTISEPTIC SURGERY.

Fractures are most common in the long bones of the limbs, particularly the collar-bone, the radius just above the wrist, the thigh-bone, and the fibula. They are rather less frequent in children than in adults, and much less in women than in men.

Causes of Fractures.—The *predisposing* causes which render bones specially liable to fracture may be local—e.g. necrosis or tumour affecting a single bone, or general—e.g. cancerous cachexia, the diseases called mollities and fragilitas ossium, and old age, all which render the bones generally less able to bear a strain. There is one predisposing

cause to fracture fortunately now but seldom seen —viz. scurvy. Not only did it make the bones brittle, but, as was seen in Lord Anson's expedition, which was manned chiefly by pensioners, old fractures again became disunited. The *immediate* cause may be either *external violence* or *muscular action*. The external violence producing a fracture may be either *direct* or *indirect*. In the former case the bone yields at the point where the force is applied, and there is always more or less bruising of the adjacent soft parts by the body which causes the fracture—e.g. when a limb is broken by a heavy wheel passing over it, or a stone falling upon it. In the latter case the bone gives way at some point between two opposing forces, and the adjacent tissues are not injured except by the broken ends of the bone—e.g. when a person falls upon his hand, and the radius or humerus gives way. The worst fractures are thus in general those produced by direct violence. Muscular action not unfrequently leads to the fracture of bones into which powerful muscles are inserted, particularly the kneecap, by simply tearing them asunder. The subject of the injury may then fall, and attribute the accident to the fall, whereas the reverse is the case. A medical man some years ago awoke with a fit of cramp, and almost immediately his left thigh-bone broke with a snap. It reunited in the usual time.

Symptoms of Fracture.—Fracture of a limb is attended by pain, swelling, and loss of power; but these do not suffice to distinguish it from other forms of injury. Deformity other than swelling (shortening, angling, or unnatural rotation of the injured limb), abnormal mobility at the seat of injury, and a rough grating sound and feeling (called *crepitus*) when the limb is so moved as to rub the broken surfaces together are the most satisfactory evidences of fracture. The patient, moreover, may have observed the sound of the break when the bone gave way. But in a case where fracture is suspected the investigation of it should be deferred till the patient has been placed where he is to be treated.

Repair of a Broken Bone.—The immediate result of a fracture is considerable extravasation of blood into the tissues around it, from the blood-vessels torn across by the injury. It is not quite certain whether some of this blood takes part in the healing process; most of it at all events is simply absorbed. But during the days following the fracture slight Inflammation (q.v.) of the wounded tissues takes place, and inflammatory lymph (here called *callus*) is thrown out between and around the broken ends of the bone. Slow organisation of the callus takes place, and in from three to six weeks it is usually converted into bone, firmly cementing the fragments together. In man, when the fracture is set in good position, there is generally little more lymph effused than suffices to restore the natural outline of the bone; but in animals the break is generally ensheathed in a large mass of it, called *provisional* callus, which steadies the bone till the *permanent* callus between the ends of the bones has become ossified; then the provisional callus, being no longer necessary, is absorbed.

Treatment of Fracture.—When a fracture has taken place it is important that there should be as little disturbance as possible of the injured part till it is to be finally adjusted by the surgeon. Many simple fractures, especially of the lower limb, are made compound by ignorance or carelessness on the part of the injured person or of officious onlookers. The injury should therefore be attended to first on the spot where it has been received; the limb should be fixed by handkerchiefs or strips of cloth to anything at hand firm enough to keep it temporarily steady (a walking-stick, rifle, broom-handle, &c.), or, in the case of the lower limb, to the other leg. When this has been done the patient may more safely be removed to the place where he is to remain during treatment.

The object of the surgeon in *setting* a fractured limb is to place the fragments as nearly as possible in their natural relation, and to retain them firmly in this position during healing. The first end is attained by extending the broken limb and moulding it with the hands; the second is opposed by the action of the muscles of the part which, pricked by the broken ends of bone and stimulated into painful spasms, tend to restore the deformity. Their action must be counteracted by the adjustment of some form of *splint* or external rigid apparatus to the limb, differing in material, shape, and method of application according to the seat of the fracture. Splints are usually made of wood, pasteboard, or gutta-percha, and fixed on by straps or bandages; but in some simple fractures, especially of the lower limb, it has been found sufficient to encase the injured limb in a bandage impregnated with some material which will harden on drying and form a shell for it (starch, salicylate of soda or 'water-glass,' plaster of Paris); in this way the patient's confinement to bed may be much shortened.

Treatment of fractures may lead to an unsatisfactory result in either of two contrary ways: when the vitality is low, or the treatment has not secured perfect rest of the broken bone, it may become united merely by fibrous tissue instead of bone, leaving a flail-like useless limb (*ununited* fracture, or false joint); or, when rest has been too long and continuous, the healing process may not merely reunite the bone, but fix the surrounding tendons and ligaments by fibrous adhesions, leaving more or less obstinate stiffness of the neighbouring joints. The former is in general more apt to occur in the shafts of the long bones, the latter close to their ends, and the treatment must be modified accordingly.

Fractures of the bones of the head and trunk are dangerous more on account of the risk of laceration of the important organs enclosed by them than because of the injury to the bones themselves; and in general any attempt to 'set' such fractures is apt to do more harm than good. Means must simply be taken to keep them as much at rest as possible.

Fra Dia'volo, properly MICHELE PEZZA, a celebrated Italian brigand and renegade monk, born at Itri, in the Terra di Lavoro, in 1760. Of plebeian origin, he at first followed the trade of stocking-weaver, then entered the Neapolitan army, and subsequently the service of the pope; finally he abandoned military life and became a monk, but, being expelled for misconduct, withdrew to the mountains of Calabria, where he headed a band of desperadoes, whose strongholds lay chiefly along the frontier of the Terra di Lavoro. Pillage, bloodshed, and atrocious cruelties signalised his career. For years he evaded the pursuit of justice by retiring to his haunts amidst mountains and forests, and skilfully defeating, with much inferior numbers, all the armed forces despatched against him. He became at length known among the peasantry of the neighbourhood as Fra Diavolo. On the advance of the French into the Neapolitan states, along with his band he warmly espoused the royal cause, and in return they were not only pardoned and reinstated in civil rights, but promoted to the grade of officers in the royal army, Fra Diavolo himself becoming colonel. In 1806 he attempted to excite Calabria against the French, but was taken prisoner at San Severino, and was executed at Naples on the 12th November. The opera of Auber has nothing in common with Fra Diavolo but the name.

Fraga, a town of Spain, on the Cinca, 63 miles ESE. of Saragossa, the centre of a district famous for a variety of small green figs, which are dried before being consumed. Here, in 1134, the Moors defeated Alfonso I. of Aragon. Pop. 6761.

Fragaria. See STRAWBERRY.

Fragonard, JEAN HONORÉ, painter, was born at Grasse in 1732. He studied under Chardin and Boucher; and, entering the academy schools, gained the 'prix de Rome' in 1752. In Italy—which, later, he revisited—he was influenced mainly by the works of Tiepolo, the last of the great Venetians; and he executed many illustrations for Saint-Non's *Voyage de Naples et de Sicile.* Returning to France, he in 1765 received 2400 francs from Louis XV. for his 'Callirrhoé,' commissioned for reproduction in Gobelins tapestry; then he ceased to be academic, and began to be personal, to follow his true bent—helped to be most himself by the art of Venice and by the art of Rubens. He painted, with a loose touch and luscious colouring, *genre* pictures of contemporary life, or of scenes which, however titled, drew their inspiration from present actuality, from humanity seen and observed by the painter himself. To these his ardent and sensuous southern temperament gave both force and charm. He is also known by his landscapes. He is well represented in the Louvre, most typically in its La Caze collection by such works as 'Bacchante Endormie' and 'La Chemise Enlevée.' He died in Paris, 22d August 1806.

Framboesia. See YAWS.

Frame, in Gardening, a term usually applied to movable structures used for the cultivation or the sheltering of plants. The most common form is that of the ordinary hotbed frame, which is a rectangular box of any convenient dimensions covered with glazed sashes; but they are made in many forms, according to fancy and the purpose for which they are particularly required.

Framingham, a post-village of Massachusetts, on the Sudbury River, 24 miles W. by S. of Boston by rail. The township includes Saxonville and South Framingham, with manufactures of blankets and straw goods. Pop. (1885) 8275; (1890) 9239.

Framlingham ('strangers' town'), a market-town of Suffolk, 22 miles NNE. of Ipswich by a branch line. It consists of a spacious market-place, with a few streets branching off irregularly. The fine flint-work church, restored in 1888–89, has a tower 90 feet high, and contains several noble altar-tombs of the Howards (the third Duke of Norfolk, the poet Earl of Surrey, &c.). Separated by the Mere from the red-brick Albert middle-class college (1864) rises the great Edwardian castle, reduced in 1650 to a mere shell, but retaining its thirteen square towers. The stronghold successively of Bigods, Mowbrays, and Howards, it was Queen Mary's refuge after Edward VI.'s death. Pop. 2518. See Hawes's *History of Framlingham* (1798).

Franc, a French silver coin which forms the unit of the French monetary system. Introduced into France 6th May 1799, it was extended to the other countries comprised in the Latin union—viz. Belgium, Italy, and Switzerland by the convention of 1865, and has since then been adopted by Roumania (1868), Spain (1871), Servia (1874), Bulgaria (1880), and Greece (1882). In Belgium and Switzerland the coin is known as the franc; in Italy, *lira;* in Greece, *drachma;* in Roumania, *lei;* in Servia, *dinar;* and in Spain, *peseta.* The franc is coined of silver, $\frac{835}{1000}$ fine, and weighs five grammes, its value being about 9½d. English money, or 19 cents of United States. One pound sterling = 25·2 francs. The franc is divided into 100 centimes, but the old division into 20 sous, valued at 5 centimes each, is still made use of in common life. There are in France silver coins of ½, ½, 1, 2, and 5 francs; and gold pieces of 5, 10, 20, 50, and 100 francs. See DECIMAL SYSTEM.

Francavilla, a town in the Italian province of Lecce, lies 22 miles WSW. of Brindisi. It has tanning, cloth-weaving, and trade in wine and oil. Pop. (1881) 17,559; (1891) 18,314.

France, the most westerly portion of Europe, occupies a most advantageous position between the Atlantic Ocean and the Mediterranean Sea. The civilisation developed on the coasts of the Mediterranean eventually found an easy passage towards the Atlantic and the North Sea by the broad valley of the Rhone and Saône, which communicates with the drainage areas of the Seine, the Loire, and the Garonne. The territory now occupied by France thus became the ground upon which Roman civilisation met and melted with the civilisation of the Celts and Teutons; and it gave birth to a race which assimilated a variety of ethnographical elements—Gaulish, Italian, Spanish, German, and Flemish—and developed into a powerful nationality, the French.

In its present limits, diminished in 1871 by the loss of Alsace and part of Lorraine (5590 sq. m., 1,600,000 inhabitants), France covers an area of 204,092 sq. m.—i.e. one-nineteenth part of Europe, and has a population of over 38,000,000 (one-eighth of the population of Europe). It is bounded on the N. by the Channel and the Strait of Dover, which separate it from England; on the NE. by Belgium and the grand-duchy of Luxemburg; on the E. by Lorraine, Alsace, Switzerland, and Italy; on the S. by the Mediterranean Sea and Spain, from which it is separated by the Pyrenees; and on the W. by the Atlantic Ocean. Its utmost extremities are comprised between 51° 5′ and 42° 20′ N. lat., and the longitudes of 4° 42′ W. and 7° 39′ E. In shape it is a compact hexagonal mass, symmetrically distributed on both sides of the meridian of Paris, its greatest dimensions being 606 miles from N. to S., 556 miles from W. to E., and 675 miles from NW. to SE.

The areas of the different administrative subdivisions of France, and their populations, as well as the former divisions into provinces, are given in the table on the next page.

Coasts, Seaports, and Islands.—The coasts of France possess great advantages for maritime intercourse with the world. The eastern part of the Mediterranean coast, owing to its crescent-shaped indentations, has several excellent harbours which combine the advantage of being situated at, or close by, the terminus of the great commercial route connecting north-west Europe with the Mediterranean (Golfe de St Tropez, Hyères roads, Toulon, Marseilles); on the other hand, the western portion of the same coast, which describes a broad curve in the Gulf of the Lion, is flat and difficult of access, as are also the shores of the Bay of Biscay in the Atlantic. The deep estuary of the Garonne has a good port in Bordeaux; for Nantes, at the head of the estuary of the Loire, owing to the shallowness of its entrance, a deeper port has been found in St Nazaire; whilst the port of La Palisse, three miles west of La Rochelle, is steadily rising in importance. Farther north the rocky coasts of Brittany are indented with numerous narrow gulfs, and dotted with small islands; and Brest, situated on one of the gulfs, is among the best ports in Europe. On the northern coast, facing towards England, France has but few natural harbours. Cherbourg, at the extremity of the Cotentin peninsula, has been made a naval port at a heavy outlay. Le Hâvre, at the mouth of the Seine, also is an artificial port, whose maritime intercourse with distant lands

Old Provinces.		Departments.	Area in Eng. sq. miles.	Population in 1891.
Île de France	1.	Seine	184	3,141,595
	2.	Seine-et-Oise	2,164	628,590
	3.	Seine-et-Marne	2,215	356,709
	4.	Oise	2,261	401,835
	5.	Aisne	2,839	545,493
Champagne	6.	Ardennes	2,020	324,928
	7.	Marne	3,150	434,692
	8.	Marne (Haute)	2,402	248,533
	9.	Aube	2,317	255,548
Lorraine	10.	Meuse	2,405	292,253
	11.	Meurthe-et-Moselle	2,025	444,150
	12.	Vosges	2,266	410,196
Flanders (Fr.)	13.	Nord	2,193	1,736,841
Artois	14.	Pas-de-Calais	2,551	874,364
Picardy	15.	Somme	2,379	546,495
Normandy	16.	Seine-Inférieure	2,330	889,876
	17.	Eure	2,300	349,471
	18.	Calvados	2,132	428,945
	19.	Manche	2,289	513,815
	20.	Orne	2,354	354,387
Brittany	21.	Finistère	2,595	727,012
	22.	Morbihan	2,625	544,470
	23.	Côtes-du-Nord	2,659	618,652
	24.	Ille-et-Vilaine	2,597	626,875
	25.	Loire-Inférieure	2,654	645,268
Poitou	26.	Vendée	2,588	442,355
	27.	Sèvres (Deux-)	2,317	354,282
	28.	Vienne	2,691	344,355
Anjou	29.	Maine-et-Loire	2,749	518,589
Maine	30.	Mayenne	1,996	332,387
	31.	Sarthe	2,396	429,737
Angoumois, Aunis, and Saintonge	32.	Charente	2,294	360,259
	33.	Charente-Inférieure	2,635	456,202
Touraine	34.	Indre-et-Loire	2,361	337,298
Orléannais	35.	Loir-et-Cher	2,452	280,358
	36.	Eure-et-Loir	2,268	284,683
	37.	Loiret	2,614	377,718
Nivernais	38.	Nièvre	2,632	343,581
Bourbonnais	39.	Allier	2,822	424,382
Marche	40.	Creuse	2,150	284,660
Berri	41.	Cher	2,780	359,276
	42.	Indre	2,624	292,868
Limousin	43.	Vienne (Haute)	2,130	372,378
	44.	Corrèze	2,265	328,119
Auvergne	45.	Cantal	2,217	239,601
	46.	Puy-de-Dôme	3,070	564,266
Lyonnais	47.	Loire	1,838	616,227
	48.	Rhône	1,077	806,737
Burgundy	49.	Ain	2,239	356,907
	50.	Saône-et-Loire	3,302	619,523
	51.	Côte-d'Or	3,383	376,866
	52.	Yonne	2,868	344,688
Franche Comté	53.	Saône (Haute)	2,062	280,856
	54.	Jura	1,928	273,028
	55.	Doubs	2,018	303,081
Alsace (part of)	56.	Rhin (Haut)	235	83,670
Dauphiné	57.	Isère	3,201	572,145
	58.	Drôme	2,518	306,419
	59.	Alpes (Hautes)	2,158	115,522
Languedoc	60.	Ardèche	2,186	371,239
	61.	Loire (Haute)	1,916	316,785
	62.	Lozère	1,996	135,527
	63.	Gard	2,253	419,888
	64.	Hérault	2,393	411,651
	65.	Tarn	2,217	343,739
	66.	Garonne (Haute)	2,429	472,388
	67.	Aude	2,438	317,372
Guienne	68.	Aveyron	3,376	400,467
	69.	Lot	2,012	253,885
	70.	Dordogne	3,546	478,471
	71.	Tarn-et-Garonne	1,436	206,596
	72.	Lot-et-Garonne	2,067	295,360
	73.	Gironde	3,761	798,528
	74.	Landes	3,599	297,842
Gascony	75.	Gers	2,425	261,084
	76.	Pyrénées (Hautes)	1,749	225,861
Bearn and Navarre	77.	Pyrénées (Basses)	2,943	425,027
Foix	78.	Ariège	1,890	227,491
Roussillon	79.	Pyrénées (Orientales)	1,592	210,125
Avignon, Venaissin, and Orange	80.	Vaucluse	1,370	235,411
Provence	81.	Rhône (Bouches-du-)	1,971	630,622
	82.	Alpes (Basses)	2,685	124,285
	83.	Var	2,349	288,336
Corsica	84.	Corse	3,377	288,596
Savoy	85.	Savoie	2,224	263,297
	86.	Savoie (Haute)	1,667	268,267
Nice	87.	Alpes Maritimes	1,482	258,571
		Total	204,092	38,343,192

is growing rapidly—as is likewise that of Dunkirk. Boulogne and Calais derive their importance from their close and extensive intercourse with England.

Except the island of Corsica, which, geographically and ethnologically, belongs rather to Italy, France has no islands of importance. The islands off the Mediterranean coast, as well as those off Brittany, are practically but small detached fragments of the mainland; while the Channel Islands (q.v.), situated between Brittany and the Cotentin peninsula, belong to Great Britain. The aggregate area of the French islands is 3686 sq. m.

Colonies.—The possessions of France outside of Europe, both colonies and protected countries, cover an aggregate of 1,195,091 sq. m., and have a population of more than 32,000,000 inhabitants. Of them, Algeria (q.v.) is rapidly becoming a part of France proper, and is considered as such for nearly all administrative purposes. The large territory of Tunis has recently been taken under French protection. Moreover, by a treaty signed in 1885 Madagascar was virtually placed under the protection of France, which also claims the protectorate of a considerable area in West Africa, along the Ogoway and its tributaries, and in 1884 reoccupied portions of the Gold Coast. In Asia, Tonkin was annexed to France in 1884, and Annam placed under its protectorate. The whole of the French possessions in Asia are now united into the governorship of Indo-China. In 1887 the French protectorate was extended in the Pacific Ocean to the Wallis Islands, west of Samoa, and to Raiatea, in the neighbourhood of Tahiti. The details of the French colonies are given in the subjoined table, although some of the figures are necessarily only estimates.

I. Colonies.	Area in sq. miles.	Pop. 1886.
Algeria	257,450	3,910,399
In Asia—		
French India	208	277,266
Cochin-China	23,000	1,795,000
French Tonkin	34,700	*c.* 12,000,000
In Africa—		
Senegambia and Dependencies	138,350	1,850,000
Gaboon and Gold Coast	267,900	186,150
Congo Region		500,000
Réunion	970	175,271
Ste Marie	318	7,444
Nossi-Bé and Mayotte		20,481
Obock	2,300	22,370
In America—		
Guiana, or Cayenne	46,850	26,905
Guadeloupe, &c.	720	182,619
Martinique	380	175,755
St Pierre and Miguelon	90	5,929
In Oceania—		
New Caledonia, &c	7,700	62,752
Marquesas Islands	480	5,250
Tahiti and Moorea	455	11,003
Tubuaï and Ravaiva	80	717
Tuamotu and Gambier Islands	390	5,946
Total of Colonies (with Algeria)	782,336	21,221,257
II. Protected Countries.		
Tunis	45,000	1,500,000
? Madagascar	228,500	3,500,000
Annam	106,250	*c.* 5,000,000
Cambodia	32,390	1,580,000
Comoro Isles	615	53,000
Total of Protected Countries	412,755	11,553,000
Total, Colonies and Protected Countries	1,195,091	32,774,257

Geographical Description.—A general idea of the leading geographical features of France can be given in a few words. Its territory embodies highlands in the south and south-east only: in the south it comprises the northern slopes of the Pyrenees, and towards the south-east frontier part of the Alps. The remainder of the territory is nearly equally divided between extensive lowlands in the north-west and a great plateau, which covers the south-eastern half, but is separated

from the Alps by the broad and deep valley of the Lower Rhone. The climate of France, its vegetation, the distribution of its population, and its very history have been determined by these leading features of its orography.

The Plateau.—The extensive mass of elevated plains which rises between the lowlands of the Mediterranean coast and those sloping towards the Atlantic reaches a height of from 3000 to 4000 feet in its higher central parts only; several chains, partly of volcanic origin, piled over its surface, attain from 5000 to 6000 feet; while the river-valleys are dug so deeply into the plateau that it often assumes a hilly aspect. The whole slopes gently towards the north-west, gradually melting into the lowlands of the Garonne, the Loire, and the Seine, which would be submerged almost entirely if the level of the ocean rose 1000, or even 660 feet. In that case the coast-line of the Atlantic would run from the Bay of Biscay towards Belgium, with some detached islands to the north of this line, and to the south of it two broad and deep gulfs, which would correspond to what are now the upper drainage areas of the Garonne and the Loire; while the Mediterranean Sea would send into the mainland a long and wide gulf up the valley of the Rhone, with a narrow elongated lake penetrating farther north, and corresponding to what is now the valley of the Saône.

It is easy to grasp at once how such a configuration facilitated the intercourse between the Mediterranean Sea and the Atlantic Ocean. The shores of the Gulf of the Lion, which at an early period of history were dotted with Greek and Roman cities, are separated from the Garonne by only a low watershed, the Seuil-de-Naurouse (636 feet above the sea), which allows easy communication with the Bay of Biscay. Farther north the depression of the Saône, which is a natural continuation of the valley of the Rhone, is connected with the Loire by a valley of so gentle a gradient that it has been utilised for a canal (the Canal du Centre), the highest part of the watershed being but 1000 feet above the sea; and, finally, the same depression of the Saône freely communicates across the lower parts of the plateau with the tributaries of the Seine. The civilisation which developed on the littoral of the Mediterranean thus found three natural passages leading to the Atlantic Ocean and the coasts of the North Sea, without having to contend with any of the natural obstacles opposed elsewhere by the Alps.

While sloping gently towards the north-west, the plateau has a short steep slope towards the valley of the Rhone and the Mediterranean coast, and the southern part of that slope is fringed by the Cévennes Mountains, which raise their granitic and crystalline summits to more than 5000 feet above the sea (chief summit, Mont Mézenc, 5754 feet). This lofty chain separates two entirely different worlds—the fertile, sunny, and warm plains of the Lower Rhone and Languedoc from the plains of the Rouergue, dreary, cold, and 3000 feet high, upon which only rye is grown, and flocks of sheep find rich grazing-grounds. Farther north the mountains on the edge of the plateau become much lower. The Monts du Vivarais reach their greatest height in Mont Pilat (4703 feet), while the Monts du Beaujolais and du Charolais as a rule do not exceed 3300 feet. The sunny slopes of the Monts du Beaujolais, turned towards the Saône, are covered with rich vineyards; while the plateau to the west of them is dotted with ironworks, coal-mines, and manufacturing cities. Still farther north the plateau, which is separated by only the narrow valleys of the Saône and the Doubs from the hills of the Jura, is fringed by the low dome-shaped hills of the Côte-d'Or (2000 feet), which connect it with the Vosges. The upper tributaries of the Seine have their source in the same wet district as those of the Saône, and both rivers are connected by the Burgundy Canal. Finally, the Vosges, although making a steep descent to the valley of the Rhine, rise but gently over the plateau, their highest points being not more than from 3300 to 4000 feet above the sea (the Ballon de Soultz, 4579 feet, is now on German territory). Thick forests still clothe their slopes, which are covered with morainic deposits of the glacial period, and their numberless streams are dotted with sawmills and factories.

The plateau reaches its greatest height of from 3300 to 4000 feet in central France—in the Massif Central of Auvergne, which covers nearly one-seventh of France's total area, and is a region of granites, gneisses, and crystalline slates fringed by Jurassic deposits, and dotted on its surface with extinct volcanic cones surrounded by wide sheets of lava. The Massif du Cantal, connected by the Margeride chain with the Cévennes, rises nearly 2000 feet above the level of the plateau, reaching 6093 feet above the sea in its highest volcanic cone, the Plomb du Cantal. The Monts Dore, 40 miles north, have the same character; their chief summit, the Puy-de-Sancy (6188 feet), surrounded by several lower volcanic cones, being the highest mountain of central France. Finally, the Monts Dôme, a few miles farther north, consist of some fifty volcanic cones, the highest of which is Puy-de-Dôme (4806 feet). The Limousin and the Marche, to the west of the above, are granitic plateaus hardly reaching 3300 feet above the sea; while the Causses of the Rouergue, in the south, are built up of Jurassic limestones deeply cut into by rivers which flow in beautiful cañons; towards the north-east the Massif Central is continued by the Morvan, and, farther north-east, by the much lower plateaus of western Lorraine and Champagne Pouilleuse, which slope with a very easy gradient towards the plains watered by the Seine. As to the Ardennes (between the Meuse and the Moselle), which have played so important a part in military history as a bulwark against foreign invasions, they are a plateau from 1600 to 2400 feet high, still covered with wide forests, and intersected by marshy depressions, ravines, and fertile valleys. The heights of the Massif Central, suffering as they do from a protracted winter, have but a poor, rapidly-diminishing population. The forests which once covered them have mostly been destroyed, save in the picturesque Margeride chain, and only flocks of sheep graze on their meagre pasture-grounds. The Causses receive rain in abundance, but are exceedingly dry—the water rapidly disappearing in the numberless crevices of the soil. The inhabitants are thus compelled to gather rain-water in cisterns for themselves and their cattle. A few acres, cultivated here and there, bear poor crops of barley, oats, and potatoes; but hundreds of thousands of sheep are kept for the special purpose of making cheese. As a rule the plateau is thinly peopled, save in the mining and industrial regions. Farther north-east, where it is much lower, and where the broad valleys between the wooded hills have a more fertile soil, a denser population gathers in the villages and the towns, and finds the means of existence in agriculture combined with a variety of small industries.

The Jura.—A narrow passage near Belfort (la Trouée de Belfort), utilised by both the canal which connects the Saône with the Rhine and the railway which leads from Paris to Switzerland, separates the Vosges from the limestone plateaus of the Jura, part of which belongs to France. The depressions and high valleys between the forest-clad hills shelter a large and laborious population, which

is supported by a combination of agriculture and cattle-breeding with a variety of petty trades.

The Alps.—Since the annexation of Savoy in 1860 the Alps of Savoy, as well as a portion of the main chain, including the northern slopes of the chain of Mont Blanc (15,780 feet), belong to France. The pass of Little St Bernard (7190) separates the latter from the Graian Alps, which have the two passes of Mont Cenis (6883) and Mont Genèvre (6802) leading from France to Italy, and are continued to the south-west by the Oisans group, where immense glaciers rivalling those of Switzerland gather around Mont Pelvoux (13,462). The valley of the Durance separates the Graian Alps from another short parallel chain of the Cottian Alps (Monte Viso, 12,608), while the still lower Maritime Alps descend in terraces to the Mediterranean coast. The cold and snowy slopes of the Alps are but thinly peopled, especially in the dry limestone spurs of the Graian and Cottian Alps. A number of agricultural villages, however, thrive in the lower spurs of the Savoy Alps, and the city of Grenoble is an industrial centre of importance; while Chamouni at the foot of Mont Blanc is one of the chief centres for tourists.

The Pyrenees.—This wild complex of lofty chains extends for a length of 260 miles between the Atlantic Ocean and the Mediterranean Sea. In the east it is built up of three parallel chains running in a north-eastern direction: the Monts Albères, the Sierra del Cadi, which enters France from Spain and has on French territory the lofty peak Mont Canigou (9137 feet), and the chain of south-east Andorra, continued in France by the peaks Puy-de-Carlitte (10,203) and Madres. Farther west the Pyrenees proper consist of at least two parallel chains of the wildest aspect, both running west-north-west and disposed in *échelons*. Here we find the highest peaks of the Pyrenees: Nethou (11,168) in the Maladetta chain, the Mont Perdu, and several others rising to heights over 10,000 feet. Wide *cirques*, which formerly were filled with *nevés* and gave origin to vast glaciers, and arid mountains intersected by narrow and dark valleys are characteristic of that part of the Pyrenees; but the Pyrenean glaciers of our own time are much inferior to those of the Alps and none descend lower than 7260 feet. The Pass of Roncevaux (Roncesvalles, 40 miles from the Atlantic coast), which has been the route of so many migrations, separates the Pyrenees proper from a series of much lower spurs of the Spanish coast-ridges, which, like the Mediterranean coast-ridges, also have a north-eastern direction. The passes across the Pyrenees proper are very few, very high, and difficult. The Pass of Roncevaux in the west and those of La Perche and Pertus in the east (16 miles only from the Mediterranean) lead through longitudinal valleys of the chains running north-east which enclose the Pyrenees at both ends. Of the passes through the Pyrenees proper none is lower than 6700 feet. Therefore the railways connecting France with Spain have been compelled to follow the very coasts of the Atlantic Ocean and the Mediterranean Sea, while the other lines stop short on both slopes of the Pyrenees proper without yet venturing to cross them. A plateau, from 1600 to 2000 feet high (Lannemezan), spreads out at the northern foot of the Pyrenees. Owing to its limestone soil it is exceedingly dry, and its grazing-lands have had to be irrigated with water derived from the Neste River.

Plains and Rivers.—The whole of north-western France, with the exception of a few hilly tracts in La Vendée, Brittany, and Normandy, is occupied by wide plains which constitute the real wealth of her territory. Taking them in order from the south-west, we have first the Landes—a wide triangular space between the Bay of Biscay, the Adour, and the Loire, covered with Pliocene sands, which would be an immense marshy fever-den, bordered by shifting sands on the sea-coast, if it were not intersected by canals, and the sands were not fixed by plantations of trees. The thick growths of bushes which cover the plain are utilised as grazing-grounds for flocks of sheep, the shepherds formerly being compelled to mount upon stilts when watching their flocks. Some of the ponds—formerly bays, now separated by sand-dunes from the ocean—are valuable fishing-grounds. The Adour (187 miles long), which fringes the Landes and receives a number of tributaries (*gaves*) from the chalky plateau of Lannemezan, has but few important cities on its course—Bayonne being the chief of them. The Garonne (346 miles), which rises in Spain, and receives the Tarn and the Aveyron from the very depths of the Massif Central, is a most important channel for navigation. But the torrential rains which pour over its drainage area of 22,080 sq. m. do not always find an easy outlet in its channel, and floods are not unfrequent. The Dordogne (305 miles), which rises in the Mont Dore, has most of its course dug into the plateau. Beautiful vineyards cover the slopes of its valley, while lower down the raising of iron ore and the quarrying of grinding-stones, as also the industry of truffle-hunting in Périgord, become a source of prosperity; the old city of Périgueux is an important centre of manufactures. The Dordogne and the Garonne join to form the Gironde, which is a true marine estuary, with the left bank bordered by the low hills of Médoc, covered with vineyards yielding every year not less than 2,200,000 gallons of the finest wines. The great port of Bordeaux, on the Garonne, is some 15 miles above the head of the estuary of the Gironde.

The monotony of the rich plains between the Gironde and the Loire, which include the old province of Poitou, is broken by the dreary hills of the Gatine, a link between the chains of Margeride and Limousin and the hilly tracts of Brittany. The southern parts of the plains on the right bank of the Gironde—the Saintonge (watered by the Charente)—are among the richest districts of France. Farther north the Bocage closely reminds one of England by its meadows enclosed within rows of trees, while Le Marais, on the coasts of the Gulf of Poitou, which has the two islands of Ré and Oléron, protecting the entrance to Rochefort, resembles the *polders* of the Netherlands.

Next we have the immense plains watered by the Loire, which becomes a great river after receiving the Allier, and has a drainage area covering one-fifth of the area of France (46,750 sq. m.; 7,000,000 inhabitants), and a total length of 670 miles. This chief river of France rises on the plateau not far to the west of the middle of the Rhone's lower course, and describes a wide curve towards the north, approaching within 70 miles of Paris at the head of the bend at Orleans. It enters the Atlantic Ocean by a wide estuary, pouring out of its broad channel into the sea no less than from 23,000 to 42,500 cubic feet of water every second. The regions along its middle course are the real heart of France. As it issues from the valleys of the plateau it waters the Sologne, the chief rye-producing region of France; the Berri, to the south of the Sologne, a chalky plain from 350 to 700 feet high, interspersed with numerous ponds and covered with rich pasture-grounds; and Beauce, situated between Paris, Orleans, and Tours, quite flat and covered with cornfields and meadows. The Gatinais, to the east of Beauce, spreads between the two great forests of middle France—the Forêt d'Orléans (which covers 99,500 acres) and the Forêt de Fontainebleau (41,700). Farther down

its course the Loire enters the lowlands of Touraine and Anjou, which are literally covered with cornfields, gardens, and vineyards, while the cities of Tours, Saumur, and Angers are centres of manufacturing industry. The beautiful meadows, cornfields, and gardens continue as far as Nantes, where the Loire enters its estuary; and the port of Nantes, although rather shallow for modern sea-going ships, grows in importance as a centre for fisheries and various manufactures.

The peninsula of Brittany is formed by two ridges of granitic hills, from 1000 to 1200 feet high, separated by a region of crystalline slates. Its scenery and moist climate, as well as those of the Cotentin peninsula, again remind one of England, with the meadows and fields fringed by trees, and the ivy-covered houses. Cattle-breeding on a large scale, poultry-farming, fruit-gardening, agriculture, and fishing are the chief riches of Brittany. The plateaus of Normandy (Le Perche), which rise from 1000 to 1300 feet above the surrounding plains, are also covered with beautiful meadows, cornfields, and forests, and French agriculture reaches there its highest development. The Seine separates them from the cretaceous chalky plains of the Caux, which raise their cliffs over the Channel, and are deeply cleft by valleys of a remarkable fertility.

The Seine (485 miles), which rises in the hills of Morvan, and drains with its tributaries (chiefly on the right bank) an area of 30,030 sq. m., certainly is far behind the Loire both as to the volume of water flowing in its channel and as a means of communication. Nevertheless, the wide Tertiary basin which it and its tributaries water has from remote antiquity been the dominant portion of historical France. Numerous large cities, like Auxerre, Sens, Troyes, Châlons, Reims, Laon, Rouen, which all took such an important part in the making up of France—and especially Paris, which acquired its importance owing to its most advantageous position at the intersection of all the chief routes crossing France—are situated either on the Seine, or on its right-bank tributaries which water the fertile plains of Champagne. Le Hâvre is the great port at the mouth of the river.

Artois and French Flanders are low tracts of land to some extent conquered from the sea. They have a flourishing agriculture, vast coal-fields, and a great industry in their chief cities (Amiens, Lille, Roubaix); their population is rapidly increasing. At the other extremity of France the lowlands of the south occupy the sea-coast and the broad valley of the Rhone, along which they extend between the Alps and the plateau, as far north as Lyons, to be continued farther north by the valley of the Saône.

The Rhone (507 miles) has its source in the glaciers of the St Gothard group, and of its 38,180 sq. m. drainage area, peopled by 4,500,000 inhabitants, nearly one-tenth belongs to Switzerland. Below the Lake of Geneva its course is still in the mountains, and it is not far from its junction with the Saône at Lyons that it enters the plain of Dauphiné, dotted with numerous industrial cities of which Lyons is the centre. After receiving the Saône the Rhone suddenly changes its westerly course and flows rapidly due south in a rich valley, the slopes of which are covered with vineyards. Below Avignon the valley suddenly assumes a decidedly southern character, not unlike the driest parts of Sicily and Greece. The Isère, which rises in the Graian Alps, the Durance, which flows from the Cottian Alps, and a number of smaller streams rushing from the Cévennes join the Rhone, which bifurcates at Arles, leaving the marshy delta of the Camargue between its two main branches, and the gravelly plain of the Crau to the left. The tides being insignificant in the Gulf of the Lion, the mouth of the Rhone is rapidly obstructed by mud and sand, and a canal (St Louis) had to be dug to permit ships to enter the river at Port St Louis.

The littoral of Provence has no great fertility, and, except the stony or marshy plains in the neighbourhood of the Rhone, there is but a narrow strip of land left between the mountains and the sea-coast, which is utilised for vineyards and fruit-gardens; but the remarkably well-sheltered harbours of Marseilles (q.v.), Toulon, Hyères, and St Tropez give birth to a considerable maritime commerce; and Marseilles is now the chief port of France for intercourse with the South and East. The eastern part of the coast, acquired from Italy in 1860, is well known for its mild climate and rich vegetation, which render Nice, Villefranche, Cannes, and Mentone the chief resort of the invalids of Europe. As to the western part of the Mediterranean coast—Languedoc—with its cities Montpellier and its seaport Cette, Carcassonne, and Perpignan, its vineyards were formerly the richest wine-producing part of France; but since 1875 they have been devastated by phylloxera, and corn grows now in the plains formerly covered with vines. The coal-fields of the region aid the development of a variety of industries. Finally, the Roussillon, which comprises the eastern outspurs of the Pyrenees, partakes of the character of the Iberian peninsula, especially of Catalonia.

Climate.—France enjoys on the whole a very fine climate; not so continental as that of central Europe, and not so maritime as that of England. Omitting the high hilly tracts of the Alps and Pyrenees, the coldest region of France is evidently that of the high plateau with its cold winters, though it has hot summer days. The north-eastern part of the plateau (Champagne, Lorraine, the Vosges) also has a continental climate much like that of central Europe. Frosts last there for from seventy to eighty-five days every year, but the amount of snow is seldom considerable in the plains. The Paris basin has a climate transitional between the above and that of the sea-coasts. Frosts occur for an average of fifty-six days yearly, but the average temperature of the winter is not lower than 38° F.; the spring is beautiful, and excessive heat does not last long during the summer. The annual rainfall is but 20 inches, and, though it rains on an average of 154 days in a year, the rains usually are of short duration. The climate of Brittany is very much like that of the south-west of England; while that of the plains on the Bay of Biscay is warm and dry (from 23 to 31 inches of rain per annum in the drainage area of the Garonne), and Pau, on the slopes of the Pyrenees, has the deserved reputation of a sanitary station. The region about Lyons has an intermediate, rather wet climate, with cold winter and not very bright summer; while the climate of Languedoc and Provence assumes to some extent an African character—a temperate winter is succeeded by a burning hot summer, moderated from time to time by the *mistral*, which blows with a terrible force from the Cévennes, purifying the air and throwing back to the sea the moistness which otherwise might result in rain, so that Marseilles has but fifty-five rainy days during the year.

Population, Occupations, National Character.—For origins of the French nation and the elements that compose the French population—Celtic Gauls, Belgæ, Aquitanians or Iberians, Romans, Franks and other Germanic tribes, and Normans—see the section below on the history of France, and the separate articles, such as BELGÆ, CELTS, FRANKS, &c. For the dominant language of France, see the section on French Language and Literature. For the Provençal language of the south of France,

see that head. In the north-west the ancient Celtic Breton tongue still survives (see BRITTANY); and in the south-west the distinct and peculiar Basque language is spoken by the bulk of the people in more than one department (see BASQUES). Flemish is spoken in French Flanders; the Walloons (q.v.) speak their own Romance dialect in the north-east of France; and German is still spoken in some districts of those parts of Alsace and Lorraine left to France on the French borders of Alsace, now incorporated with Germany. As to the national character, it is the sum of so many individual, provincial, and political varieties that a general judgment cannot be pronounced too cautiously. So much, however, can be said, that, like its territory, the French people is a natural transition between the inhabitants of southern Europe and those of the north. It combines the impressionability, the vivacity, the rapidity of conception, and the artistic feeling of the men of the south with the persistence, laboriousness, and rationalism of the men of the north. The sociability of the French has become proverbial. Their instability and levity are often, especially in Britain, made accountable for the frequent changes of government in France; but these assumed characteristics are but a poor attempt at an explanation of facts that have a far deeper historical meaning, and, moreover, stand in sheer contradiction to the practical sense and the inborn talent for organisation which are amongst the most striking features of France's economical and social life. The deeply systematic mind of the French strongly seconds a natural power of organisation, which appears in the simplest labour combinations of the workmen, as well as in the greatest enterprises in the more abstract domains of literature and science.

According to the census of May 30, 1886, the population of France (without Algeria) reached 38,218,903 inhabitants, as against 27½ millions at the beginning of the century, 32½ millions in 1831, 37½ millions in 1861, 36,102,921 in 1872, and 37,672,048 in 1881. The decline in population in 1861–72 is largely accounted for by the loss of territory that followed the Franco-German war; the remainder was due partly to losses in the war, and partly to an absolute decrease in the population of more than half of the departments. In 1881–86, also, over one-third of the departments show a falling off. The annual increase throughout France is notably slower than in the other chief countries of Europe, and its low rate is due not to a higher mortality—the mortality in France being nearly equal to that of the United Kingdom (23 to 24 per 1000)—but to the relatively small number of married people, and to the small proportion of children in each family (26 births per 1000 inhabitants, as against 35 in Great Britain, and nearly 40 in Germany). This low birth-rate does not hold good for all France: the small yearly increase of the total population is chiefly due to the more numerous births in the north and centre, the highest average (3 per family) being found in Brittany.

Frenchmen emigrate but little. Still, the last census has shown no less than 261,591 Frenchmen in Algeria; besides, there are 167,375 in the Argentine Republic and Uruguay (1880–82); 106,971 in the United States (1880); 58,992 in Switzerland; 51,104 in Belgium; and more than 20,000 in Spain. On the whole, emigration from France has been on the increase during the last few years. On the other hand, no less than 1,126,531 foreigners (chiefly Belgians, Italians, Germans, Spaniards, and Swiss) were returned in the census of 1886 as living in France.

In 1850 three-fourths of the population lived in the country, and one-fourth only in the cities; but the migration of country people to the cities has gone on in France, as elsewhere, on a great scale; and at present out of each hundred inhabitants thirty-six are living in the cities. Migration is especially active into Paris and its neighbourhood, and to the seaports. In 1886 no fewer than 6,000,000 people lived in the forty-seven chief cities having each more than 30,000 inhabitants; and the following eleven cities had populations of more than 100,000: Paris (2,344,550), Lyons (401,930), Marseilles (376,143), Bordeaux (240,582), Lille (188,272), Toulouse (147,617), Nantes (127,482), St Etienne (117,875), Le Hâvre (112,074), Rouen (107,163), Roubaix (100,299).

Nearly one-half of the population still live by agriculture, as seen from the returns of 1886: Agriculture, 17,698,402; industries, 9,289,206; commerce, 4,247,764; sailors, fishermen, railway servants, 1,020,721; public forces, 613,362; professions, 1,805,260; living on income, 2,295,966; without occupation, 728,273; occupation unknown, 231,303 —total, 37,930,257. Of the total population no less than 19 million persons represented families living on somebody else's salary or income, and more than 2½ millions are domestic servants; of the professional class one-half were public officials; while the grand total of clerks and other salaried persons in trade and commerce (exclusive of domestic servants) amounted to less than 5 million men and women. In agriculture the occupations appeared as follows: Farming proprietors, 2,431,481; farmers and *métayers*, 1,311,089; nursery-gardeners, &c., 212,055; foresters, wood-cutters, &c., 91,539—thus giving a total of 4,046,164 'heads of establishments.' These employed 2,869,801 labourers and domestic servants, and their families amounted to 10,782,437 persons.

Land-tenure.—The current opinion is that landed property is extremely subdivided in France, but this is true to a certain extent only, and needs some explanation. The official statistics supply merely the number of land-assessments (*cotes foncières*)—i.e. of persons having to pay the land-tax—and this number is a little over 14 millions. But, as it often happens that the same person pays several assessments in the same commune or in different communes, the above figure is much above the real number of landholders. It results from such statistics as are available that on the average the number of owners stands in the ratio of 594 owners to 1000 assessments, so that the aggregate number of land-owners hardly exceeds 8 millions, as seen from the following table:

Size of Properties (Assessments).	Number of Assessments.	Estimated Number of Land-holders.	Number of Acres.	Percentage to Aggregate Area.
Very small properties (less than 5 acres)	10,426,368	6,182,837	12,851,075	10·5
Small properties (5–15 acres)	2,174,188	1,289,237	18,640,688	15·3
Medium properties (15–120 ac.)	1,351,499	801,440	47,490,166	38·9
Large properties (120–500 acres)	105,070	62,306	23,174,522	19·0
Very large properties (over 500 acres)	17,676	10,482	19,812,498	16·2
Total	14,074,801	8,346,302	121,968,949	100

Besides, out of the more than 10 million assessments of the first category, no less than 6½ millions are upon built property; so that the aggregate number of real agricultural land-owners does not exceed 4½ millions; of these about 73,000 persons own one-third part of the territory, about 801,000 own two-fifths of it, while 1,289,000 own only one-seventh part; and nearly 2,340,000 landholders who own less than one-thirtieth part of the

territory are compelled to work on somebody else's land. France is thus the country of middle-sized agricultural landholdings, with a considerable number of agricultural labourers who own nothing but a house and a garden, or not even that, and a not inconsiderable number of larger landlords. It must, however, be remarked that, though the concentration of land in the hands of great landowners is going on in certain parts, especially of central France, the tendency in other parts is towards the increase of such holdings of about 20 acres as can be cultivated by one family.

As to the dwellings of the peasantry, it appears from the fiscal registration made for levying the window-tax that no less than 2 million houses (of 8,933,986 houses all over France) are provided with one window only, or even have no aperture save the door; 3,709,566 houses have but two windows, or less.

Agriculture.—The landholdings are subdivided into no less than 127 million separate small plots, and this subdivision is the source of many drawbacks. Moreover, French agriculture suffers from an exceedingly high taxation. Nevertheless, it can favourably compare with that of Great Britain. Of a territory covering 123 million acres no less than 37 million acres are under cereal crops, 5,730,000 acres under vineyards, a little over 12 millions under meadows and grazing-lands, 21 millions under forests, and less than 17 million acres are unproductive. The average yield of wheat is but from 18 to 20 bushels to the acre (as against 28 in Great Britain), but the area under wheat (17 million acres) is much larger than in England; and the cereals altogether cover no less than 29 per cent. of the territory. The different crops and their average produce (in millions of bushels) are as follows:

	Acres.	Million Bushels.
Wheat	16,980,000	290-320
Oats	9,113,000	236
Rye	4,100,000	66
Barley	2,400,000	48
Buckwheat	1,500,000	24
Maize	1,500,000	24
Green crops	7,000,000	..

Beet-root for sugar covers about half-a-million acres. The terrible ravages of the phylloxera have reduced the area under vineyards from 6,382,000 acres in 1875 to 2,868,000 acres in 1885; but there has been some improvement since, and in 1888 the vineyards covered over 4½ million acres, yielding 662,247,000 gallons of wine. The imports of wine amount to about one-third of the home crop. The yearly production of cider varies from 210 to 440 million gallons, and that of alcohol (41 million gallons in 1885) is on the increase.

One of the most promising features of French agriculture is the high development of nursery-gardening, which achieves most remarkable results in variety and richness of crops. It may suffice to say that, owing to their perfect methods of horticulture, the *maraîchers* round Paris and other large cities succeed in obtaining vegetables and fruit to the value of from £60 to £180 per acre. The planting out of trees and the reclamation of unproductive soil go on in various parts of France on a large scale; and, though the division of land prevents the farmers from acquiring improved machinery, the peasants' associations, and the practice of renting machines for a few days in a year, supplement that want to some extent.

Cattle-rearing has a tendency to become more and more specialised. Fine breeds of horses are reared in the north and north-west; the south is renowned for its donkeys and mules; cattle-breeding prospers in the wet climate along the Channel, in the Pyrenees, the Limousin, the Jura, and the Vosges, and sheep-rearing all over the higher part of the plateau. Swine-breeding is on the increase, and poultry-farming is an important source of well-being in the north and north-west. The exports of cattle, butter, eggs, cheese, and poultry, especially to England, are very considerable—no less than 70 million pounds of butter and 1000 million eggs being sent every year across the Channel.

Fisheries.—The fisheries are of great importance for France, both the deep-sea fishery (especially about Newfoundland), valued at nearly 3½ millions sterling every year, and also the coast fisheries, which employ some 53,000 fishermen, and yield a value of nearly 4 millions sterling every year. See FISHERIES.

Mining and Metallurgy.—France is relatively poor in minerals and metals. It has no gold, no silver, no platinum or mercury, and its produce of copper, zinc, lead, and tin hardly supplies one-twentieth part of its annual consumption. The iron-mines are more productive, but they are mostly far away from the coal-mines, and the cost of production is consequently increased. In fact, from one-third to one-half of the iron ore used in France is imported from foreign countries. The 112 foundries and 168 blast-furnaces of France produce every year a little more than 1½ million tons of pig-iron, while 200 ironworks, with about 1000 furnaces, make an average of 820,000 tons of iron and half-a-million tons of steel; but this supply falls far short of the demand. The coal-mines, which are scattered over the north, the region of the Upper Loire, and in Languedoc, are far from satisfying the needs of France, which imports about 28 million tons of coal, as against an average of 21 million tons raised at home.

On the other hand, France is very rich in all kinds of building stone, gravel, chalk, plaster, &c., and this circumstance has permitted her to build most of her cities of excellent stone, and to lay over the country a network of fine roads. The shales and phosphates, produced on a large scale, supply agriculture with chemical manure. No less than 100,000 men are engaged in quarrying the various kinds of stone. Rock-salt is raised to the amount of more than 100,000 tons, and 640,000 tons more of salt are secured from the sea.

Manufactures.—Manufactures have made rapid progress during the 19th century. While 65 steam-engines only were at work in 1820, their number has risen to nearly 55,000, representing more than 3½ million horse-power, and thus adding to the producing powers of the country a force equivalent to that of nearly 60 millions of human beings. All kinds of industries are represented amongst the nearly 150,000 manufactures of France. The textile industry gives occupation to at least 2,000,000 persons. In silks France has no longer the monopoly she formerly had, these being now woven all over Europe; but she still occupies the first rank, especially with regard to the finer stuffs and the production of new ones. The cotton factories are on a much smaller scale than those of Great Britain or the United States; but in the number of spindles (4,900,000) they nearly equal those of Germany. The aggregate annual produce of the textile industries (9,237,000 spindles, 166,300 power-looms, and 145,000 hand-looms) is valued at about £160,000,000. Then there are also sugar-works (423,000 tons), sugar-refineries (355,100 tons), chemical industries, potteries, paper-mills, and industries connected with furniture, dress, carriages, and all possible articles of luxury. Hundreds of small industries, which occupy two-thirds of the French industrial workers, are especially worthy of note, because it is in them that the artistic taste and inventive genius of the nation are especially apparent. Paris is the world's emporium for such small industries.

Communications.—The highways in France as a rule are kept in an excellent state, and no less than 120,000 miles of *routes nationales*, and twice as many miles of district roads, are the feeding-arteries of the network of railway lines, which covered an aggregate length of 19,909 miles in 1888. The total receipts were about £40,000,000. The traffic on the French railways is not half so brisk as on those of Great Britain, and the yearly number of passengers is only about one-third as large. The navigable rivers and canals, to which a great deal of attention is given in France, have a total length of 6510 miles, and the aggregate weight of merchandise transported on these waterways is twenty times the weight of transports by rail.

Commercial Navy.—The French mercantile marine—984 steamers (506,650 tons) and 14,253 sailing-vessels (465,880 tons) in 1888—is behind not only those of Britain, the United States, and Norway, but even of Germany and Italy. In the tonnage of her steamers, however, France is ahead of Germany by nearly 250,000 tons. Nevertheless, three-fourths of the French coasting and foreign trade is carried on under the flags of the republic. No less than 100,000 vessels (20 million tons) enter the French ports, and of these more than one-fifth (22,000 ships) are engaged in foreign trade.

Foreign Trade.—France is an illustration of the fact that a country having a well-developed agriculture may be very wealthy without having a considerable foreign trade. While the aggregate value of exports of home produce and imports for home consumption varies from £17 to £20 per head of population in the United Kingdom, it hardly reaches £8 in France. During the five years 1883–87 the annual foreign trade was valued at 5223 million francs for the imports, and 4244 million francs for the exports; of which the imports for home consumption were 4294 million francs, and the exports of home produce 3253 million francs (172 and 130 millions sterling respectively). The chief import is raw produce (1,906,752,000 francs in 1888), and the chief item of export is manufactured goods (1,656,317,000 francs). Raw silk, cotton, and wool are imported both for home use and for re-exportation in the shape of stuffs. Hides are imported to be manufactured into fine leather, gloves, or shoes; timber leaves France in the shape of artistic furniture, &c. France imports, as already said, a good deal of coal and iron ore, as well as of colonial wares, cattle, cereals, and other alimentary substances, representing an aggregate of 1,485,186,000 francs; she exports, too, 669,270,000 francs' worth of these, and 690,478,000 francs' worth of raw produce.

None of the French colonies is a source of enrichment for the mother-country. The total of French exports to the colonies amounts to about 9 millions sterling, Algeria alone representing 6½ millions; while the imports from the colonies (exclusive of Tunis) are valued at 11 millions sterling, Algeria representing about 5 millions, and the produce of the Newfoundland fisheries (imported from St Pierre and Miquelon) one million sterling.

Government and Administration.—Since the overthrow of Napoleon III., on September 4, 1870, France has been under a republican form of government, sanctioned in February 1875 by a constitutional law which has undergone since but slight modifications. The present French constitution remains a mixture of monarchical and republican institutions, and it has fully maintained its strong and old-established centralisation.

The unit of French administration is the commune, the size of which varies greatly, and which administers its own local affairs by means of an elected municipal council and an elected mayor. (Paris and Lyons have mayors for each of the divisions of the city, the place of mayor of the city being taken by a nominated *préfet de police* and a *préfet*, whose jurisdictions overlap and occasionally come in conflict.) The independence of the communes is very much checked by the central government, but the present tendency of the more advanced municipalities is to take into their own hands the administration of a wide range of affairs formerly considered attributes of the state, while some of them incline more and more towards taking over the solution of important social questions. Every ten to fifteen communes constitute a *canton*, and next comes the *arrondissement*, or district, composed of not more than nine *cantons*; this has its own elected council, entrusted with the assessment of the local taxes, and subject to the sub-prefect. Four arrondissements on an average compose a department. This division was introduced during the great Revolution, when it was found desirable to abolish the old provincial institutions and to submit the whole of France to a centralised government. Nearly all departments are administrative areas which have received their names from their chief rivers or mountains, but otherwise have no geographical or economical meaning. France had 89 departments before 1870, but now it has only 86, or 87 if the 'territory of Belfort' be considered as a separate department (Haut Rhin). Each of them has a 'general council,' elected by universal suffrage—each canton electing one councillor. The general councils have wide powers as regards taxation and the promotion of institutions of public utility; but their decisions are jealously controlled by the prefect, who is the representative of the state in the department.

The legislative functions of the central government are vested in the Chamber of Deputies and the Senate; and the executive power in the ministry and the President of the Republic. The chamber is composed of 584 deputies (6 for Algeria, and 10 for the colonies), elected for five years by universal suffrage, in the proportion of at least one deputy for each district, or as many more as the population of the district contains hundreds of thousands of inhabitants. The composition of the senate is more complicated. Under the Constitution of 1875, of the 300 senators 75 had to be nominated for life by the government; but, by an amendment of the law, these are replaced by election as they die out. Of the remaining 225 seats a third are filled every third year by means of double elections. Every new law must be voted by both the chamber and the senate, and a congress of both bodies sitting together must be convoked for discussing alterations of the constitutional law.

The ministry is selected from the chamber by the President of the Republic, whose powers are, on the whole, very wide. He promulgates the laws voted by the two legislative bodies, he concludes treaties with foreign powers, appoints all functionaries, and has the right of dissolving the chamber with the approval of the senate. There is, moreover, a special body, the Council of State (*Conseil d'État*), which dates from the first and second empire, and now has the duty of giving its opinion to the government upon pending legislative schemes.

A formidable army of functionaries stands under the central government, in subjection to the prefects, who themselves are wholly under the authority of the Ministry of the Interior, and exercise a powerful influence on the results of the elections through their subordinates, as well as by means of various kinds of favours which they are in a position to accord to tradesmen, industrial establishments, and all kinds of private persons.

The names adopted by the sections of the Legislative Assembly in 1791, from the part of the house

in which they sat, have, with modifications, been retained in France, and extended to parliamentary parties in Germany and other countries. Those sitting on the 'Extreme Right' and the 'Right' of the president's chair were representatives of the burgher interest, Constitutionalists like the Feuillans (q.v.), and supported the king as far as they could. The 'Left' was composed of the Girondists (q.v.), moderate republicans who favoured the constitution as it stood. The 'Extreme Left' sat on the higher benches, and was nicknamed the 'Mountain;' it comprised representatives of the advanced clubs, Robespierre of the Jacobins (q.v.), and Danton of the Cordeliers (q.v.). The 'Centre' had no definite principles, usually voting with the Left.

The *judicial organisation* maintains many traces of its ancient character, and remains a powerful instrument in the hands of the government in political matters. In each canton there is appointed a justice of peace, who can decide only small civil cases where a value of not more than £8 is involved. Affairs of more importance must be brought before tribunals sitting in each district—all cases involving more than £40 being open to appeal before the appeal courts. In larger cities there are commercial courts and tribunals of *prud'hommes* elected by the heads of industrial establishments and the workers.

In criminal matters the secrecy of preliminary investigation (*instruction*) is a distinctive feature of the French judicial organisation; and this investigation, conducted by a state functionary, may last for months. No counsel for the defence is admitted till the affair has come before a court. Minor offences are tried by police courts, and a wide range of crimes, involving imprisonment for many years and the loss of civil rights, are tried by the courts of *Police Correctionnelle* without jury. The assize courts are assisted by a jury; but the jurors (from 400 to 3000 for each department) are chosen from among the citizens over thirty years old by a special committee composed in each canton of the mayor, the justice of peace, and his deputies; and that commission has the power to exclude any citizen from the list of jurors. These lists are submitted to a further scrutiny by a second district committee, which has the further right of nominating additional jurors to the extent of one-tenth of the total number required. From the decisions of all kinds of tribunals appeal may be made to the Court of Cassation (q.v.). The government is represented at each court by a public prosecutor. Separate military and naval courts pronouncing severe judgments in the smallest disciplinary matters complete an organisation which has been less modified than any other by the progress of liberal ideas. For French Law, see CODE.

The French prisons, one in each department, and nine central prisons for convicts undergoing more than one year's imprisonment, are mostly organised on the system of renting the prisoners' work to private employers. Those condemned to hard labour (an average of about 900 every year) are sent to New Caledonia or to Guiana.

Religion.—There is complete religious toleration in France, but three faiths are recognised by the state—i.e. their ministers are paid by the state, and enjoy several privileges. These are the Catholic, which is professed by 98 per cent. of the population; the Protestant, which has nearly 600,000 members, chiefly Calvinist; and the Jewish (63,000 in France, 43,000 in Algeria). The Mohammedan religion stands in the same position in Algeria. The statistics for 1884 show an aggregate of 54,513 priests, including chaplains, and 10,500 pupils of diocesan seminaries.

Public Instruction.—The present system is the outcome of a long, not yet fully terminated struggle between the state and the church, for the right of using education as a means for promoting each its own ends. The National Convention drew up in 1794 and 1795 a wide scheme of public education under the control of the state, and to the exclusion of the clergy. But the scheme was never carried out, and under Napoleon I. education was organised so as to be subject to the combined influence of the state and the church. The right of establishing private schools was as good as prohibited. In 1833 (under Louis-Philippe and Guizot) the church obtained several privileges in its favour; and those privileges were confirmed and extended to middle and higher education by the two republican governments of 1850 and 1875. The church not only thus had its own primary schools, but it obtained the same privileges as regards secondary education, as well as the right of conferring university degrees. The laws of 1880 were a return to the schemes of the Convention. By these laws compulsory and free primary education has been introduced under the control of the state; the privileges of the church have been abolished; and, instead of religious teaching, the teaching of 'civic morality' from handbooks issued by the state has been introduced. But this subject has again come up for consideration. Private schools of all degrees are permitted, provided the teachers pass the obligatory examinations.

France is divided into seventeen educational districts called *académies*, the rectors of which are entrusted with the administration of higher and secondary education, as also with the inspection of the primary schools. Each educational district has an academic council, and each department has a council composed partly of state officials and partly of general councillors and delegates from the schoolmasters. In 1886 there were 66,500 primary schools, having 96,600 schoolmasters, of whom 16,400 were members of religious orders. Teachers are trained in eighty-nine training schools for male, and seventy-seven for female teachers. Nearly one-tenth of all recruits are still illiterate.

Secondary education, which may be classical, scientific, or technical, is provided for in 98 *lycées* and 256 *colléges* for boys (100,000 pupils), and 35 *lycées* and *colléges* for girls (only 9600 pupils); the latter are of quite recent introduction, the girls formerly being chiefly trained in convents, or receiving no education at all. Some 48,000 boys still receive secondary education in schools kept by the Catholic clergy.

Higher education, given in the *facultés* (universities), is of a high standard, and almost quite free. The chief centres are at Paris, Lyons, Bordeaux, Toulouse, Montpellier, Nancy, Lille, Nantes, and Grenoble; but most of these have only three, two, or even one of the four separate *facultés* (law, medicine, natural science, literature). Indeed, there is but one university of France, officially so called, which comprises the *facultés* at all the various centres (see UNIVERSITY). Altogether, these have 1600 professors and about 18,000 students. The clergy have their own 'free universities.'

Various special institutions, such as the Collége de France, the Museum of Natural History, the Polytechnic School, and many others, have a high reputation of long standing. For the Institute of France, with its five academies, see ACADEMY.

Army and Navy.—During the German war of 1870–71 France was able to meet the invaders with less than 400,000 men and 1250 guns; and it was not till after the fall of Napoleon that 700,000 men, mostly untrained and very badly provisioned, could be brought into the field. The whole system was totally reorganised in 1872. According to the new law, which received further development from subsequent legislation (especially in 1888), every Frenchman twenty years old, if not infirm, or

exempted from service for educational reasons, must enter the army and serve three years in the active army, six in the reserve, six in the territorial army, and ten in the territorial reserve. Rifles, guns, and all the necessaries of warfare are kept in readiness for nearly 4 million men. Nearly 300,000 young men are called out every year, and more than 200,000 enter the ranks. The army numbers 541,000 men, and has 136,000 horses in time of peace. But in case of war it can be raised to 2½ million men; and 1¼ million men more, all having received military training, may be added to the above. The military education of the soldiers is now much better than it was before 1870. See also ARMY.

The French navy is second only to that of Great Britain. It consists of 21 ironclad men-of-war, 7 ironclad cruisers, 6 ironclad guard-ships, 8 gun-boats, also ironclad, and 4 torpedo-cruisers. It has, moreover, 34 cruisers, and a number of fine despatch-boats and torpedo-boats, making a total of 351 steamers and 41 sailing-vessels. Of these there are 190 commissioned ships (704 guns), 55 ships in reserve (180 guns), and the rest (189 guns) were in 1889 not in commission.

Finances.—Like all other European nations, France sees its budget increasing every year, and yet never covering the expenditure. The chief source of revenue is indirect taxation (excise, registry, customs, and stamps), which forms about 62 per cent. of the revenue; the direct taxation (land, trade licenses, personal property, and doors and windows) comes next and makes 15 per cent. of the revenue; the monopolies (such as tobacco) and the remunerative services (like the post-office) supply 20 per cent. of the yearly income, and all these sources together have yielded annually during the ten years 1880–89 a little over 3000 million francs (£120,000,000). But, as the expenditure exceeds the income, extraordinary sources of revenue—chiefly loans—are resorted to, and during these ten years the real budgets varied from 3548 to 4167 million francs under the head of revenue, and from 3542 to 4190 million francs under the head of expenditure. Various new indirect taxes have had to be introduced to meet the expenses, among which the army counted for over 556 million francs in 1889, the navy for nearly 193 millions, the administration for 327 millions, the public instruction for 136 millions, and the public debt for no less than 1291 million francs—i.e. more than one-third of the yearly revenue.

The public debt, which reached 5516 million francs on the eve of Napoleon III.'s *coup d'état* (1851), was more than doubled during his reign. It rose to 12,454 million francs in 1870, and more than 11,000 million francs have been added to it since, chiefly on account of the war indemnity and war expenses, which together amounted to nearly 10,000 million francs. The French debt is now heavier than that of Great Britain, and the more so as France pays much higher interest on it. Collectively the national debt has been calculated at from 32,000 to 36,000 million francs (£1,280,000,000 to £1,440,000,000)—which is about the estimated aggregate yearly income of the whole of the nation.

The aggregate debts of the separate municipalities reach about 3000 million francs. Paris is one of the most heavily indebted cities of Europe, and pays every year no less than 107 million francs of interest upon its municipal debt.

For the money, weights, and measures used in France, see FRANC, METRE, LITRE, GRAMME, DECIMAL SYSTEM. For further information on France, geographical and statistical, see Elisée Reclus's *Nouvelle Géographie; En France*, by Onésime Reclus; *France as It is*, by André Lebon and Paul Pelletier (trans. by Mrs W. Arnold, 1888); *French and English*, by P. G. Hamerton (1889); Block's *Annuaire*, and his *Dictionnaire;* official publications, such as the *Annuaire Statistique de la France;* the *Almanach de Gotha; Statesman's Year-book*, &c. For the geological history of France, see the article EUROPE; also the great geological chart of France, on the scale of 1–500,000th (1882–89).

HISTORY.—Through association of mind with the people and country of France in their contemporary form, the student of French history starts with an aggregate of geographical, ethnological, and sociological notions whose validity diminishes in proportion as he plunges deeper into the past.

In prehistoric times, among the inhabitants of western Europe, from the Rhine to the Atlantic seaboard, no essential lines of difference can be drawn; the Alps, the Pyrenees, the British Channel formed land-marks of a superficial character. But the Rhine was then, as it is now, a sharp ethnological boundary. The trading-voyages of the Phœnicians and the conquests of the Carthaginians left no impression upon the west of Europe. Though Greek civilisation gained a footing at Massilia, now Marseilles, history, for France, as for Great Britain, and Spain, began with the Roman Conquest. Julius Cæsar is the first historian of France, which, under the name of Gaul, was invaded by him (59–51 B.C.), civilised by force, and incorporated into the Roman empire. Thanks to the common ethnological points of Celt and Roman, the native elements rapidly adopted the imported language, culture, and laws of Rome. Protected against Teutonic invasion by military posts on the Rhine, subjected for the first time to legislation and administration, the Gallic tribes, who had risen before their conquest to the height of civilisation attainable by them without foreign aid, turned to peaceful pursuits, such as agriculture and commerce, and built for their governors amphitheatres, public baths, aqueducts, military roads. Lugdunum (Lyons) became a Transalpine Rome. In the 2d century A.D. Gaul was the most populous, in the 4th it was one of the most civilised Roman provinces. Its schools were so famous that Roman-born students went to learn there the art of eloquence. Its nobles and cultured classes supplied the empire with more than one general and with more than one poet or prose-writer. It became the home of an enlightened Christianity, but did not escape the rebellions of slaves and land-labourers which broke out now and then in the empire, and bore witness to aristocratic and ecclesiastic oppression. Thus, by the engrafting of Roman civilisation upon the old Celtic stock, there grew between the Alps, the Mediterranean, the Pyrenees, the Atlantic, and the Rhine a Gallo-Roman state, with a culture free from the Hellenistic stamp peculiar to the eastern provinces of the empire, and more akin in many respects to our modern circumstances than to those of the ancient world. Indeed, Gaul was fast being elaborated into a pure neo-Latin nationality, when, from the year 395 onward, the Teutonic tribes, pent up to the east of the Rhine, and pressed from behind by Slavonic hordes, burst upon the scene and acted as a dissolvent upon Roman civilisation. Beaten in Tuscany in 406, bands of Vandals, Burgundians, Suevi, and Alemanni, falling back upon Gaul left bare of troops, destroyed the forts on the Rhine and in the interior of the country. After long wanderings the Burgundians settled in the fruitful plains of the Rhone valley, and founded the kingdom of Burgundy from the Mediterranean border to the Vosges. A few years later the Goths, also retreating from Italy, occupied both sides of the Pyrenees, founding the kingdom of the Visigoths, from the Garonne in the north to the Ebro in the south, with its capital at Toulouse. In 451 a Roman general of barbarian birth, Aetius (q.v.), fighting at the head of an army in which Romans, Burgundians, and Visigoths stood

side by side, defeated in the Catalaunian fields (Châlons-sur-Marne) the hordes of Attila. This was Rome's last deed of war in Gaul.

The staff of military supremacy fell from the hands of the Romans into those of the Franks. These were a confederacy of the Germanic tribes between the Rhine and the Harz Mountains, whom the Romans had attacked in vain, and to whose persistent invasions they had to sacrifice Belgium. Once in possession of the banks of the Meuse and of the Sambre, they advanced under their king Clovis (481–511) towards the Seine and the Loire, and made at first Soissons and then Paris their capital. Clovis became a Christian. Carving out for himself a realm abutting to the south upon the Visigoths, and to the east and south-east upon the Burgundians, he laid, from the Rhone and Garonne to Brittany, foundations for the future kingdom of France. Clovis, through his zeal in the interests of the Catholic Church, earned the title of 'most Christian king,' which passed from the Frankish chiefs to the kings of France. The emperor at Constantinople gave him the Roman title of patrician and consul. The Franks remained subject to their own 'Salic law,' but they maintained in Gaul Roman law, Roman state and church organisation. Thus a Germanic tribe became the leading military and political agent in the plains of northern Gaul, and gave to France its name and its first dynasty of kings, the Merwings or Merovingians (q.v.); but it adopted the Romance tongue of the conquered, and so did the Visigoths and Burgundians in their own dominions.

In 752 the Karlings or Carlovingians (q.v.), in the person of Pepin the Short, superseded the Merovingian dynasty, and laid the foundation of the temporal power of the popes. Pepin's son, Charlemagne (768–814), raised to its zenith the supremacy of the Franks in western Europe, by uniting under his hegemony the Germanic states hewn out of the Roman provinces. Coming at a time when the Germanic ruling classes were no longer separable from the conquered masses, the formal centralisation of power in his hands, ratified by his coronation in 799 as Roman emperor by the pope Leo III., could not long stem the forces at work for the splitting up of western Europe into a number of small states; neither could this result be accomplished by the building up of a military monarchy extending from the Ebro in Spain, and from the Apennines in Italy, to the North Sea, and from the Atlantic to the Elbe in Germany, the establishment of a code of imperial law and of a system of imperial government, the encouragement of learning and commerce. The Frankish military hegemony fell to the ground under the reign of his weak successors. The next step towards the formation of France was the Treaty of Verdun (843), by which the localisation of the Germans became final; their former racial unity sank in an awakening sense of different nationalities.

Feudal Monarchy.—Though Charles the Simple was politic enough to put an end to the incursions of the Normans by making their leader Rollo Duke of Normandy, the unchecked development of a hereditary aristocracy had reduced the royal power to a shadow, when in 987 Hugh Capet, Count of Paris and of Orleans, was made king by the feudal chiefs. He was the real founder of the French monarchy as distinct from the extinguished Frankish kingship, and from the imperial dignity which was vested after Charlemagne in the ruling house of Germany. While the Roman emperors of the German nation often took up their abode at Aix-la-Chapelle, Charlemagne's residence, the Capetian kings, residing in Paris and crowned in Rheims, became an outward sign that the Rhine divided races again, as in the days of Varus and Arminius (q.v.). Louis *le Gros* (1108–37) regulated the feudal system, abolished serfdom on his own estates, secured corporate rights to the cities under his jurisdiction, while a new element in the state was generated by the foundation of a free burgher class. At this juncture the policy of the Plantagenets forced England into hostility with France. Henry of Anjou, already Duke of Normandy, suzerain lord of Brittany, Count of Maine and Touraine, had married Eleanor of Aquitaine, who brought him the provinces of Guienne, Poitou, and Gascony; and when in 1124 he became king of England as Henry II. (q.v.), his prestige outshone utterly the French court. The kings of England laid claim to the crown of France; the French kings demanded obedience from their too powerful vassals. Hence an enmity so persistent, and fed subsequently from so many sources, that the Crusades, of which the Normans were the most zealous promoters, and in our days the Crimean war, offer the only instances of military fellowship between England and France. Philippe Auguste (1180–1223) recovered Normandy, Maine, Touraine, and Poitou from John of England. He took an active personal share in the Crusades, and permitted the pope to organise a cruel persecution against the Albigenses in the southern parts of the country. Philippe was the first to levy a tax for the maintenance of a standing army, and in his reign a chamber of peers, of six secular and six ecclesiastical members, was instituted to act as a council of state. Many noble institutions date their origin from this reign, as the university of Paris, the Louvre, &c. A right of appeal to the royal courts was established, and the arbitrary power of the great vassals crippled. Improvements in the mode of administering the law were continued under his son, and his grandson, Louis IX. (1226–70), who, before his departure for the Crusades, secured the rights of the Gallican Church by a special statute, in order to counteract the constant encroachments of the papal power. Under his son, Philippe III. (1270–85), titles of nobility were first conferred by letters-patent. He added Valois and the *comtés* of Toulouse and Venaissin to the crown. Philippe IV. (1285–1314), surnamed *le Bel*, acquired Navarre, Champagne, and Brie by marriage. With the object of securing support against the secular and ecclesiastical nobility, Philippe gave prominence to the burgher element in the nation, and for the first time called together the *États Généraux*, or States General, at which the *tiers état*, or burgher class, appeared together with the nobles and clergy. With the view of securing to the crown the great fiefs, he abrogated the right of females to succeed to landed property. His tyrannical persecution of the Templars showed his abuse of the regal power, while the transfer ence of the holy see to Avignon brought the popes for seventy years under the influence of the French court. Under his three sons and successors, Louis X. (1314–16), Philippe V. (1316–22), and Charles IV., *le Bel* (1322–28), the rule of the kings of France was strengthened and extended.

House of Valois.—Philippe VI. (1328–50), the first of the House of Valois, succeeded in right of the Salic law. His reign, and those of his successors, John (1350–64) and Charles V., *le Sage* (1364–80), were disturbed by constant wars with Edward III. of England, who laid claim to the throne in right of his mother, a daughter of Philippe *le Bel*. The war began in 1339; in 1346 the battle of Crécy was fought; at the battle of Poitiers (1356) John was made captive; and before its final close, after the death of Edward (1377), the state was reduced to bankruptcy, the nobility excited to rebellion, and the mass of the people sunk in barbarism. Debasement of the coinage,

onerous taxation, and arbitrary conscriptions brought the country to the verge of irretrievable ruin, while the victories of England humbled the sovereign, annihilated the French armies, and cut down the flower of the nation. The long and weak minority of Richard II. diverted the English from the prosecution of their groundless claims to the kingdom of France; but during the minority of Charles VI., *le Bien Aimé* (1380–1422), the war was renewed with increased vigour on the part of the English nation, who were stimulated by the daring valour of Henry V. The signal victory won by the English at Agincourt in 1415; the treason and rebellion of the French princes of the blood, who governed the larger provinces; the ambition of the several regents, the ultimate imbecility of the king, the profligacy of his queen, and the love of pleasure early evinced by the dauphin; all combined to aid Henry in his attempts upon the throne. But the premature death of Henry, the persevering spirit of the people, and the extraordinary influence exercised over her countrymen by the Maid of Orleans concurred in bringing about a thorough reaction, and, after a period of murder, rapine, and anarchy, Charles VII., *le Victorieux* (1422–61), was crowned at Rheims. He obtained from the States General a regular tax (*taille*) for the maintenance of paid soldiers, to keep in check the mercenaries and marauders who pillaged the country. The policy of his successor, Louis XI. (1461–83), favoured the burgher and trading classes at the expense of the nobles, while he humbled the power of the vassal princes. He was a crafty ruler, who managed the finances well, and succeeded in recovering for the crown the territories of Maine, Anjou, and Provence; while he made himself master of some portions of the territories of Charles the Bold, Duke of Burgundy. Charles VIII. (1483–98), by his marriage with Anne of Brittany, secured that powerful state, and consolidated the increasing power of the crown. With him ended the direct male succession of the House of Valois.

Louis XII., *le Père du Peuple* (1498–1515), was the only representative of the *Valois-Orléans* family. The tendency of his reign was to confirm the regal supremacy, while the general condition of the people was ameliorated. He and his successor, Francis I. (1515–47) of the *Valois-Angoulême* branch, wasted their resources in futile attempts to establish their hereditary claims to Lombardy. Francis I.'s rivalry with the Emperor Charles V. of Spain, representative of the House of Hapsburg-Burgundy, gave itself vent in four wars for the possession of Burgundy and Italy. Taken prisoner at the battle of Pavia (1525) and led away to Madrid, Francis ultimately made good his title to Burgundy (1544), but had to renounce Italy. His reign is marked by the flowering of the Renaissance, by the beginning of the Protestant Reformation, by the further strengthening of the absolute power of the monarchy, by the subordination of the clergy to the crown in terms of the 'Concordat' signed with the pope. An ally of the Protestant princes in Germany, and of the schismatic king of England, Henry VIII., he yet remained in his home policy an adherent of the Roman Catholic religion. He and his immediate successors were concerned mainly with the political aspects of the Reformation, which recruited its upholders from the aristocratic and enlightened classes. Henri II. (1547–59) recovered Calais for France. Under Francis II. (1559–60) the Roman Catholic House of Guise obtained possession of the effective power in the state. Their adversaries, the House of Bourbon, headed the movement of the 'Réforme.' Under the weak kings Charles IX. (1560–74) and Henri III. (1574–89), who were under the influence of their mother, Catharine de' Medici, this division in the French nobility resulted in the war of the League and wars of religion. The massacre of the Protestants on the night of St Bartholomew (1572) raised to such a pitch the pride of the House of Guise that Henri III. fled to the camp of the Bourbon leader, where he was murdered by a fanatical monk. The name of Charles IX. remains associated with the horrors of the St Bartholomew's night, which witnessed the striking of a blow at the very heart of the nation; the first step in a periodical recourse to murder, persecution, and proscription. Such horrors, renewed by Louis XIV. against the Protestants, and applied by the Revolution to a different class, have, with the triumphant campaigns of Napoleon, done more to weaken France than the worst blows of its enemies.

Bourbon Line.—The accession of the Bourbon prince, Henri IV. of Navarre (1589–1610), allayed the fury of religious wars, but his recantation of Protestantism in favour of Catholicism disappointed his own party, to which, however, he granted the free exercise of their religion and ecclesiastic autonomy by the Edict of Nantes (1598). By degrees Henri, through the counsels of his minister Sully, and by his own personal popularity, raised the power of the crown higher than ever, while he began a system of thorough administrative reform, which was arrested only by his assassination by the fanatic Ravaillac. During the reign of his son, Louis XIII. (1610–43), Cardinal Richelieu, one of the greatest statesmen of modern Europe, resumed the policy of Francis I. against the House of Hapsburg by entering into a compact with the Protestant princes engaged in the Thirty Years' War, raised higher the authority of the crown at home, and humbled the Huguenots, who in the south and west of France had established almost a state within the state. Cardinal Mazarin, under the regency of the queen-mother, Anne of Austria, governed during the minority of Louis XIV. His continuation of Richelieu's policy roused the parliament of Paris to a last effort in favour of its ancient political liberties, systematically cut down or ignored by the kings; the nobility also made a last stand for their feudal rights. The civil war of the Fronde ensued (1648–53). Its termination put all classes under the heel of the young king, Louis XIV. (1643–1715), who could justly say, with local parliaments reduced to judicial and administrative bodies, with aristocrats demeaned into courtiers, 'L'état, c'est moi.' During his reign the French monarchy culminated. But under a cloak of magnificence, sores gathered sufficient to effect its ruin less than seventy-five years after his death. He continued the policy of Richelieu and Mazarin. The successes of his armies under Condé, Turenne, Vauban, Luxembourg, Catinat, Vendôme, Bouffiers, and Créqui extended the boundaries of France to the Rhine, and to Flanders in the north; this was mainly due to the talent of Louvois in developing the military and naval resources of France, and to the financial skill of Colbert. But the war of the Spanish Succession (1701–14), though confirming a prince of the House of Bourbon upon the Spanish throne, ended disastrously for the French, repeatedly defeated by Prince Eugene of Savoy and Marlborough. At home the greatest splendour and luxury were displayed; art, literature, and science flourished to a degree unknown before. The proud king compelled the pope to restore to the Gallican Church some of its privileges, but he fell under the influence of Jesuit advisers, and dealt his country a baneful blow by the revocation of the Edict of Nantes (1685), causing 400,000 Protestants to emigrate. At the close of his rule, his absolutism and

bigotry, the oppressive war-taxes, the prodigality of the court, and the luxurious lives of the clergy bore their fruit.

His youthful heir, Louis XV. (1715–74), succeeded to a heritage whose glory was tarnished, and whose stability was shaken to its very foundations. The long reign of Louis XV. presents nothing worthy of notice except the gradual rise of those modern philosophical and political sentiments which prepared the overthrow of all the ancient institutions of the country. The regency of the profligate Orleans paved the way for the miseries which followed, while his corrupt financial administration brought the nation into the most overwhelming financial embarrassments. In this reign Corsica was added to France. The thorough disorganisation of the state, and the neglect of the fleet and army, prevented all attempts at conquests either by sea or on land. The colonies were left a prey to the attacks of other powers, while the capricious change of policy which the king's mistress, Madame de Pompadour, forced upon the government brought contempt on the country. The Peace of Paris (1763), by which the greater portion of the colonial possessions of France were given up to England, terminated an inglorious war, in which the French had expended 1350 millions of francs. The close of this unhappy reign was still further disturbed by the cabals of the Jesuits, but their banishment in 1764 marked the triumph of the philosophic movement over the Roman Catholic Church. In 1774 Louis XVI., a well-meaning, weak prince, succeeded to the throne. His first ministers, Maurepas, Turgot, and Malesherbes, had not the vigour to carry out reforms. They were succeeded by the financier Necker, who endeavoured, by economy and method, to arrest the impending bankruptcy of the state. The influence of Voltaire, Rousseau, Montesquieu, and a host of other writers imbued with the modern democratic spirit, the sufferings of the masses, the importation of English political ideas, the American war of independence, in which the French took an important part (in pursuance of a deliberate design in this way most effectually to weaken England), the restoration to the Paris and provincial parliaments of some of their long-lost privileges, conspired together to sound the death-knell of monarchical absolutism. After much opposition on the part of the king and court, the States General, which had not met since 1614, assembled at Versailles on the 25th of May 1789. They formed themselves into a *National Assembly*, thereby commencing the Revolution, and undertaking to make a new constitution, they presently called themselves the *Constituent Assembly*.

The Revolution.—Under the 'ancien régime' thus abruptly brought to an end the grades of nobility had become so numerous that their members stood in the ratio of 1 to 250 of the entire population. Nevertheless, every grade of nobility exempted its holder from the payment of the ordinary land-tax or *taille*, from the charge of maintaining the public roads (*corvée*), from military conscription, from receiving billets of soldiers, &c. The nobles paid the *capitation* tax, but in a very unequal proportion, although the landed property was vested almost entirely in their hands. They, in fact, together with the clergy, monopolised the principal share of the national revenues, and left to the lower classes the burden of labour and of paying the taxes. At the outbreak of the Revolution the French nobility were sunk in profligacy and fallen to the lowest stage of demoralisation. The clergy kept pace with the nobles in general depravity, and while their aggregate revenues amounted, according to Necker, to 130,000,000 of livres, and their landed property stood in the relation of 1 to $5\frac{2}{4}$ of that of all other proprietors, their contributions towards the maintenance of the state were inadequate and irregular. The *tiers état* were crushed by the weight of an unjust taxation, which was rendered more obnoxious by the system of farming out some of the taxes. The most tyrannical of these was the tax (*gabelle*) on salt. The municipal institutions which had been permitted to flourish under some of the Valois princes in the middle ages were almost entirely abolished, and the offices of towns, like those of the state and the courts of justice, were either hereditary or open to purchase. The *tiers état*, which included professional men and all who were not members of either the noble or the clerical order, saw themselves utterly excluded from all participation in the privileges and duties of free citizens at the very time when their minds were drawn to the discussion of questions of political independence, equal rights, and universal freedom.

The resistance made by Louis and his advisers to the reasonable demands of the Deputies led to their declaration of inviolability. The king retaliated by ordering a large body of troops under arms, dissolving his ministry, and banishing Necker, whom he had shortly before recalled under the pressure of public opinion. The consequence was the outbreak of insurrectionary movements at Paris, where blood was shed on the 12th July 1789. On the following day the National Guard of Paris, and a new civic militia under the authority of the municipality, was convoked; and on the 14th the people stormed the Bastille. The provinces repeated the acts of Paris, and everywhere national guards and revolutionary municipal councils were called together. On the 4th of August feudal and manorial rights were abrogated by the Assembly, which made a solemn declaration of the equality of human rights. The royal princes and all the nobles who could escape sought safety in flight. The royal family, having attempted in vain to follow their example, tried to conciliate the people by the feigned assumption of republican sentiments; but on the 5th of October the rabble, followed by numbers of the National Guard, attacked Versailles, and compelled the king and his family to remove to Paris, whither the Assembly also moved. The next two years witnessed the solemn inauguration and the subsequent withdrawal of various constitutional schemes. The princes of the blood and the ancient noblesse raised corps of emigrés, but their efforts could not arrest the spread of republicanism. The king alternately made concessions to the republicans, and cherished schemes for escaping from their surveillance; but each month added to his humiliations and to the audacity of those surrounding him. With the death in 1791 of Mirabeau, the champion of the National Assembly, all chance of the establishment of constitutional monarchy perished. The Constituent Assembly was succeeded in 1791 by the *Legislative Assembly*. The king was compelled by the Girondists to a war with Austria in April 1792; and the early defeats of the French were visited on Louis, who was confined in August with his family in the Temple. The advance of the Prussians into Champagne threw Paris into the wildest excitement. The Assembly dissolved itself in September, the *National Convention* took its place, and the republic was proclaimed. In December the king was brought to trial, and called upon to answer for repeated acts of treason against the republic. On the 20th January 1793 sentence of death was passed upon him; and on the following day he was beheaded. Revolts burst out in every part of France. England, Holland, Spain, Naples, and the German states combined together against the republic. Christianity was now formally repudiated, and

the sacredness of the republic and the worship of Reason solemnised. Marie Antoinette, the widowed queen, was guillotined; the dauphin and his surviving relatives suffered every indignity. A reign of blood and terror succeeded. Danton and Robespierre, after having condemned countless numbers to the guillotine, suffered each in turn a similar fate. After the destruction of the Terrorists a reaction gradually set in; the people were wearied of bloodshed and anxious for peace and order at any price. In 1793, 1795, and later, insurrections took place in La Vendée on behalf of the white flag, but were quenched in blood. The brilliant exploits of the young general Napoleon Bonaparte in Italy turned men's thoughts into fresh channels. In 1795 a general amnesty was declared, peace was concluded with Prussia and Spain, and the war was carried on with redoubled vigour against Austria. The Revolution had reached a turning-point.

A *Directory* was formed to administer the government, which was now conducted in a spirit of order and conciliation. In 1797 Bonaparte and his brother-commanders were omnipotent in Italy; Austria was compelled to give up Belgium and recognise the Cisalpine Republic. The glory of the French arms was re-established abroad, but at home the nation was still suffering from the shock of the Revolution. The Directory repudiated two-thirds of the national debt, and thus almost ruined the commerce and credit of France. Under the pretext of attacking England, a fleet of 400 ships and an army of 36,000 picked men were equipped; their destination proved, however, to be Egypt, whither the Directory sent Bonaparte; but the young general, resigning the command to Kléber, landed in France in 1799. The Directory fell on the famous '18th Brumaire' (9th November 1799); under the constitution of Sieyès the state was put under three consuls who unlike those of Rome were three in number, with different degrees of authority; Napoleon secured supreme power as First Consul. In 1800 a new constitution was promulgated, vesting the sole executive power in Bonaparte, who showed consummate skill in reorganising the government, to which he imparted a systematic efficiency and a spirit of centralisation that secured a thoroughly practical administration. Having resumed his command, he marched an army over the Alps, attacked the Austrians unawares, and decided the fate of Italy by his victory at Marengo. In 1801 the Peace of Lunéville was concluded, and the boundaries of France were once more extended to the Rhine. England was the only country which refused to recognise the various Italian and German conquests of France; and, with the exception of a brief period of peace, England remained the implacable foe of Bonaparte from the days of the consulate to his defeat at Waterloo. Every period of respite from war was employed by the First Consul in fostering trade and industry, and in obliterating both in private and public life the stains left by the Reign of Terror.

The Empire.—In 1804, on an appeal by universal suffrage to the nation, Bonaparte was proclaimed emperor. The pope came to Paris to crown him and his wife Josephine; a new nobility was rapidly created, and the relatives and favourites of the emperor received vanquished kingdoms and principalities at his hands. For a time Napoleon's influence with the weakened powers of the Continent succeeded in maintaining an injurious system of blockade against England; and, except in the Peninsula, his arms were everywhere victorious. His marriage, too, with the Archduchess Maria Louisa, a direct descendant of the ancient House of Hapsburg (1810), seemed to give to his throne the prestige of birth, which alone it had lacked. He kept up the democratic impulse of the Revolution as much as was wanted to drive his engine of war. His tactics would have availed him little against the successive European coalitions had he not adopted the principle of national armies, general conscription, and forced requisition introduced by Carnot, the 'organiser' of revolutionary France's victorious resistance against foreign aggression. This principle has since become the outstanding feature of continental warfare. It gave Napoleon an empire including practically the whole of Europe, except Russia, Turkey, and Great Britain; when it was quietly introduced by Prussia, it assisted effectually in bringing to a close the emperor's career, but not until he had made himself king of Italy (1805), made of Holland and Naples vassal kingdoms (1806), set up in Germany the Confederation of the Rhine, conquered Prussia (1806–7), occupied Portugal, deposed the Bourbons in Spain (1808), reduced the Hapsburgs after four campaigns from their medieval title of Roman emperors to the status of emperors of Austria, made of Rome a French town, and carried off Pope Pius VII. to Fontainebleau. In the long run, the evils attending his high-handed policy both in France and out of it undermined his position. The French navy was destroyed by Nelson at Trafalgar (1805), and the sea-trade of France much injured. His despotism, the unceasing strain of war, the burden of conscription, the estrangement between emperor and pope threw the seed of disaffection among the French people.

From 1811 to his final defeat in 1815 the emperor rapidly lost ground. The disastrous Russian campaign, in which his enormous army of 400,000 men was lost amid the rigours of a northern winter, was soon followed by the falling away of his allies and feudatories. Napoleon himself was still victorious wherever he appeared in person, but his generals were beaten in numerous engagements; and the great defeat of Leipzig (1813) compelled the French to retreat beyond the Rhine. The Swedes brought reinforcements to swell the ranks of his enemies on the east frontier, while the English pressed on from the south; the senate and his ministry betrayed his cause, and the allies marched on Paris, which, in the absence of the emperor, capitulated after a short resistance, March 30, 1814. Napoleon now abdicated in favour of his young son, and retired to the island of Elba, the sovereignty of which had been granted to him. His wife and son removed to Vienna; his family were declared to have forfeited the throne; France was reduced to her former limits, and the provinces she had acquired were restored to their national rulers.

The Restoration.—On the 3d May Louis XVIII. (the brother of Louis XVI.) made his entry into Paris. The conduct of the Bourbons did not conciliate the nation; they returned loaded with debts, and surrounded by the old nobility and clergy, who had not renounced their former privileges, and who looked upon the generation of Frenchmen that had arisen since the Revolution as their natural enemies. A narrow spirit influenced the weak policy of the king, which led to the establishment of a strict censorship, the extension of the powers of the police, and the persecution of the adherents of the Empire; while the lower classes and the army, who alike resented the humiliating reaction that had followed the former excitement of war and conquest, were treated with an indifference, and even contempt, by the returned emigrés, to which they were wholly unaccustomed. On the 1st March 1815 Napoleon left Elba and landed in France. The soldiers flocked around his standard; the Bourbons fled, and he took possession of their palaces. The news of his landing spread terror

through Europe; and on the 25th March a treaty of alliance was signed at Vienna between Austria, Russia, Prussia, and England, and preparations were at once made to put down the movement in his favour and restore the Bourbon dynasty. At first the old prestige of success seemed to attend Napoleon; but on the 18th June he was defeated at Waterloo; and, having placed himself under the safeguard of the English, he was sent to the island of St Helena, in conformity with the generally acknowledged sentiment that it was necessary to the peace of Europe to remove him finally and definitely from the scene of his former power.

The second restoration gave occasion to many pledges of a more liberal policy on the part of Louis, but few of them were fulfilled, and a general and sullen discontent reigned among the people, who were again deprived of all voice in the administration or in the election to offices, and were harassed by the petty tyranny of the priests, who were the favourite advisers of the crown. In 1821 Napoleon breathed his last at St Helena; and in 1824 Louis XVIII. died without direct heirs, when his brother, the Duc d'Artois, succeeded as Charles X. The same ministerial incapacity, want of good faith, general discontent, and excessive priestly influence characterised this reign, which was abruptly brought to a close by the revolution of 1830, and the election to the throne of Louis-Philippe, Duke of Orleans, as king by the will of the people. Progress in material prosperity made his government popular with the *bourgeoisie* or middle classes, and for a time he held his ground. The warlike propensities of the nation found an outlet in the war in Algeria with Abd-el-Kader.

The Second Republic.—But the determined resistance of the king to the growing desire for electoral reform led at last to open insurrection in Paris; and, Louis-Philippe having abdicated (February 24, 1848), a republic was proclaimed under a provisional government. An insurrection of the Red Republicans in Paris (June 1848) was only put down after great slaughter. Louis Napoleon was elected President of the Republic in December 1848; but by the famous *coup d'état* of December 2, 1851, he violently set aside the constitution and assumed dictatorial powers; and a year after (2d December 1852) he was raised by the almost unanimous voice of the nation to the dignity of emperor, as Napoleon III.

The Second Empire.—The constitution of this second empire was the same as that of the first. A senate and a legislative body, shorn of all effectual parliamentary rights, screened badly the emperor's complete absolutism, under which, however, France made great advances in the development of her natural resources and in manufactures. Assuming the character of an adjuster of the wrongs of nations, Napoleon proclaimed himself a mediator in the Danish and Austro-Prussian wars, and the defender of the Italians against Austria, of the pope against the people of Italy, and of the Mexicans against the government of the United States of America. By his help the Italians were relieved from the Austrian yoke, and the pope was left master of Rome; but in Mexico his intervention only led to greater bloodshed, and ended ignominiously for his arms, and fatally for the cause and life of his protégé, the Austrian Prince Maximilian. He acted better beside England in the Crimean war (1854–56), and entered upon a wise economic policy by signing with that country a treaty of commerce (1860) on free-trade lines. Although the brilliant success of the Paris Exhibition of 1867 seemed to afford evidence of the personal and national consideration in which the emperor was held, his political credit had already then lost its importance. At home the great financial embarrassments of his government were arousing the discontent of the people; and to avert the growing disaffection Napoleon offered (1869) to adopt a constitutional form of government, and to make some concessions in regard to freedom of the press. It was soon found that the responsibility of the ministry was fictitious, and that the emperor availed himself of its protection to cloak his own acts of personal government. The result of the appeal made to the nation in 1870, on the plea of securing their sanction for his policy, was not what he had anticipated; and the 50,000 dissentient votes given by the troops in this plebiscite revealed a hitherto unsuspected source of danger. Confident in the efficiency of the army, and anxious to rekindle its ardour, he availed himself of a pretext to declare war against Prussia.

The course of events in the short but terrible Franco-German conflict of 1870–71 astonished Europe by its unexpected character, revealing at once the solidity of Prussian strength and the hollowness of imperial power in France. War was declared on the 15th July, and it had been the intention of the French emperor to cross the Rhine at Maxau and push his armies between the North and South German States so as to force the latter into neutrality. Such action required superiority in numbers and mobility at the very outset, besides good generalship. These advantages were soon found to be all on the side of the Germans, whose perfect organisation enabled every detail of mobilisation to be completed by the 30th July. Their troops, 518,800 men, with 1584 guns, were then formed into three armies—the first under General Steinmetz, the second under Prince Frederick Charles, and the third under the Crown Prince.

The French had with difficulty collected 270,000 men with 925 guns by the beginning of August, and these were deficient in transport and equipment. The emperor assumed the chief command, and had 128,000 men between Metz and the frontier at Saarbruck, some 47,000 under Marshal MacMahon on the eastern slopes of the Vosges Mountains, and 35,000 in reserve at Châlons. The first engagement took place on 2d August, when General Frossard's corps drove out the weak German detachment in Saarbruck, but did not push its success, and the Germans took the offensive next day. On the 4th the third army (130,000) on the German left met General Douay's advanced brigade (5000 men) near Wissembourg (Ger. Weissenburg), defeated him, and pressed on to Wörth, where MacMahon had taken up a strong position with his main body (45,000). The battle fought here on the 6th was disastrous to the French, who fled in confusion through the Vosges Mountains. On the same day the battle of Spicheren was fought between 67,000 of the first German army and 32,000 of Frossard's corps, and ended in the orderly retreat of the latter. As a result of these disasters the emperor found it necessary to retire towards Metz, and, after the fierce and undecided rearguard action at Borny on the 14th, entered that fortress on the following day with 176,000 men and 540 guns. He then abandoned the chief command to Marshal Bazaine. Meanwhile the second German army had reached the Moselle, and was threatening with its advanced troops the roads to Paris. This was unknown to Marshal Bazaine, although he had a large force of cavalry which should have kept him informed of the enemy's movements. He ordered the retreat westward to continue, and his staff made the great error of directing the bulk of the troops to use only one, and that the southernmost, of the two broad chaussées available. At least seventy-two hours would have been necessary to complete the with-

drawal from Metz under these circumstances, and the Germans had already placed some cavalry across the road near Mars-la-Tour. On the 16th they were vigorously supported (as was invariably the case in this campaign) by other troops, and succeeded in stopping the westward movement of the French. Next day the latter concentrated on the Gravelotte position, eleven miles in extent. On the 18th the pitched battle of Gravelotte was fought, and resulted in the French being driven back on Metz. Here they were surrounded, and, after several gallant but unsuccessful attempts to break out, surrendered on 27th October.

Thus within a month the regular armies of France had been rendered powerless to oppose the German advance. But in the meantime the Gardes Mobiles had been called out, and, with the remains of MacMahon's army, formed at Châlons a body of 120,000 men, with 324 guns, much disorganised, and almost entirely without discipline. With these it was determined to attempt to join hands with Bazaine by a northerly march, which was commenced on 21st August, without intelligence reaching the Germans, part of whose second army was again in motion towards Paris. On the 25th the Germans learned, it is said through a telegram in a foreign newspaper, of MacMahon's movements, and at once changed the direction of their march so as to intercept him. The effects of want of discipline and contradictory orders had greatly delayed his march, and he was much harassed by the enemy, till finally on the 30th the 5th corps under De Failly, having encamped near Beaumont without taking the precaution of protecting themselves by a chain of outposts, though it had been engaged the previous day, was surprised and driven northwards on Sedan. Here MacMahon collected his dispirited troops, but only to find that the enemy had surrounded him, and by vigorous forward movements had captured the bridges over the Meuse and the commanding positions round the town. A fierce battle commenced early on the 1st September by the attack on Bazeilles. This village was captured by the Bavarians and recaptured by the French, and ultimately burned. By noon MacMahon had been wounded, and General Wimpffen as senior officer had taken command, only to find further resistance hopeless, in spite of the gallant charges of the French cavalry under General Marguérite, who fell at their head. Nearly 500 guns were playing upon the French, who were crowded into Sedan and under its walls, and at 5 P.M. the white flag was hoisted on the citadel. Next day the emperor, who was with the army, surrendered with 83,000 men.

On the 4th Paris was in rebellion, the senate dissolved, the empress-regent a fugitive on her way to England, and France proclaimed a republic amid tumultuous excitement. Before the close of September, Strasburg, one of the last hopes of France, had capitulated, and Paris was completely invested by German troops; and on the 5th October the Prussian king had taken up his headquarters at Versailles. Gigantic efforts were made to raise armies in the provinces for the relief of Paris. Gambetta, escaping from the city in a balloon, joined the government at Tours, and by his energy got together many thousand armed men. These under the successive command of Generals D'Aurelles de Paladine, Chanzy, and Bourbaki fought stubbornly on the Loire, and with some slight success, threatening at one time to cut the German line of communications, at another to raise the siege of Belfort. But the surrender of Metz by Bazaine, and consequent reinforcement of the German armies round Paris, frustrated the first, and the masterly tactics of General von Werder on the Lisaine not only prevented the second, but drove the French troops into Switzerland, where they were disarmed and interned. Whilst these events were occurring in the south and south-east, the Germans were overrunning the north as far as Dieppe, and fought a drawn battle with the French levies under General Faidherbe, who perhaps displayed more talent than any other French leader during the campaign. From Paris, where almost every able-bodied man was enrolled in the ranks, frequent sorties were made, and bloody battles fought in the villages to the east and south, Le Bourget, Champigny, Le Hay, Bougival, Rainey, &c., several of which were taken and retaken more than once. The city also underwent a bombardment for several days, from which, however, it suffered little, and it was not till compelled by hunger in January 1871, after a four months' investment, that negotiations were opened with the enemy at Versailles. The united efforts of the different branches of 'the Provisional Government of Defence,' respectively installed at Paris and Tours, then succeeded in bringing about an armistice, and a portion of the investing army entered the city, which had been till then cut off from all communication with the outer world, except by balloons and carrier-pigeons, and finally threatened by famine. They remained but a few hours, and with the concurrence of Germany the French nation now proceeded by a general election of representatives to provide for the exigencies of the country.

The Third Republic.—The First National Assembly of the French Republic met at Bordeaux in February. After receiving from the Provisional Government of Defence the resignation of the powers confided to them in September 1870, the Assembly undertook to organise the government, and nominated M. Thiers chief of the executive power of the state, with the title of President of the French Republic, but with the condition of responsibility to the National Assembly. On the 1st of March the preliminaries of peace were finally ratified at Bordeaux, the chief conditions being that the province of Alsace (except Belfort) and part of Lorraine, including Metz, should be ceded to the German empire, and that France should pay a war indemnity of 5000 millions of francs, and continue to be occupied by German troops till the money was all paid. This enormous obligation was discharged in September 1873, and during the same month France, after an occupation of three years, was finally relieved from the presence of foreign troops. In the spring of 1871 the peace of France was seriously threatened by a successful outbreak at Paris on the part of the Communists; but, after great bloodshed and grievous damage to public and private property, they were quelled by the regular army, and on 20th May order was restored in Paris.

The difficulties which beset the French in the war commenced with bad organisation for collecting the reservists and mobilising the army. In contrasting the two opponents, it is remarkable how inefficient the fine French cavalry was in obtaining information, how slow one commander was to march to the support of another, how defective were the services of the staff, how little strategical talent was to be found among the generals, and how often ordinary military precautions were neglected by them. To these must be added most persistent bad fortune.

Since then France has been successfully trying to obliterate some of the numerous misfortunes resulting from the war, and commerce and national prosperity have very rapidly revived. The ex-Emperor Napoleon died in 1873 at Chislehurst, where he had resided with his family since his liberation in March 1871. His son was killed in

the Zulu war (1879). In 1873 M. Thiers resigned the office of President of the French Republic, and was succeeded by Marshal MacMahon, who appointed ministers willing to pave the way for the reinstatement of the French monarchy, under the descendants of the Bourbon dynasty. But the plan of a fusion between the two branches of the family failed through the action of the Comte de Chambord, whom it was intended to make king under the title of Henri V.; whereupon the monarchical majority in the National Assembly, in spite of the growth of republican feeling in the country, confirmed for seven years MacMahon's tenure of the presidentship. Matters thus remained in suspense between a return to the monarchical principle and a thorough acceptance of the republic till 1875, when, by the accession of some Orleanists to the moderate republican parliamentary party, it became possible to pass constitutional laws for the republic. A senate and chamber of deputies represented the people; a president elected for seven years stood at the head of the government. The general election held in virtue of the constitution showed that France, under universal manhood suffrage, was now in favour of a parliamentary republic. A last attempt made in 1877 by the 'reactionary' parties to stem the tide of popular feeling met with a decided rebuff at the polling-stations. In presence of a republican majority both in the House of Deputies and in the senate Marshal MacMahon resigned his office (1879), and an out-and-out republican, M. Grévy, was appointed in his stead. Gambetta, the eloquent orator and leader of the republicans, who became after the death of Thiers the paramount political power in France, now led his party into courses of uncertain wisdom. The Communards were rehabilitated; the church was irritated by violent measures; the Tunis expedition was entered upon; public instruction, on the other hand, especially in its primary grade, was greatly developed. To their irritating attacks upon the Orleanist, Legitimist, and Bonapartist parties, representative relics of France's former political states, and upon the Roman Catholic Church, the largest and most united corporate power in the country, the republicans soon added internal discord, and suffered from their inexperience of parliamentary government. The true conservative power in France, the body of peasant proprietors, began to include their chosen representatives in their distrust of all politicians. Republican prospects became clouded through Gambetta's accession to the premiership and his failure to keep it; through his death (1882), which left his party without a leader and the people without an idol; through the weakening of French influence in Egypt, less owing to English action than to the vacillating policy of the ministry (1882); through the Tonquin expedition and embroilments with China, which cost many lives and much treasure without perceptible returns; through accusations of jobbery and malversations brought against M. Grévy's son-in-law, which resulted in a change in the presidentship by the resignation of the former, and the election of M. Carnot (1887). The election of 1885 showed that the republic had lost ground, and the infatuation of a large section of the electors for General Boulanger (1887), supported by the reactionary parties in his schemes of personal political aggrandisement, while doing little to unite the broken front of the republican majority, put in jeopardy the rational, practical, and undoubtedly liberal parliamentary institutions which the third republic had been instrumental in implanting in France. In 1889 the French held their fourth universal exhibition; and the general elections in the autumn effected a final settlement of the duel between Boulangists and Constitutional Republicans. When all the uncertainties of the situation are summed up, and in spite of the permanent threat of a war with Germany, the fact remains that France, since the defeat received at the hands of that country, has immensely improved its material and military resources, and taken a long stride towards a healthy, well-regulated, peaceful, national life.

See the French Histories of France by Anquetil (1805; new ed. 1879), Sismondi (1834), Thierry (1827; new ed. 1872), Michelet (1833–74), Martin (4th ed. 1856–60), Guizot (1874), Duruy (1852); the *Recueil des Historiens des Gaules et de la France*, edited by Dom. Bouquet and other Benedictines, and continued by members of the Institute (i.–xxvi. 1738–1885); Crowe's *History of France* (Lond. 1830–44); the short histories by Mrs Brook and Miss Yonge; and Dean Kitchin's *History of France previous to the Revolution* (3 vols. 1873–77). For the Revolution, see the works of Mignet (1824), Thiers (1823–27), Louis Blanc (1847–64), Michelet (1847–53; centenary ed., 5 vols. 1889); Taine's *Origines de la France Contemporaire* (1875–85; Eng. trans. 1878–85); Carlyle's *French Revolution* (1837); Morse Stephens' *History of the French Revolution* (vol. i. 1886); and Von Sybel and Wachsmuth in German. For the Restoration, see Lamartine (1829) and Capefigue (1869); for the Revolution of 1848, Lamartine (1849), Garnier-Pages (1872); and for the Second Empire, Delord (1875). See also the articles in this Encyclopædia on the chief kings, rulers, and great men of France, such as FRANCIS I., HENRY IV., LOUIS XIV., DANTON, MIRABEAU, RICHELIEU, ROBESPIERRE, NAPOLEON, THIERS, GAMBETTA, &c.; and those on GALLICAN CHURCH, BOURBON, GIRONDISTS, HUGUENOTS.

LANGUAGE AND LITERATURE.—The French language belongs to a family which offers unusual interest and exceptional facilities for philological and literary study. From the standpoint of the English scholar it appears better suited than any other modern tongue to impart a sense of genesis in language, and by analogy and parallelism in almost everything else. It is the best specimen of its kind, because the decomposed soil from which it springs—Latin—is school property; because the successive states it has gone through are visibly marked on its material and in its significance; because its line of development, diverted from Roman culture, lies across the richest and most accessible historical ground. Moreover, since the rise of modern philology, no language has been subjected to more patient and more profound research, nor has any repaid more fully the labour expended upon it. No greater monuments of linguistic science have been erected than the special literature produced mainly in Germany and in France by the students of French philology; so much so that one's admiration is divided between the intellectual penetration which has discerned the laws of growth in the French language, and the marvellous fixity and regularity of these laws themselves. Long before the Romans conquered Gaul their speech was already undergoing certain specific changes, whence in due course and in the proper places the modern languages of Italy, Roumania, Spain, Portugal, and France would take their rise. These changes consisted principally in the weakening or dropping off of primitive elaborate case inflexions, the suppression of short vowels between consonants that could with ease be pronounced together, a gradual increase in the stress laid in pronunciation upon the accented syllable, the use among the Roman plebs of forms and words not accepted in the polished classes of society, and the tendency to depart from the earlier and synthetic modes of expression in order to introduce into the mechanism of speech a new class of words, which slowly took the place of perishing case and verb inflexions.

Through Latin, its ancestor, French belongs to the

Aryan stock of languages. Along with its sister-languages, Roumanian, Italian, Spanish, and Portuguese, it sprang into being when soldiers, colonists, and merchants, in the course of several centuries of Roman domination, had saturated western and southern Europe with their *lingua romana rustica*, or common Latin speech, an essentially popular and unliterary form of utterance, but forcible and instinct with an irrepressible vitality. This Latin of the Roman people and of their European possessions is known to philologists in the shape it received after the invasion of the barbarians and through the admixture of Teutonic elements, under the name of Romance. It is as it were a vegetable mould, spread to a great depth over the surface of western and southern Europe; and from its common properties were formed, by a process of differentiation, the special and localised soils suited to bring forth ultimately the distinct literatures of Italy, France, Spain, and Portugal. In France Romance gave birth to Old French, which can be divided into three successive periods—the period of formation, the flourishing period, and the period of decay. The first is contemporaneous with the earliest middle ages, and its origin, like that of French history, dates back to the conquest of Gaul by Rome. The Celtic dialects were overpowered by the *lingua romana rustica*. While the masses spoke popular Latin, the literary dialect of Cicero was written and spoken by the educated and governing class: it was a class language, and continued so till the church was left alone in possession of this effete legacy of ancient Rome.

The *lingua romana*, according to a law inherent in every language, was already assuming local peculiarities in different parts of Gaul when the first move towards the formation of a French language, the campaigns of Julius Cæsar, was completed by a second, the settlement in Gaul of the Frankish, Burgundian, Saxon, and Gothic tribes from beyond the Rhine. The formation of different dialects received fresh impetus from the complete disruption of the Roman power in the West. From that day, the processes of decay, which till then might be considered as modifications within the *lingua romana*, assumed a regenerative character and became the starting-point of a new language. To the Franks has fallen the honour of having their name attached to it. This Germanic title has by no means affected the inner construction of the language. Teutonic influences can be traced in goodly number in the vocabulary and phonetics of Old French; but the grammatical framework and the syntax, which developed only in the late stages of Old French, are wholly and absolutely Latin in origin and Latin in spirit. Language in Gaul, as elsewhere, ran into types: dialects, whose primary causes are obscure, were formed. In the valleys of the Rhone and of the Garonne, in the whole country (very nearly the half of modern France) verging to the Bay of Biscay, from the mountains of Auvergne southwards, early French was not French; it inclined to the Italian and Spanish modifications of Romance on which it bordered. These southern dialects, known under the collective name of *langue d'oc*, fell out of the race for supremacy when the centre of political and military power in Paris became strong enough to absorb the Mediterranean border in its circle of influence. By degrees inner troubles and invasion from without deprived the southern speech of its national significance as a body of language. Nowadays Provençal (q.v.) is for the people a patois, for literary antiquaries and philologists a curious study. Its victor, the *langue d'oïl*, the parent of modern French, has had a triumphant career. Geographically, to it belonged the valleys of the Saône, Loire, Seine, Scheldt, and Meuse. Scholars recognise four dialects in it. The dialect of Paris became paramount after the building up in Paris under the Capetian kings of a natural centre for the gradual nationalisation of France. The culminating point of Old French was reached when it had evolved fully its 'half synthetic system' in the 12th century.

The language thus shaped brought forth a stupendous amount of literature. For two centuries medieval French was the polite language of Europe, more so than modern French has ever been; for after the early but transient literary outburst of the *langue d'oc*, and before the dawn of the Italian Renaissance, French had no rivalry to fear from still shapeless contemporaries. It was currently held till within the last fifty years that French literature had its roots in the Augustan age of Latin culture, and that the Hellenism of the Renaissance was the first air in which it flourished. The mythological apparel of French poetry and the classical rhetoric do admittedly proceed from that source. But hearts beat and imagination wove its webs of fancy in France ages before scholars imported the literary finery of Greece and of Rome. The natural trunk of French literature, if not of French letters, casts its roots in the same soil whence the language sprang. Language, nationality, and society are even in the middle ages the constituent elements of history, and the true nature of the times is better elicited from them than from the records of military violence.

In the flourishing period of Old French, society is feudal, its character is the division of men into four sharply defined classes: the nobility, whose occupations were mainly martial, and who in consequence fostered an epic literature; the burghers, among whom are first found the more strikingly national points—common sense, wit, good-humoured satire, gracefulness, a fresh and nimble style; the villeins, affording to the burgher plentiful material for jest; the clerics, including the clergy and all professional men, who spoke and wrote Latin, and who when they took to writing in French brought to it the older language's historical and philosophical qualities. Those four classes had their being between the four walls of medieval immutability—the Catholic religion, feudalism, monarchy, and the grossness of their world-conceptions. Thus rough-hewn, French society, from the 11th to well into the 14th century, assumed and preserved throughout the Crusades, throughout the struggle between emperor and pope, in spite of the annexation to England for a time of a large portion of France, the proud position of master and arbiter in matters of the intellect and of social commerce. The deeds of war of the Frankish kings of the Merovingian and Carlovingian dynasties called forth French epic poetry. The appearance of Clovis as the champion of the Catholic faith against the Arian heresy, of Charles Martel as the protagonist of Christendom against the Moslem Arabs from Spain, of Charlemagne as conqueror of the heathen Saxons in Germany and of the Mohammedans on the banks of the Ebro, fed an ever-swelling strain of song till it rang its loudest in the *Chanson de Roland* (11th century). Round this epic poem, struck up by the Norman *trouvère* at the battle of Hastings, further royal, feudal, and biographical epics ranged themselves, almost all grounded on fact, some borrowed from antiquity, some suggested by the Crusades, some imported from Brittany. The last class may be claimed by Great Britain as derived from the literary fund of its oldest inhabitants; for, when the Celts of Britain had been driven from the east coast by the Angles and the Saxons, a part of them crossed the sea to French Brittany, taking with them the

legend of King Arthur. Those who remained in Wales, after charming their Teutonic conquerors by their gift of song and poetry, fascinated with still greater ease the Normans romanised by their long stay in France. Their *Round Table*, *Perceval*, and *Lancelot* were incorporated in Anglo-Norman literature, till they won for French in their continental form the prize of narrative poetry. From France those romantic stories passed into the Netherlands, Germany, Italy, and the Spanish peninsula, carrying everywhere that air of chivalry and gallantry which in matters of the imagination gave an ideal to society and constituted its moral unity. In the middle of the 13th century the purely epic cycle and the romantic cycle engrafted upon it were complete. Then came in verse the opportunity of the story-teller and in prose that of the chronicler. The French fabliau or tale is unequalled for wit, humour, alertness, good-tempered malice, and refined mockery, with a strong dash of the salt of coarseness. The Voltairian spirit already tripped lightly about, and the fabliau writer, in his swift, pointed treatment of social matters, is the forerunner of the *esprit Gaulois* and Parisian vivacity which feed a distinct current in the stream of French literature. Boccaccio and Chaucer drew much material from the French elaboration of tales hailing from all quarters of the globe.

Whole collections of fables were fathered upon Æsop, dubbed to that purpose with the familiar name of Isopet. By degrees the short fable was succeeded by long semi-epic, semi-satirical compositions, in which a moral was aimed at man by the transference of social relations to the animal world. The *Roman du Renard*, the most representative and most comprehensive of these productions, was imitated and translated everywhere, and its more interesting parts have remained a common possession of all literature, suggesting for instance the Flemish *Reynaert de Vos*, and finally appearing as Goethe's *Reineke Fuchs* in modern literature. In the 14th century the latest French compilation of Mr Reynard's exploits throws a deal of light on the society of the time. It expresses the ideas of the comparatively wakeful and wealthy middle class then occupying the large towns, their hatred of the landed aristocracy, and indifference to the villein's lot. The French have to thank the Crusades for their first histories. Some of these belong to Anglo-Norman literature, and recount the deeds of France's ally, Richard Cœur-de-Lion. But they are outshone by Villehardouin's *Conquête de Constantinople*, the masterpiece of historical composition in the middle ages proper. He reminds us of Herodotus as the *Chanson de Roland* reminds us of Homer. The sixth crusade and the life of Louis IX. are the subject of Joinville's *Mémoires*, while various causes resulted in an outburst of French or rather Anglo-Norman historical productions in England which did not extend beyond the beginning of the 14th century. History in the middle ages being heroic, epic, and chivalrous rather than didactic and philosophical, the aristocrats provided the clerics with the material and spirit of its treatment. But as time wore on the latter in their turn enriched French literature with branches that are entirely their own. They began to write in the character of students and scholars, of moralists, caricaturists, educators, dramatists, and professors of religion. Their most important contribution to general literature is the *Roman de la Rose*, a vast allegorical treatment of the lover's woes and the lover's bliss in the pursuit of the object of his passion. Begun by Guillaume de Lorris, the poem was continued and diverted from its original purpose by Jean de Meun; it became popular throughout Europe in the multitudinous artificially-cultured court circles of the 14th century. It passed into the Dutch, Italian, and English languages. It imparted its character to French literature till the end of the 15th century, was transcribed and printed during 300 years, and stands in an indirect relation to the 'romans' and 'précieux' works of the 17th century. Lyrical poetry has, properly speaking, no cradle of its own within the strict limits of French medieval literature, for it was brought thither from a sunnier, warmer, and softer southern air. Italian, Spanish, and the *langue d'oc* were the natural and early vehicles of lyricism in Europe. Of these three languages the last named was the first to bear fruit. There prevailed in Provence some particular rules of etiquette and of good breeding, upheld by a brilliant society in which women held the foremost place. The troubadours in their lyrics held up the mirror to that society and reflected its tastes. When the south had fallen a victim to the bane of persecution and military supremacy extended upon it from the sterner north, the art of the troubadours found in the 13th century a temporary abode in Champagne, Picardy, Flanders, and Artois, whence it passed to Germany, to Italy, to Sicily, to Spain, to Portugal, inspiring everywhere the first lisping attempts of nationalities whose languages have since proved themselves to be, as lyrical instruments, superior to the French.

The 15th century witnesses the linguistic transformation of Old French into Modern French. The last traces of case inflection disappear, the analytic form of language supersedes in all essential parts the half-synthetic system. The French mind acquires these qualities of reflection, French thought takes that philosophic turn which distinguishes the idealism of the intellect from the idealism of the imagination. Froissart, in his Histories, wields an inquiring as well as a picturesque pen. His successor, Philippe de Comines, the historian of Louis XI., is still more of a moralist and of a politician. Charles d'Orléans, snatching from the perishing troubadours the thread of lyrical poetry, passed it to Villon, who wove into its silk many a coarse hempen filament, till Clement Marot raised French verse to religious solemnity in his translation of the Psalms, preserved its grace in his epistles, and gave it a pathetic ring in his elegies. In the meanwhile the Italian Renaissance was filling with its glory the world of art and of literature. Native and spontaneous literary activity was paling before the light of the revival of learning. With the accession of the House of Valois to the throne we find at once that the spirit of France has passed away from the old into a new society and a new literature. France will now receive the lessons of ancient Rome, ancient Greece, and modern Italy before it does again original work and resumes its supremacy in Europe. French society becomes polished, its local provincial centres die out, and culture flourishes in the court of the king. Francis I. is proclaimed the father of letters. The state is organised, there is a general intellectual impulse, women are promoted to the place of honour in social and court life. French officers, sent year after year at the head of French troops to Italy by Charles VIII. and Louis XII., brought back a knowledge and a love of art and letters. Italian architects built mansions for them and palaces for the royal family. Italian painters and sculptors hung pictures and set up statues in their halls. Italian scholars interpreted for them the masterpieces of Roman and Greek literature. No longer mere power or physical prowess, but mind was the object of a gentleman's ambition. It became the fashion at court to show enlightenment by attending the preachings of the Reformers. Francis I. laid the foundation of the Bibliothèque

Nationale and of the Collége de France. He, and his sons after him, encouraged artists and scholars. Paris numbered then 500,000 inhabitants, of whom 15,000 were students.

In the general excitement of the Renaissance and the Reformation, literature could not but move in the same direction as society at large. Italian comedy ousted the *mystères*, *sotties*, and *farces;* the imitation of Greek and Latin authors reduced the flow of inspiration in poetry, and burdened it with artificial rhetorical rules and with a mass of ill-advised borrowings from the Latin vocabulary and from the Latin syntax. Ronsard and his *Pléiade* stood in the van of this movement, which Régnier endeavoured to stem, while Rabelais, mixing the new material with the old in an ill-assorted, stupendous mass of cumbersome learning, low jesting, high thinking, and word-rioting, came near being the burlesque Shakespeare of his age, whose energies are best represented in we know not which of the numerous veins running through *Gargantua* and *Pantagruel*. No two minds could be more different than those of Rabelais and Montaigne, the great prose-writers of the 16th century, yet only the Renaissance could produce either; the first, with his reason driven wild in pursuit of the visions of his imagination; the second, a blithe Greek sage, carrying his wisdom lightly and discoursing as if arm in arm with Plutarch, his model. Rabelais, Montaigne, Calvin, and Descartes, by setting French prose on the basis afforded by the revival of learning, drew to themselves some of the attention then given to Italy. Poetry was rescued from Ronsard's exaggerations by Malherbe only to be tapered down almost out of existence by over-much attention to elegance, refinement, lightness, and style. Looking forward through the spans of time, we find that, divorced from nature and limited to the expression of the social emotions, poetry is poetical with Lafontaine only in his *Elegie aux Nymphes de Vaux*, with Racine only in the choruses of his tragedies. As for the professed lyric poets of the 17th and 18th centuries, their performance bears the impress of the sterility and rhetoric of their Latin models. J. B. Rousseau, Lefranc de Pompignan, Lebrun, and Pindare are worse sinners in this respect than Racan, Chaulieu, and Parny. Lyricism finds better interpreters in church orators, such as Bossuet (*Oraisons Funèbres*), Bourdaloue, Massillon, and Fléchier, all of the 17th century. It pervades the glowing pages which love of nature and effusion of sentiment dictated to J. J. Rousseau and Bernardin de St Pierre in the later part of the 18th; it dwells in the religious fervour of Chateaubriand and in the passionate enthusiasm of Madame de Staël on the threshold of the 19th. André Chénier was the first to restore some soul to poetry, in the pure Greek note which he sang during the horrors of the Revolution.

Such a long eclipse is partly explained by the premature application to literature of standards of taste and of formal criticism. Malherbe subjected his talent to a personal discipline which Boileau consolidated into a set of rules enforced with the lash of satire. Corneille wrote his tragedies early enough to remain comparatively free from this rod, but Racine acknowledged Boileau as his master. The 17th century is in France the age of authority in literature as in everything else. The French Academy, founded by Richelieu in 1635, to establish positive rules for the French language and to render French speech not only elegant, but also fit to present all arts and all sciences, gave an earnest of its future labours by an endeavour to curb Corneille's waywardness in composition. Public opinion at court and public opinion in town circles —for Paris was becoming a centre of culture and thought, forming together with the court the whole of French society—fell by degrees into line with the Academy and with Boileau. Thus was formed, along with French unity, the unity of French literature, and to this period is ascribed the name *classical period*, to distinguish it from the period of liberty and individualism ushered in after the Revolution and the Empire, by the rise of liberalism in politics and the return to freedom in the matter of prose and verse composition. As long as town and court moved together in the same direction, the unity of French thought, of French literature, and of French political development remained unimpaired and produced its fruits good and bad. After Corneille's sublimity and his representation, not without some Spanish staginess, of the conflict of duty and passion in heroic human breasts, came Racine's polished and courtly expression of the agitations of the heart. Molière, the greatest French painter of men from life, showed himself in his *Tartufe* the scourge of hypocrisy; in his *Misanthrope* he was austere and touching; in the *Femmes Savantes* and in the *Précieuses Ridicules* he exposed the false and pedantic erudition of the woman of the period; in the *Avare* he related the plight of an unconscious miser; playful withal, castigating with sobriety, ruthlessly just and gently forgiving, uproariously funny and immensely suggestive, acting his parts himself in the happiest fashion, using the sharpest, tersest, and brightest French. Regnard followed him, but far behind. Then came Destouches, Le Sage, Piron, Gresset, Sedaine, without Molière ever having a rival, except perhaps Lafontaine, whose fables, conceived in the same inimitable French vein, are one and all natural or comic little dramas in which an apparently artless exhibition of the ways of animals and things leads to a neat moral applicable to man. Florian followed in his footsteps at a respectful distance. Madame de Sévigné gained a place for letter-writing as a distinctly French art, an accomplishment in which many Frenchwomen have excelled after her. In contrast to Bossuet's Hebrew-like eloquence and militant ecclesiasticism stood Fénelon, gentle, suave, and versatile, ever healing wounds and pointing a warning finger to dangers ahead. Totally different from either of them had been Pascal, an introspective pessimist oddly placed in the vestibule of an impersonal age, wrestling with doubt, bending the language to his intellectual agony, and planting upon the Jesuits the stigma of his honest, piercing satire. La Rochefoucauld, who wrote his contribution to moral philosophy before La Bruyère, was also a memoir-writer, a gift in which Cardinal de Retz, the naturalised Scotsman Hamilton, and the Duc de St Simon all excelled.

Amidst the mistaken foreign and home policy which was striking at the very roots of the nation, French literature offered towards the end of the long reign of Louis XIV. a spectacle of imposing intellectual force. France established thereby so well its claim to the leadership of society and literature in Europe that, thanks to a lull in native literary production, as in England, or to a comparatively backward state of culture, as in Germany, or to a paralysis of the national vigour, as in Italy, the French 17th century might seem to protract itself in all these countries even at a time when a total change was passing over French society, and pointing its literature in a new direction. The age of Louis XIV. was, above all things, that of a well-balanced literature, the work of men whose nerves are not upset, who are fully satisfied with the work suggested by their situation. Their stock of ideas was adequate to their power of treatment, and nothing came to mar the dignity and gravity with which they approached their subjects. There is a wholesome moral tone underlying their performance, and the

kind of repose bred from the illusion that one's work is final. But Louis XIV.'s senility and fanaticism, and after him the license and unscrupulousness of the regent, disorganised the court; a larger number of thinking and able men collected in Paris than the service of the state and of the church could occupy. Parisian society, once educated by the court and long led by it, broke away, and violently rebelled against an irksome tutelage. It returned to freedom first, then it welcomed adventurous minds which abandoned troublesome spiritual and moral loyalties to swell the ranks of drawing-room malcontents, while below them seethed a large class of *intrigants* and schemers recruited in the overgrown establishments of noblemen and courtiers. Literature, from being an art in itself, became subordinate to ideas; by an enormous influx of ripening thought it became a vehicle for hitherto unexpressed political, moral, religious and scientific matter. Till 1750 the disintegration of the old social body remained latent. Still, Montesquieu's *Lettres Persanes* and his *Considérations sur la Grandeur et la Décadence des Romains* announced plainly enough the advent of social satire, and the application of philosophic method to the study of political history. But his *Esprit des Lois*, by showing the interdependence of physical and moral laws and the conditions to which is subjected the legislator's apparent liberty, marks a clear departure from the traditional theories of government.

The great mouthpiece of the spirit of the age, Voltaire, belongs still in pure literature to the times of Louis XIV. His tragedies are classical, his literary criticism is that of Boileau, his poetry is an academic display of wit and sociability; but the remainder of his works form a complete battery in which his tales represent the light artillery and his histories the heavy guns. Combining passion with philosophic acumen, strangely divided between vanity and generosity, the personal friend of kings and the advocate of individual and popular rights, preaching tolerance and openly undermining public respect, deep in prejudice and the enemy of superstition, he showered upon the tottering edifice of French society pamphlets, treatises, letters, discourses, epistles—all of them shafts pointed with sarcasm, finely weighted with a touch of plausible learning, and feathered from the wing of his sparkling imagination. He was assisted in his incessant warfare by a host of talented and original thinkers. Sensualistic followers of Locke, like Condillac and Condorcet; combative materialists, like Helvetius and D'Holbach; encyclopædists, headed by Diderot and D'Alembert; earnest moralists like Vauvenargues; writers of novels and plays with a purpose, such as Le Sage and Beaumarchais, or with the object of minute psychological analysis, such as Marivaux and l'Abbé Prévost; naturalists, like Buffon and Bernardin de St Pierre, showed each in his own department of letters, art, or science, many even in several departments at once, one common spirit and an identical zeal by which all thinkers and writers, often unknown to themselves, worked in concert as if holding of malice prepense an intellectual Pentecost. The age was too much in earnest for plain comedy; it was too bitter for poetry; Gilbert almost alone wrung a true cry from his heart; Crébillon writes some overwrought tragedies, and Laharpe stands forth as the last critic of the Boileau school.

At this juncture J. J. Rousseau appeared to complete Voltaire. Born in Geneva, where the political institutions towards which France was moving were partly in existence, early weaned from an atmosphere still nominally Calvinistic, professedly at war with the philosophers, he gave them the support of his persuasive eloquence, passion, imagination, inspiration, enthusiasm, heating in fact their cold intellectualism with an emotional fire that quickened the seed of mischief, and raised the nation's pulse to fever-heat, till even Rousseau's voice was lost in the clamour of the Revolution. He broke fresh ground in the science of politics by his *Contrat Social*, in the art of education by his *Émile*, in pure literature by his *Nouvelle Héloïse*, painting a picture of more natural morals, often greatly at variance with morality. An unworthy son of the society of his day, he passed condemnation upon it. In the year after his death the political assemblies began the realisation of his ideas. Thus literature, at work among other causes, led straight to the Revolution. The ring of Mirabeau's oratory was heard for a few years above the turmoil in which perished the poet André Chénier.

As long as the axe did execution in France, and as long as Napoleon's sword held sway in Europe, literature did not raise its voice. Madame de Staël drew her inspiration from without, though mentally and emotionally in touch with J. J. Rousseau. She called the attention of France to the benefit it could derive from the study of independent foreign literature, such as the nascent literature of Germany and the established literature of England. She showed that the poetry of the Renaissance, derived from the ancients, elaborated into formal classicism, burdened with pagan associations, and modernised in Italy and Spain, could not be compared with the hidden bubbling springs welling forth in the chivalry and cathedrals of the land, and flowing from the lips of the greatest poets out of France.

By doing away with every sort of restriction and privilege the Revolution imparted a new unity to the French nation, immensely developed the function of the middle class, and threw open vast prospects to its hopes and ambitions. Becoming the centre of gravity of the nation, and holding in its hands the reality of power, it re-echoed the ideas of Madame de Staël. Chateaubriand, finding in a return to medieval ideals the proper food for his imagination and the right colours for his style, unwittingly favoured her liberalism. Then Lamartine stepped forth as the lyrical poet long looked for in vain, revealing in his reposeful, tuneful lines, often sad, and ever bathed in a dim religious earnestness, a beautiful and sympathetic side of French poetic sentiment which had never yet found a mouth able to utter it. A whole school of lyric poets followed in Lamartine's footsteps—Alfred de Vigny and Victor de Laprade being among the greatest. Casimir Delavigne is not free from the besetting sin of rhetoric, and Victor Hugo was master of too many instruments besides the lyre to be classed here. His position is that of founder and head of the French romantic school, as the men called themselves who threw off all allegiance to the classical traditions. He philosophised for his followers on romantic æsthetics, explaining what relation ugliness bears in art to beauty. He applied his doctrine in a series of dramas, to one of which, *Hernani*, the romanticists nailed their colours and compelled the public to bow. From 1830 to 1885 Victor Hugo was in all kinds of literature, at first an initiator, then a revered and victorious chief, and during his old age an idolised master. Under his leadership formalism was excluded from the technique of poetry; ingenuity and a free adaptation of rhetorical means to poetical ends taking the place of compulsory standards. In prose style was left similarly to individual initiative; the language being boldly bent to the purpose of the writer, and receiving its moulding from the originality and character of his mind. There was no longer a question of imitating set

models and complying with fixed precepts. Expression received its form from within. Hence a new, multiple, and often eccentric art, seeking too much after the pictorial and sensational significance of words, a general strain on the resources of language and of literary expression, but a profusion of striking effects, and the transference to the pen of many capabilities belonging properly to the brush, the pencil, or the chisel. Victor Hugo inaugurated thus a new method in literary composition. Taste and wit became of less moment, because literature no longer rested upon society as a whole, but upon the nature of each individual writer.

Romanticism represented three things: a return to ideals medieval, a recoil from ideals classical, and the awakening of modern France to its own ideals. Victor Hugo embodied all this in his long career. Royalist and Catholic at first, he sang odes to the past; adversary of the Academy and of the Théâtre Français, he gained seats in the first for his followers and the boards of the second for his and their dramas. Then, interpreting the inner life of the bourgeoisie, he wrote for them the poetry of their daily musings, of their affections, of their children. Next, led on to liberalism and to the breadth of human charity, he with one hand branded Napoleon III., with the other revealed what gleams of spiritual beauty shine unknown in the hearts of the lowest and poorest, while his imagination wrought into epic poems the history of the world and the destiny of man. Nobody ever did so much with words, and words never did so much for any one. The æsthetics of romanticism bore fruit in the transformation of dogmatic criticism into literary history. Sainte-Beuve applied the theory of the new practice with so much success that the critique of art and literature, always a favourite pursuit with the French, but long a cause of weakness, became one of their strongest points, and most beneficial to all literature. With him, Villemain, and Scherer, literary history became comparative as well as personal. To attempt an enumeration of Victor Hugo's followers, or of the writers in any given field, would break the proportions of this general survey, besides conveying a wrong impression, for it is a feature of this century that the activity of talent pervades several fields, and expresses itself in verse and in prose almost indifferently. Lamartine, for instance, was an orator and a historian as well as a poet. Victor Hugo was still more discursive. Few men sat down to their work with the intention of deriving their inspiration from the nature of their subject only. Subjects were rather chosen as themes, and their treatment showed a complicated compromise between man and thing. Michelet's history, for instance, is not separable from Michelet. After the first ado of the romantic movement, which immensely broadened the stream of French literature, the old and new flood mixed their waters and ran as it were into four principal masses. Poetry became more and more of an art and less and less of a substance, except in Alfred de Musset, who rivalled the finest performance of Lamartine and Victor Hugo without sacrificing his originality to either, sometimes toying with life, sometimes sneering at it, sometimes uttering the cry of man unredeemed from vice, crushed in sorrow, and bound in weakness, in a voice so true, in so sweet a melody, that he is the most loved of French poets. Below him stand the Parnassian poets, Leconte de Lisle, Baudelaire, Sully-Prudhomme, François Coppée, and, among his minor contemporaries, the satirists Barbier and Barthélémy, Brizeux, the two Deschamps, the ultra-romanticists Gérard de Nerval and Théophile Gautier.

The drama, to which Casimir Delavigne, Alfred de Vigny, and Alexandre Dumas laid stepping-stones for Victor Hugo, fell after him into the hands of the semi-classicist Ponsard, of Augier, Feuillet, Alexandre Dumas fils, and Sardou. The comic stage, occupied by the rapidly-constructed and rapidly-vanishing productions of Scribe, only seldom saw a real comedy. But as a set-off some of the old comic force entered now and then into the romantic drama, and trickled into many novels and romances. These were a genuine growth of the times, and, for variety, artistic treatment, psychological analysis, they rank high above every novel published before, with the exception of but a few to which they are historically affiliated. Novels are fantastic with Ch. Nodier, historical with Alfred de Vigny, realistic with Mérimée, Balzac, Flaubert, and Daudet, panoramic with Alexandre Dumas the elder, homely with Sandeau. George Sand, possessed like Madame de Staël of almost masculine gifts, and, like her, one of Rousseau's disordered kindred, exhibited in herself and in her books the play of the passions in their natural state, till she poured forth her mellowed ardour in pure idyls of country life. There is but a distant affinity between the 'realism' of some of the preceding writers and the naturalism of the brothers De Goncourt, Zola, Guy de Maupessant, and Paul Bourget. A wave of liberalism in the Roman Catholic Church bore Lamennais, Lacordaire, and Montalembert to oratorical fame, while Renan shone in church history, Cousin and Auguste Comte in philosophy, Taine in scientific psychology. Béranger stood almost alone in having but one specialty. A liberal, though under the spell of the Napoleonic military glory, he raised to an art his turn for penning popular songs. The analytical qualities of the French mind and its power of constructive writing were nowhere better displayed than in the department of history. A. Thierry with fidelity and picturesqueness, Guizot with some heaviness, Thiers with patriotic complacency, Quinet and L. Blanc with too much passion, Michelet with an excess of the poetical faculty, De Tocqueville with breadth and insight, attached their names to some masterly work.

In France more than in any other country mental power is accompanied by the literary faculty. Hence all science and manner of erudition claims a place in literature. An inquirer going the round of the interests of civilised man would with difficulty find an object of study or a branch of culture in which the French could not offer a model of presentment. Their literature is marked by symmetry and fullness in its successive periods, by continuity in its unity and variety, by evenness in its distribution over the pursuits of man, by regularity in its function towards society, by the amenableness of the people to its influence. Literature is a mightier instrument with them than elsewhere. They quickly respond to it. The susceptibility of the national character, its somewhat feminine eagerness and quickness of perception, which keep society as it were in a continual whirl of integration and disintegration, and ideas in perpetual revolution, are the very endowments which make their literature the most uniformly readable of all. With a little less of the mind-quality about them, they would be happier and wiser, perhaps, but Europe would be duller and poorer.

The history of the French language may be studied in the dictionaries of Diez, Scheler, Brachet, Littré, and Godefroy; its grammar in such books as those by Diez, Bartsch, Brachet, and Gaston Paris. The last commenced his *Manuel d'ancien Français* (11–14th century), including a summary grammar, selection of texts, and glossary, with an admirable volume, *La Littérature Française*

au Moyen Age (1888). Many invaluable contributions to French philology have appeared in the pages of *Romania*, founded at Paris in 1872, and edited by Paul Meyer and Gaston Paris; and of the *Zeitschrift für Romanische Philologie*, founded at Halle in 1877, and edited by G. Gröber. The Société des Anciens Textes has issued many texts since its foundation in 1872; the student may also be directed to Dr Wendelin Förster's *Altfranzösische Bibliothek* (i.–xi. Heilbronn, 1881–88), and to Suchier's *Bibliotheca Normannica* (3 vols. Halle, 1879–85).

For the history of the literature, the first work to be named is the monumental and magistral *Histoire littéraire de la France*, begun by the Benedictines and continued by members of the Institute (i.–xxx. 1733–1888), but not yet beyond the middle ages. More accessible for medieval times are the works of J. J. Ampère, Léon Gautier, Gidel, Albert, and Aubertin. For later times one of the best books is Godefroy's still unfinished *Histoire de la Litt. Franç. depuis le 16ᵐᵉ Siècle jusqu'à nos jours* (9 vols. 1859–81). Sainte-Beuve, and Darmesteter and Hatzfeld have devoted special study to the 16th century.

For the 17th century may be named the works by Voltaire, Demogeot, Laharpe, Sainte-Beuve, V. Cousin, and Fournel; for the 18th, Barante, Villemain, Bersot, Albert, John Morley, E. and J. de Goncourt; for the Revolution, J. Chénier, Géruzez, and the works of Maron, G. Merlet, and the brothers De Goncourt.

For the 19th century and modern times may be named the special books by Charpentier, Merlet, and critical essays on contemporary writers by Vinet, Sainte-Beuve, Villemain, Montégut, Prévost-Paradol, A. Pontmartin, Caro, Taine, Scherer, Paul de St Victor, G. Planche, H. Etienne, St René Taillandier, Janin, Saint-Marc-Girardin, Lemaitre, Bourget, Pollock, Saintsbury, and Henry James.

Good manuals covering the whole ground are the books by Nisard, Demogeot, and Géruzez, and by Van Laun and G. Saintsbury in English. Walter Besant's *Early French Poets* and his *French Humourists* are also serviceable English books. The reader is referred also to the articles on the chief French writers in this Encyclopædia, as well as to CHANSONS DE GESTES, DRAMA, FABLIAUX, NOVELS, and the like.

France, ISLE DE. See MAURITIUS.

Francesca da Rimini, the beautiful daughter of Giovanni da Polenta, lord of Ravenna, was given in marriage to Giovanni the Lame, son of Malatesta, lord of Rimini, on the conclusion of peace between the two houses. But her heart was already given to Paolo, Giovanni's brother; and in 1285 Giovanni, surprising the two lovers together, slew them both. The incident is woven into the *Inferno* of Dante. See Yriarte, *Françoise de Rimini dans la Légende et dans l'Histoire* (Paris, 1882).

Francesco di Paula, or ST FRANCIS OF PAOLA, founder of the order of the Minims, was born in 1416 at Paula or Paola, a village of Calabria. At the age of thirteen he was the inmate of a Franciscan convent; and at nineteen he retired to a cave where he inflicted on himself every species of self-mortification. The fame of his piety having attracted to his cell several emulators of his austere life, he obtained permission to erect a convent, and the new community received from Pope Sixtus IV. the title of the Hermits of St Francis of Assisi; but the title was changed by Alexander VI. to Minim-Hermits of St Francis of Paola. The founder established numerous communities in Italy, Sicily, France, Spain, and Germany, but the Minims were never settled in Great Britain or Ireland. To the usual conventual vows, Francesco added one of the most rigorous abstinence—flesh, eggs, cheese, and milk being strictly forbidden the entire year, except in illness. Popular report having attributed to Francesco several wonderful cures, Louis XI. of France, being ill, summoned him to his presence. Francesco was received with the highest honour, and attended the king on his death-bed. Charles VIII. and Louis XII. induced him to settle in France, and built him convents at Plessis-les-Tours and Amboise. Francesco died at Plessis on Good Friday 1507, and was canonised in 1519. The habit of the Minim friars is a gown of coarse undyed woollen stuff, and formerly they went barefoot or with sandals only.

Franche Comté, an old province in the east of France, in the basin of the Rhone, corresponded to what was at one time known as the County of Burgundy, and comprised what now forms the departments of Doubs, Haute-Saône, and Jura, and had for its capital Besançon.

Franchise, originally 'freedom,' but usually 'a privilege;' in England especially a royal privilege or exemption, belonging to a subject by prescription or conferred by grant. The franchise is the right to vote for members of parliament or congress. See PARLIAMENT, CONGRESS, and the sections on government in the articles on the various countries.

Francia, JOSÉ GASPAR RODRIGUEZ, usually called Dr Francia, Dictator of Paraguay, was the son of a small landed proprietor, of French or Portuguese origin, and was born near the town of Asuncion about 1757. He studied theology at the university of Cordova de Tucuman, took his degree as doctor, and was for some time a professor in that faculty. Next he adopted the profession of law, and practised for thirty years, with a high reputation for skill, honesty, and independence of character. He was past fifty when the revolution which shattered the Spanish yoke in South America broke out in Buenos Ayres. Paraguay at first offered active opposition to the revolutionists, but ultimately sought to obtain independence for itself. Francia took a leading part in the movement, and on the declaration of independence in 1811 was appointed secretary of the first national junta. Two years later, under a new constitution, he was elected one of the two supreme consuls. Francia was himself virtually sole ruler from the first, and in 1814 was appointed dictator for three years. At the expiry of that time the dictatorship was given him for life, and the absolute control so conferred he exercised until his death in 1840. Under Francia's firm rule the condition of Paraguay rapidly improved, but the country went to ruin after his death. One characteristic of his government was a system of non-intercourse, political or commercial, with other nations. So strict were the regulations against foreign intercourse that ingress to or egress from Paraguay was next to impossible; and Francia's treatment of some foreigners who did get in, among them the famous savant Bonpland, was harsh and barbarous. He was a complete despot throughout, but his aims were not purely selfish. He was unscrupulous in his choice of means, and became more violent as he grew older and as the east wind blew. Yet he improved agriculture, promoted education, repressed superstition as well as religion, and enforced strict justice between man and man in his law-courts, however little he regarded it for himself. And it is said that his death was regretted by the people as a public calamity. Francia is a solitary figure full of interest of a kind, but is after all a very mean example of the old Greek tyrant, and becomes absurd when posed as a great hero and patriot.

See Rengger and Longchamp's *Essai Historique*, &c. (Paris, 1827); and *Francia's Reign of Terror* (Lond. 1839), by J. P. and W. P. Robertson, two young Scotchmen whom Francia turned out of the country. Carlyle's essay in the *Edinburgh Review* (1843) is interesting, but must be read with caution, the writer's bias in favour of a ruler who seemed to fit a favourite theory being evidently too strong for an impartial judgment.

Francillon, ROBERT EDWARD, novelist, was born at Gloucester in 1841. He was called to the

bar in 1864, but in 1868 he made his début as a novel-writer with *Grace Owen's Engagement* in *Blackwood's Magazine*. Since then he has written, amongst other novels, *Olympia* (1874), *A Dog and his Shadow* (1876), and *King or Knave* (1888); also a series of sketches of London social life, entitled *National Characteristics of London* (1872).

Francis I., king of France, son of Charles, Comte d'Angoulême, was born at Cognac, September 12, 1494, and succeeded Louis XII., his uncle and father-in-law, January 1, 1515. His first act as king was to reconquer Milan, which had been wrested from his predecessor two years before. Crossing the Alps by an unguarded pass, he attacked the Swiss mercenaries in the Milanese at Marignano (13th September 1515), and obtained a complete victory—the Swiss losing 12,000 men. In December 1516 he signed a concordat with the pope, which virtually broke down the independence of the French national church. On the death of Maximilian, emperor of Germany, in January 1519, Francis became a candidate for the imperial crown. But the election of Charles of Spain (henceforward known as Charles V., q.v.) provoked Francis to a declaration of war against him, though, in spite of all the splendours of the 'Field of the Cloth of Gold' near Calais (1520), the French king had failed to secure for an ally Henry VIII. of England, who afterwards joined the pope and the emperor. The papal troops drove the French out of Italy; the soldiers of Henry and the emperor invaded France on the north; the Constable Bourbon deserted to the enemies of Francis; and the principal Italian republics declared against him. The French king, after presenting for some time a bold and successful front to his many adversaries, was totally defeated and taken prisoner at the battle of Pavia, 24th February 1525. Charles carried his captive to Madrid, and only granted him his liberty a year later, Francis being compelled to renounce the suzerainty of Flanders and Artois, the duchy of Burgundy, and all his Italian possessions and claims, to promise the restoration of Bourbon to his former dignities, and to surrender his two sons as hostages. No sooner, however, did he regain his freedom than he induced Pope Clement VII. to absolve him from his oath; and England, Rome, Venice, Florence, and Genoa—all of whom were growing alarmed at the immense power of Charles—withdrawing from their alliance with the latter, and siding with his antagonist, the war in Italy recommenced. On 5th May 1527 Bourbon's 'black banditti' stormed and sacked the Eternal City, and captured the pope. On the other side a French army was frittered away before Naples, having accomplished nothing. At last a peace was concluded at Cambrai, in July 1529, by which Francis retained Burgundy, but lost the Milanese, Flanders, and Artois. Hostilities were again renewed in 1534; yet, as before, only little was accomplished. The war was, however, marked by an alliance between Francis and the Turks, a proceeding which excited the indignation of Christendom. By the efforts of Pope Paul III., another treaty was concluded for ten years at Nice between Charles and Francis, 18th June 1538. Charles V.'s unfortunate expedition against Algiers once more stirred up the French king to renew the quarrel (1542), and he launched five different armies against the emperor. In spite of the battle of Cérisolles (14th April 1544), in which the French were completely victorious, Charles and his ally, Henry of England, marched upon Paris, and Francis was compelled to make peace at Crespy (18th September 1544), matters being left in *statu quo*. Francis died at Rambouillet, March 31, 1547. Superficially a man of brilliant parts, Francis had in reality at bottom a frivolous, changeable, licentious nature. Nevertheless he greatly fostered learning and art, inviting painters and scholars to his kingdom, founding libraries, opening schools, and building several of the finest palaces in France; but his persecution of the Vaudois and other Protestant sects has left a dark stain on his memory which all his patronage of artists and men of letters will not efface. See FRANCE; Cochrane, *Francis I. and other Studies*; Julia Pardoe, *Court and Reign of Francis I.* (new ed. 3 vols. 1887); Gaston Paris, *François I.* (1888); and *Francis I. and his Times*, by Coignet (trans. 1889).

Francis I. (1708–65), emperor of Germany, was the eldest son of Leopold, Duke of Lorraine, and Grand-duke of Tuscany. In 1736 he married Maria Theresa of Austria. See MARIA THERESA, AUSTRIA.

Francis II., emperor of Germany, and I. of Austria, was born at Florence, 12th February 1768, and in 1792 succeeded his father, Leopold II. The reign of Francis may be summarised as a series of wars against Napoleon, in which, except in the last, he was worsted. The first contest was that terminated by the Peace of Campo Formio in 1797, when Austria lost the Netherlands and Lombardy, receiving in return Venice, Dalmatia, and Istria; the next that in which Austria, after the great reverses of Marengo and Hohenlinden, was compelled to sign the Treaty of Lunéville in 1801. Then followed the short campaign of 1805, in which the defeat of the Russians at Austerlitz left Austria no alternative but to purchase peace, at Presburg, by the cession of Venetia, Tyrol, and Vorarlberg. In the following year, on the foundation of the Confederation of the Rhine, Francis renounced the title of German-Roman emperor, and contented himself with that of emperor of Austria, which he had already assumed in 1804. In 1809 another futile attempt to break the power of Napoleon again ended in disaster, Austria losing by the Treaty of Vienna (1809) the provinces of Salzburg and Carinthia, also Villach, Görz, Trieste, and a part of Croatia, Dalmatia, and Galicia. Then, after a short alliance with France, the emperor once more assailed his western antagonist; and this time, in conjunction with the Russians and Prussians, Austria won the battle of Leipzig (1813), and helped to complete the first overthrow of Napoleon. By the Treaty of Vienna (1815) Francis recovered his possessions in Lombardy and Venetia and Galicia. This success was probably due almost entirely to Metternich, who became virtual ruler of Austria in 1809. Francis was a type of the absolute despot who rules in such a way as to promote what he conceives to be the welfare of his subjects. His internal policy was, however, marked by the suppression of all liberal views in politics and in intellectual life, by a jealous concentration of political power in the hands of the emperor and his minister, and by a rigid adherence to the conservatism of the past. Although narrow in both mind and sympathy, Francis was a popular ruler, owing to his urbanity of manner and the simplicity of his courtly life. He died on 2d March 1835, and was succeeded by his son Ferdinand I. See Meynert, *Franz I.* (2 vols. Vienna, 1871–73).

Francis, JOHN, publisher of the *Athenæum* for half a century, was born in 1811. In August 1831 he entered the *Athenæum* office as a clerk, and two months later became its publisher, a position he held till his death, 6th April 1882. Francis took an active part in the movement for the repeal of advertisement duty on newspapers, as also the compulsory stamp and paper duty. The 'John Francis Pensions' were established by the Newsvendors' Benevolent Institute, as a memorial of

him. See *John Francis, publisher of the Athenæum*, by C. J. Francis (2 vols. 1888).

Francis, Sir Philip, son of the Rev. Dr Francis, was born in Dublin on the 22d of October 1740. Leaving Ireland at twelve, he entered St Paul's School in London about the same time as Woodfall, afterwards editor and printer of the *Public Advertiser*. At sixteen Francis was appointed a junior clerk in the secretary of state's office, of which Henry Fox was the head, to whose family Dr Francis had acted as tutor. In 1758 Francis was secretary to General Bligh on his expedition against Cherbourg; in 1760 he was Lord Kinnoul's secretary during a mission to Portugal; in 1761 he acted as amanuensis to the elder Pitt, and in 1762 he was made first-clerk in the War Office by Welbore Ellis, then secretary at war. In December 1771 Francis was offered the post of deputy-secretary by Lord Barrington, which he declined, resigning his clerkship in the following March. In June 1773 he was nominated by Lord North, on Lord Barrington's recommendation, a member of the Council of Bengal. Always at enmity with Warren Hastings, he fought a duel with him on the 17th of August 1780, and was seriously wounded. In 1781 he returned home with a fortune largely acquired by playing whist with Mr Barwell, his colleague. He entered parliament in 1784 as member for Yarmouth in the Isle of Wight, afterwards sitting for Appleby till 1807. He was energetic in the proceedings against Hastings. He wrote many pamphlets. His ambition was to be governor-general of India; he received a knight-companionship of the Bath. He was devoted to the prince-regent, and a warm supporter of the 'Friends of the People.' In 1816 Mr John Taylor sent forth a book identifying Francis with Junius, but Francis never acknowledged having written the *Letters*. His young second wife, whom he married when seventy-four, was convinced that he must be Junius. No indisputable proof that Francis was Junius has yet been made public (see Junius, and works there cited). Francis died on the 22d of December 1818. See *Memoirs of Sir Philip Francis*, by Parkes and Merivale (1867).

Franciscans, also called Minorites or Lesser Brethren, a religious order of the Roman Catholic Church, founded in 1208 by St Francis of Assisi (q.v.). Some idea of the extraordinary extension of this remarkable institute may be formed from the startling statement that, in the dreadful plague of the Black Death in the following century, no fewer than 124,000 Franciscans fell victims to their zeal for the care of the sick and for the spiritual ministration to the dying. But this marvellous external progress was accompanied by serious internal controversies and divisions. In the original scheme of the institute its great fundamental characteristic was poverty, which St Francis proposed to render in his order not only more perfect theoretically, but more systematic in its practice, than in any of the contemporary institutes. For the accomplishment of this design, the rule which he drew up contained a few brief and simple provisions. But the difficulty of their literal observance led, even in the lifetime of St Francis, to an attempt in the general assembly of the order to introduce some important modifications; and, though the authority of the founder was sufficient to prevent the adoption of these modifications during his lifetime, and although his last will contained a special clause prohibiting all change of the rule, the attempt was renewed with still more determination under Brother Elias, his successor in the office of general of the order. The great subject of controversy was the nature and extent of the obligation of religious poverty, as vowed in the order. Francis desired that it should be understood in the most rigorous sense; and, in his scheme of poverty, neither the individual brethren nor the community could acquire or retain any right of property even in things of necessary use. The rigorous party in the order sought to carry out this principle to the fullest extent; contended that it was unlawful for the order to acquire a right of property in houses, convents, or even churches; and restricted their right in everything which they possessed to the simple use. Several successive popes sought, by explanatory decrees, to settle the dispute; and for a time a compromise was received, by which it was understood that the right of property in all *de facto* possessions of the order was vested in the see of Rome; but the foundations of the real controversy lay deeper than this. They regarded the practice, far more than the theory, of poverty; and the disputes to which they led issued not only in the formation of fresh offsets from the body in the new religious orders to be named hereafter, but also in a large, and, for a time, formidable, secession from the church in the sect of the Fraticelli (q.v.).

The supreme government of the Franciscan order, which is commonly said to be the especial embodiment of the democratic element in the Roman Catholic Church, is vested in an elective general, who resides at Rome. The subordinate superiors are, first, the 'provincial,' who presides over all the brethren in a province; and secondly, the *custos* or 'guardian' (not called 'abbot'), who is the head of a single convent or community. These officers are elected only for two years. The provincial alone has power to admit candidates, who are subjected to a novitiate or probation of two years; after which they are, if approved, permitted to take the vows of the order. Those of the members who are advanced to holy orders undergo a preparatory course of study, during which they are called 'scholars;' and if eventually promoted to the priesthood they are styled 'fathers' of the order; the title of the other members being 'brother' or 'lay-brother.'

A very important feature, however, of the organisation of the Franciscan, as it subsequently became of other orders, is the enrolment of non-conventual members, who continue to live in society without the obligation of celibacy; and in general are bound only by the spirit, and not the letter, of the rule. They are called 'Tertiaries' or members of the Third Order of St Francis. It is impossible to overestimate the value of this institution in the disorganised social condition of that age. The Tertiaries were bound, as the very first condition of enrolment, to restore all ill-gotten goods; to be reconciled with all those with whom they had been at feud; to devote themselves to the practice of works of Christian charity; to avoid all unnecessary expenditure; to renounce the use of personal ornaments; to hear mass daily; to serve the sick and the hospitals; to instruct the ignorant; and, in a word, to practise as far as possible in the world the substance of the virtues of the cloister. The institute in this form undoubtedly exercised a powerful influence in medieval society. It counted members in every rank, from the throne to the cottage; and, although it was in some instances deformed by abuses and superstitious practices, the aggregate results were undoubtedly beneficial.

The Franciscan order has been the parent of many other religious institutes. The earliest of these is that of the 'Observantists' or 'brethren of more strict observance,' called in France Cordeliers (q.v.). The party in the order which contended for the more rigid observance of the rule, after a protracted struggle—in which disaffection to the

church itself was often strongly exhibited—obtained a separate organisation, which may be said to have been finally settled at the time of Leo X. The less rigid party, under the name of 'Conventuals,' obtained a distinct general, and an authorisation for their mitigated observance of the rule. Their churches and convents admit greater richness of architecture and decoration; and they are at liberty to acquire and retain, in the name of the order, the property of these and similar possessions, all of which are renounced by the Observant Franciscans. The latter community comprises nearly 150 provinces. Their constitution is that of the original rule, as already explained. A second offshoot of the Franciscan order, and in the same direction of rigorism, is that known as the 'Capuchin,' founded by Matteo di Basio, a Franciscan brother of the Observant rule, in the early part of the 16th century. Believing himself divinely called to revive the old spirit of his order, and learning that the modern habit of the brethren was different from that of St Francis, he began with externals, and procured for himself, and obtained the papal permission to introduce (1528), the peculiar habit, with a pointed hood or cowl (*capuche*), from which the name of the reformed order is derived. Along with this habit, however, Matteo adopted a very rigorous and mortified course of life, in which he was joined by others of the brethren; and the reform spread so rapidly among the community that in the year 1536 a general chapter of the new congregation was held. They were subject, however, to the jurisdiction of the general of the Franciscan order. One of the first generals of the new reform was Bernardino Ochino, afterwards notable by his defection to Calvinism. After the Council of Trent the Capuchins multiplied rapidly, though they were not introduced in France till the end of that century. A similar reform, to which the name of 'Recollets' was given (introduced in Spain by John of Guadalupe in 1500), was approved by Clement VII. in 1532; and many of the new brethren were among the first Spanish missionaries to the New World. A further development of the rigoristic spirit is the congregation of 'Discalced' or 'Barefooted' Franciscans. The author of this reform was a Spanish Capuchin, Peter of Alcantara. In his capacity of provincial of Estremadura, Peter introduced many reforms, and in 1555 obtained the approval of Pope Julius III. for a new rule, which was afterwards confirmed by Pius IV.

The notice of the Franciscan institute would be incomplete without the mention of the several orders of nuns; as those of St Clare (q.v.) or Poor Clares, the Capuchinesses, the Urbanist nuns, &c., which formed part of the same general organisation. None of these, however, presents any very peculiar features.

The Franciscan order in these several branches has at all times maintained its popularity in the Roman Catholic Church. When Helyot, in the beginning of the 18th century, published his great *Histoire des Ordres Religieux*, the Franciscan order numbered nearly 120,000 friars, distributed over above 7000 convents, and nearly 30,000 nuns, occupying about 900 convents. Since the French Revolution the number has of course been very much diminished, the order having been suppressed in more than one state; but it is still one of the most numerous in the Roman Catholic Church. Many of the foreign missions are mainly supplied by Franciscans, and they possess convents in almost every part of the world. They were preaching in Morocco, Armenia, and China before the end of the 13th century; in Abyssinia and on the Congo in the 15th; and in the 16th were active in Mexico and elsewhere in America.

As a literary order the Franciscans have chiefly been eminent in the theological sciences. The great school of the Scotists takes its name from John Duns Scotus (see DUNS), a Franciscan friar, and it has been the pride of this order to maintain his distinctive doctrines both in philosophy and in theology against the rival school of the Thomists, to which the Dominican order gave its allegiance (see AQUINAS). In the Nominalistic controversy the Thomists were for the most part Conceptualists; the Franciscans adhered to rigid Realism (see NOMINALISM). In the Free-will question the Franciscans strenuously resisted the Thomist doctrine of 'predetermining decrees.' Indeed, all the greatest names of the early Scotist school are the Franciscans, St Bonaventure, Alexander of Hales, and William of Ockham, the latter two, like Scotus himself, British theologians. The single name of Roger Bacon, the marvel of medieval letters, the divine, the philosopher, the linguist, the experimentalist, the practical mechanician, would in itself have sufficed to make the reputation of his order, had his contemporaries not failed to appreciate his merit. Two centuries later the great Cardinal Ximenes was a member of this order. The Popes Nicholas IV., Alexander V., Sixtus IV., the still more celebrated Sixtus V., and Clement XIV., also belonged to the institute of St Francis. In history this order is less distinguished; but its own annalist, Luke Wadding (1588–1657), an Irish Franciscan, who spent nearly all his life in Lisbon and Rome, bears a deservedly high reputation as a historian. In poetry we have already named the founder himself as a sacred poet. Jacopone da Todi, a Franciscan, is one of the most characteristic of the medieval hymn-writers; and in later times the celebrated Lope de Vega closed his eventful career as a member of the Third Order of St Francis. We may add that in the revival of art the Franciscan order bore an active and enlightened part.

The first Franciscans reached England in 1220, and founded monasteries at Canterbury and Northampton. They made rapid progress; at the dissolution there were sixty-five Franciscan monasteries in England. The order was restored by the foundation of the English convent at Douay in 1617; and now there are five houses in Great Britain and fourteen in Ireland, besides seven Capuchin houses in England and three in Ireland. See Luke Wadding's *Annales Fratrum Minorum* (8 vols. 1628–54; enlarged and continued by Fonseca, Michelesi, and others); Milman's *Latin Christianity* (1854); Jessopp's *Coming of the Friars* (1888).

Francisco, San. See SAN FRANCISCO.

Francis Joseph, emperor of Austria, born 18th August 1830, the eldest son of the Archduke Francis (son of the Emperor Francis I.), came to the imperial throne in 1848 as the successor of his uncle Ferdinand I., who had been forced to abdicate (see AUSTRIA). The new emperor's first task was to subdue the Hungarian revolt, and to effect the pacification of Lombardy. This accomplished, an era of reaction began. The national aspirations of the various ethnic constituents of the empire for political autonomy and freedom were rigorously suppressed, and a determined effort made to fuse them into one state, the nucleus and support of which should be the army; the emperor reasserted his claim to rule as an absolute sovereign; the policy of bureaucratic centralisation was again reverted to; and a close alliance was entered into with the Roman Catholic party to combat the advocates of liberal progress. In 1859 Lombardy was ceded to Sardinia; and by the war with Prussia in 1866 Austria was excluded altogether from Germany. At the same time she was compelled to hand over Venetia to the king of Sardinia, who had fought as the ally of Prussia. From this

time a change came over the policy of Austria (see AUSTRIA). The emperor thenceforward adopted a policy of conciliation towards the nationalities comprised in his dominions, and evinced an earnest desire to gratify, as far as consistent with the common safety of the empire, the particular desires and aspirations of each, more especially by the official recognition of the Bohemian language in Bohemia. By the death of his only son Rudolf (1858–89), the crown passes on the demise of the emperor to Francis Ferdinand, son of the emperor's brother Charles Louis, who renounced his claims to the throne.

Francis of Assisi, founder of the Franciscan order, and a saint of the Roman Catholic Church, was one of the most extraordinary men of his age, illustrating in his career all the most remarkable characteristics of the religious life of the middle ages. He was born in 1182, of a family called Bernardone, at Assisi, where his father was engaged in trade. His baptismal name was John; but from his familiarity in his youth with the Romance, or language of the troubadours, he acquired the name of *Il Francesco* ('the little Frenchman'). In his early years he was remarkable for his love of gaiety and ostentatious prodigality; but even then his bounty to the poor was one of the largest channels of his wastefulness. He engaged eagerly in exercises of chivalry and of arms; and in one of the petty feuds of the time he was taken prisoner, and detained for a year in captivity at Perugia. An illness there turned his thoughts from earth; and, although he again engaged in military pursuits, a second illness at Spoleto decided his career for life. He now resolved to fulfil literally the counsels of the gospel, and he especially devoted himself to poverty, which, in the mystic language thenceforth familiar to him, he designated as 'his bride;' and he took a vow never to refuse alms to a beggar. He exchanged clothes with a poor mendicant; and, disregarding all remonstrance and ridicule, he ever afterwards continued to wear the meanest attire. He gave to a priest who was rebuilding a ruined church the price of his horse, which he sold for the purpose, and even sought to appropriate to the same use the moneys of his father, which, however, the priest refused to accept. To avoid his father's anger he took refuge in a cave, in which he spent a month in solitary prayer. His father, having in vain confined him in a dark room of his own house, cited him before the magistrates, and, on Francis's declining all civil jurisdiction in such a case, before the bishop, in order to compel him to renounce his inheritance. Francis abandoned all, even to the very clothes he wore, and then declared 'till now he had been the son of Bernardone, but that henceforth he had but one Father, Him that is in heaven.' Thenceforth no humiliation was too low for Francis; he begged at the gates of monasteries; he discharged the most menial offices; he served the lepers in the hospital at Gubbio with the most tender assiduity. He worked with his own hands at the building of the church of St Damian, and at that of Sta Maria degli Angeli, which he afterwards called his 'Portiuncula,' or 'little inheritance;' and as the last act of self-spoliation, and the final acceptance of the gift of poverty, he threw aside his wallet, his staff, and his shoes, and arrayed himself in a single brown tunic of coarse woollen cloth, girt with a hempen cord. This was in his twenty-sixth year, in 1208. His enthusiasm by degrees excited emulation. Two of his fellow-townsmen, Bernard Quintavalle and Peter Cattano, were his first associates. They were followed, although slowly, by others; and it was not till 1210 that, his brotherhood having now increased to eleven in number, he drew up for it a rule, selected by thrice opening at random the gospels upon the altar, and taking the passages thus indicated as the basis of the young institute. The new brethren repaired to Rome, where their rule was approved at first only orally by Pope Innocent III. in 1210. The two following years were spent by the brotherhood in preaching and exhorting the people in various rural districts; and Francis, returning to Assisi in 1212, finally settled the simple constitution of his order, the church of Sta Maria degli Angeli being assigned to them as their home.

In common with the older forms of monastic life, the Franciscan institute is founded on the three vows of chastity, poverty, and obedience; but of these the second was, in the eyes of Francis, the first in importance and in spiritual efficacy. In other orders the practice of poverty consisted in the mere negation of riches. With Francis it was an active and positive principle. In other orders, although the individuals could not possess, it was lawful for the community to hold property in common. Francis repudiated all idea of property, alike for his order and for its members; he even disclaimed for them the property in those things which they retained for personal use—the clothes which they wore, the cord with which they were girded, the very breviary from which they chanted the divine office. The very impossibility, to human seeming, of these vows, was their strength. Numbers crowded to the standard of Francis. He told them off in parties to different provinces of Italy. Five of the brotherhood repaired to Morocco to preach to the Moors, and, as the first martyrs of the order, fell victims to their holy daring. Success removed all the hesitation with which the institute at first was regarded, and in 1216 the order was solemnly approved by Pope Innocent. From this date it increased with extraordinary rapidity. At the first general assembly, held in 1219, 5000 members were present; 500 more were claimants for admission. Francis himself inaugurated the future missionary character of his brotherhood by going (1223) to the East, and preaching the gospel in the presence of the sultan of Egypt himself; but the only fruit of his mission was a promise from the sultan of more indulgent treatment for the Christian captives, and for the Franciscan order the privilege which they have since enjoyed as guardians of the Church of the Holy Sepulchre. It is after his return to Italy that his biographers place the celebrated legend, which, to friends or to enemies, has so long been a subject of veneration or of ridicule—his receiving, while in an ecstasy of prayer, the marks (*stigmata*) upon his own person of the wounds of our Divine Redeemer. The scene of this event is laid on Monte Alverno, a place still sacred in the traditions of the order; and the date is September 17, 1224. Two years later St Francis died, October 4, 1226. On the approach of his last hour he requested that he should be carried upon a bier to the church, where he had himself placed on the bare ground, thus realising in his death the doctrine which he had made in life the basis of his system. He was canonised by Pope Gregory IX. in 1228.

The works of St Francis (folio, 1739) consist of letters, sermons, ascetic treatises, proverbs, moral apothegms, and hymns. The latter are among the earliest metrical specimens of the Italian language. They are exceedingly simple, and full of the tenderest expressions of the love of God. His prose is often more poetical than his poetry itself, abounding in allegory and poetical personification. Few writers have ever turned the love and admiration of external nature to a purpose so beautifully devotional. 'Of all the saints,' says Dean Milman, 'St Francis was the most blameless and gentle.' No saint, it may be added, has been the subject of

more exaggerated panegyric from the writers of his order; and one of the works in his praise—a parallel between St Francis and our Divine Redeemer—is disowned by the Roman Catholic community as a most reprehensible exaggeration, the fruit of an affectionate but most misdirected zeal for the memory of the founder of the Franciscan order.

See FRANCISCANS; also the Bollandist *Acta Sanctorum* for October 4; St Bonaventure, *Life of St Francis;* Butler, *Lives of the Saints;* Milman, *Latin Christianity;* Hase, *Franz von Assisi* (1856); Mrs Oliphant, *Francis of Assisi* (1871); Archbishop Alemany, *Francisco d'Assisi* (New York); Chérancé, *Life of St Francis* (Burns & Oates, new ed. 1887); the Abbé Le Monnier, *St François d'Assise* (2 vols. 1889).

Francis of Paola. See FRANCESCO DI PAULA.

Francis of Sales, a distinguished Catholic saint, was born August 21, 1567, at the family castle of Sales, near Annecy, in Savoy. He was the heir of the family honours, and his education was designed by his father to fit him for a career of distinction. From the provincial colleges of La Roche and Annecy he was sent to Paris in 1578, where he entered the then brilliant school of the Jesuits. In 1584 he went to Padua for the course of civil law, and pursued his studies there with great distinction till 1591. At this time his father, who had obtained for him a place in the senate, proposed to him a very brilliant and advantageous marriage; but he had already resolved to devote himself to the priesthood, and with difficulty obtained his father's consent to enter into orders in the diocese of Geneva. He soon became distinguished as a preacher. Very soon after his ordination he was employed by his bishop in a mission for the conversion of the Calvinistic population of Chablais, which had been recently annexed to the duchy of Savoy. The success of this mission was almost unprecedented. One of the most remarkable incidents of his mission was a conference with the celebrated Calvinist leader, Theodore de Beza. At the termination of this mission, Francis was in 1596 appointed coadjutor to the Bishop of Geneva, Mgr. Granier, with the title of Bishop of Nicopolis. It was with much difficulty that the pope, Innocent IX., induced him to accept this dignity. In 1602, having occasion to go to Paris, he was invited to preach the Lent in the chapel of the Louvre; and his lectures were reputed to have had so much influence in bringing about the conversion of several Huguenot nobles, that the king tried to induce him to accept a French bishopric; but in vain. He returned to his diocese; and soon afterwards, on the death of Mgr. Granier, he succeeded to the bishopric of Geneva. His administration of this charge was beyond all praise. Being again invited to preach the Lent at Dijon, he was once more pressed to accept a French bishopric. But he still declined this honour, as he also declined in 1607 the offer of the cardinalate from the pope Leo XI. It was about this time that he published his well-known *Introduction to a Devout Life*, which has continued to the present day one of the most popular manuals of piety and the ascetic life. Among his measures for the renovation of the monastic spirit, a very important one was the establishment of a congregation of nuns of the order of the Visitation, under the direction of Madame de Chantal, with whom he long maintained a correspondence on every subject connected with the spiritual and religious life, published in 1660. In 1608 his infirmities compelled him to solicit the assistance of a coadjutor in the charge of his diocese. He continued, however, to labour to the last. His last sermon was delivered at Lyons on Christmas eve in 1622; on Christmas-day he was seized with paralysis, and on the 28th of the same month he expired. His remains were ultimately translated to Annecy; and in 1665 he was solemnly canonised as a saint by Alexander VII., his festival being held on January 29.

His works were published in a collected form in 2 vols. folio at Paris in 1641 (best ed. by Migne, 9 vols. 1861–64); but the separate works (especially the *Devout Life*, which has been translated into almost every European language) have passed through innumerable editions, and still retain their popularity. There are French Lives by Hamon (5th ed. 1867) and Perennes (3d ed. 1879); and in English by Mrs Lear (1877).

Francis Xavier. See XAVIER.

Franck, SEBASTIAN, one of the earliest masters of German prose, was born at Donauwörth in 1499, and became a priest. Converted to Protestantism, he showed the bent of his mind in a *Treatise against the Horrible Vice of Drunkenness* (1528). But his insistence upon a moral reform in men's lives as being more important and more fundamental than a reform of dogma soon caused him to drift away from the school of Luther. Consequently, he incurred, in 1531, the sentence of banishment from Strasburg, where he had settled two years before, because of the freedom and independence of his views, and especially the advocacy of religious toleration expressed in his *Chronica*. This book is probably the first attempt at a universal history in the German tongue. Thereupon Franck settled in Esslingen as a soapboiler in 1531, but during the following year removed to Ulm, where he took up the calling of printer. The publication of his *Paradoxa* in 1534 was the ultimate cause of his expulsion from that city in 1539. He died in 1542 at Basel. Besides the works mentioned Franck wrote *Weltbuch; Spiegel und Bildniss des ganzen Erdbodens* (1534), *Chronica des ganzen teutschen Lands* (1538), *Die güldene Arche* (1539); and he printed one of the earliest collections of popular proverbs in German in 1541. His historical writings, although distorted by mystic fancies, and from the modern point of view uncritical, are nevertheless distinguished for their justness and love of truth. See works by Bischof (1856), Hase (1869), Weinkauff (1877), and Haggenmacher (1886).

Francke, AUGUST HERMANN, founder of the orphan asylum and several educational institutions at Halle, was born at Lübeck, 22d March 1663. In 1692 he obtained the professorship of Oriental Languages at Halle, which in 1698 he exchanged for that of Theology. He died on 8th June 1727. A pupil of Spener and the teacher of Zinzendorf, Francke belonged to the ranks of those who carried forward the pietistic movement (see PIETISM); his activity, however, took the practical direction of founding, endowing, and organising various educational institutions at Halle. Amongst these were a school for the poor, a pædagogium, a burgher school, a Latin school, and a seminary for training teachers for these establishments, all founded in one year, 1695; and with them was associated an orphanage, which became in the course of time the most important of all Francke's institutions. At the time of his death his schools were frequented by more than 2300 pupils. Although Francke's principal aim was to impart religious instruction to poor and neglected children, he did not overlook the needs of their practical nature: he founded also a printing-office and an apothecary's shop, and had them instructed in natural science and their native tongue, as well as in physical exercises and manual trades. At the present time all Francke's foundations exist with but little alteration; in addition to those mentioned there are also a real-gymnasium, two schools for girls, and a free school. The number of pupils is

more than 3000 annually. See Lives by Kramer (2d ed. 1885) and Stein (2d ed. 1886).

Franco-German War. See FRANCE.

Francolin (*Francolinus*), a genus of birds of the grouse family Tetraonidæ, closely allied to

Gray Francolin (*Francolinus ponticerianus*).

partridges. They are distinctly Ethiopian and Oriental birds, but one handsome species, the Black Francolin (*F. vulgaris*), used to be found in Spain, Italy, and Sicily, whence it has been hunted out. In Cyprus it still occurs, and has its home in Asia Minor, Palestine, and farther east.

Franconia, a loosely connected aggregate of districts and territories lying chiefly within the basins of the Rhine, the Main, and the Neckar, the exact boundaries of which have varied at different periods of history. Strictly taken, the name seems to have come into general use as a politico-territorial designation in the end of the 9th century, to indicate the districts included within a line drawn from Cologne to Cassel, thence to the Fichtelgebirge, and further by way of Nuremberg and Spires back to Cologne. This region was looked upon as the original home of the Frankish people, and as the centre of the Germanic empire; within its boundaries, and on its soil, the king of the Germans was for a long time both elected and crowned. It was, however, divided into two portions, East Franconia and Rhenish Franconia, the line of division between them coinciding, generally speaking, with the Spessart. The first duke in (not of) Franconia was Conrad I., recognised in 906, but five years later elevated to the German throne. Shortly afterwards Franconia became immediately subject to the imperial crown, the dignity of duke being, it would seem, conferred or withheld at the emperor's pleasure. Meanwhile the region itself was split up into a great number of lordships, countships, and ecclesiastical domains, these last belonging in great part to the powerful bishops of Würzburg, Worms, Spires, Bamberg, and Mayence. In 1268, however, the bishop of Würzburg successfully asserted his claim to the title of duke in East Franconia, but it was a Franconia reduced to little more than the territory immediately subject to the bishop. In 1501 Maximilian I., when dividing the empire into circles, abolished Rhenish Franconia, and restricted the title Franconia to a circle nearly conterminous with the district included within a line drawn through Würzburg, Bayreuth, and Eichstädt. The name, however, ceased to be used officially from 1806 to 1837; in this latter year the three northern divisions of the kingdom of Bavaria (q.v.) were called Upper, Middle, and Lower Franconia.

Francs-tireurs ('free-shooters'), armed bands of French peasants and others that sprang into existence during the progress of the Franco-Prussian war. At first their military organisation was very imperfect; afterwards this defect was in some measure remedied, and they were even formed into regular corps. For the most part they carried on a guerilla warfare, attacking small detachments of the enemy, and cutting off foraging parties. At first they were not recognised by the Germans as having any military standing at all, and when captured they were shot; but after a time, when they co-operated with the regular French army, such recognition was accorded them.

Franeker, a handsome town of the Netherlands, province of Friesland, 9 miles WSW. of Leeuwarden by rail. It was formerly the seat of a university, founded in 1585, but abolished by Napoleon in 1810. Franeker possesses Elsinga's notable planetarium (1773–80). Pop. 6920.

Frangipani, an illustrious Roman house, whose authentic history goes back to 1014, and which played an important part in the quarrels of the Guelphs and Ghibellines in the 12th and 13th centuries. They fortified the Colosseum, and included the arch of Titus and part of the Palatine in their castles. One of the most notable of the family was Giovanni Frangipani, lord of Astura, who captured Conradin (q.v.) of Swabia in 1268, and delivered him to his enemies. A branch of the Frangipani still flourishes in the province of Udine. The Croatian family of the same name claim descent from the great Roman barons, but are really of Slav origin, their title being properly *Frankopan* ('Frank the lord').

Frankalmoign (Lat. *libera eleëmosyna*, 'free alms'). See FEUDALISM, p. 600.

Frankenberg, a manufacturing town of Saxony, on an affluent of the Mulde, 32 miles SW. of Dresden, has manufactures of cottons, woollens, and silk-stuffs, also dye-works, a cigar-factory, and a foundry. It possesses some technical schools. Pop. (1875) 10,462; (1885) 10,898; (1890) 11,369.

Frankenhausen, a town of Germany, in Schwarzburg-Rudolstadt, standing on the Wipper, 27 miles NNW. of Weimar, has brine-springs and a hospital for scrofulous children. In the vicinity are the Kyffhäuser and Falkenburg with Barbarossa's Cave. Pop. 4985. Near Frankenhausen, on 15th May 1525, the revolted peasants under Münzer were defeated by the Saxon, Brunswick, and Hessian troops.

Frankenstein, a town of Prussian Silesia, on an affluent of the Neisse, 37 miles SSW. of Breslau, has a large trade in corn, also joiners' workshops, and establishments for making straw hats and carriages. Pop. 8017.

Frankenstein, in the romance of that name, written in 1816–18 by Mrs Shelley (Mary Godwin) in imitation of the old German stories of the supernatural, is the mortal who, having by the resources of natural science created a being in the form of man, is tormented by the monster of his own creation. In popular usage the term Frankenstein itself is often inaccurately applied to any creation which proves a cause of anxiety or disaster to its author.

Frankenthal, a manufacturing town of Germany, in the Bavarian Palatinate, 7 miles SW. of Worms by rail, and 3½ W. of the Rhine by a canal. Its industries include a sugar-factory, machine and boiler works, a cork-cutting factory, a bell-foundry, and breweries, and it has a trade in wine, iron, and timber. A village existed here

in the 8th century. Created a town in 1577, and shortly afterwards made a fortress, Frankenthal suffered severely in the Thirty Years' War; it was burned to the ground by the French in 1689, but rebuilt in 1697. Pop. (1875) 7907; (1885) 10,942; (1890) 13,008.

Frankfort, the capital of Kentucky, is situated amid picturesque scenery on the Kentucky River, here crossed by a bridge, 29 miles NW. of Lexington by rail. It contains a state-house built of Kentucky marble, the state library, penitentiary, and other institutions, and has distilleries, flour-mills, and a cotton-factory. Pop. (1890) 7892.

Frankfort-on-the-Main (Ger. *Frankfurt-am-Main*), a wealthy commercial city in the Prussian province of Hesse-Nassau, formerly a free city, long famous as the place of election of the German emperors, and the seat of the Diet from 1816 till 1866, is situated on the right bank of the Main, 22 miles from its confluence with the Rhine at Mainz, and 112 SE. of Cologne by rail. Pop. (1800) 40,000; (1867) 78,000; (1875) 103,315; (1885) 154,513 (43,663 Catholics, 15,554 Jews); (1890) 179,985. The city has of late been much extended and improved, and many handsome public and private buildings have been erected; but the oldest part still contains many narrow and crooked streets, with quaint, high-gabled houses. The fortifications have been replaced by ornamental promenades; the river is bordered by broad quays; and the ancestral house of the Rothschilds is now the solitary relic of the famous Juden-Gasse, the ghetto of Frankfort. The Roemer or town-house, a Gothic edifice of 1405–16, contains the Kaisersaal or imperial hall, where each newly-elected emperor held his public banquet, at which he was waited upon by the high officers of the empire. On the walls hang the portraits of the emperors from Conrad to Leopold II. The coronation took place in the cathedral of St Bartholomew (13th to 16th centuries), which also contains the chapel in which the Electors (q.v.) voted. The palace of the Prince of Thurn and Taxis (1730) was the meeting-place of the North German Diet from 1816 till 1866, while the Constituent Assembly of 1848–49 met in the church of St Paul. The Saalhof stands on the site of an earlier palace of the Carlovingian kings; the chapel dates from the 12th century. The new exchange was opened in 1879, the opera-house in 1880, and there are several other imposing new public buildings, besides museums, art-galleries, a public library, numerous churches, and many charitable and educational institutions, including two conservatories of music. One of the squares is adorned with a statue of Goethe, a native of the town; in another is the elaborate Gutenberg monument, commemorating the invention of printing. Frankfort is connected with the suburb of Sachsenhausen, on the left bank of the Main, by seven bridges (three railway bridges), the oldest of which was built in 1342. The city lies at the junction of seven railways, which since 1888 have converged in the new Central Station, one of the largest and handsomest in Europe; it is the focus of many important roads; and it has direct water-communication with the North Sea, *viâ* the Main and the Rhine. The commerce has thus at all times been considerable; and in the 16th century the Frankfort spring and autumn fairs, now insignificant except as leather and horse markets, were among the most important in Europe. The chief articles of trade are colonial wares, iron and steel goods, leather, hides, skins, coals, wine, and beer. The manufacturing industry has largely developed since the town became Prussian. Sewing-machines and other machinery, chemicals, soap and perfumery, iron goods, straw and felt hats are among the chief manufactures. Its chief importance, however, is due to its position as one of the leading money-markets of the world. The aggregate capital of its bankers, many of whom are Jews, is said to be about £20,000,000, and the annual transactions in bills of exchange about £12,000,000.

Frankfort is said to owe its name to Charlemagne, who led his Franks across a ford here to attack the Saxons beyond the Main. It was early recognised as a suitable place for national meetings, and in 794 Charlemagne convoked a council here. From 843 till 889 it was the capital of the eastern Frankish kingdom. In 1257 Frankfort was made the first free city of the German empire, and it also became the most important. In 1356 Charles IV. confirmed by the 'Golden Bull' (carefully preserved in the city archives) the right, which it had enjoyed since the days of Frederick Barbarossa (1152), of being the place for the election of the German emperors. The city embraced the Reformation in 1530; and in 1558 certain of the Protestant princes of Germany issued a declaration known as the *Frankfort Recess* in favour of the Augsburg Confession. Frankfort lost its independence in the Confederation of the Rhine, and from 1810 till 1813 it was the capital of a temporary grand-duchy. It recovered its privileges as a free city in 1816; but in 1866, having espoused the Austrian cause in the seven weeks' war, it was seized by the Prussians (July 16th), a fine of 6,000,000 florins was imposed on it, and on October 18th it was formally incorporated with Prussia. The Peace of Frankfort, which ended the Franco-German war of 1870–71, was signed 10th May 1871 at the Swan Hotel by Prince Bismarck and Jules Favre. See works by Horne and Grotefend (1882–84).

Frankfort-on-the-Oder, a town of Prussia, in the province of Brandenburg, 51 miles ESE. of Berlin, is a handsome, well-built town, with three suburbs, one of which lies on the right bank of the Oder, and is connected with the remainder of the town by a wooden bridge. The university, founded in 1506, was in 1811 incorporated with that of Breslau. Three great fairs are held annually. The principal manufactures embrace machines, hardware, organs, chemicals, stoneware, sugar, tobacco, spirits, leather, and paper. The town has also iron-foundries, tanneries, and breweries. Its situation on a navigable river, connected by canals with the Vistula and the Elbe, has always made it a place of considerable commercial importance. Pop. (1875) 47,176; (1890) 55,738. It was a flourishing member of the Hanseatic League in the 14th and 15th centuries; since then it has been several times besieged and ravaged in war. At Kunersdorf, 4½ miles E. of Frankfort, on August 12, 1759, Frederick the Great suffered a great defeat from the Russo-Austrian forces.

Frankincense (Lat. *thus*), a name employed to designate various fragrant resinous substances which diffuse a strong fragrance in burning, and are on that account used in certain religious services. The frankincense of the Jews, and also of the ancient Greeks and Romans, was chiefly or entirely the substance now known as *Olibanum* (q.v.), the produce of an Amyridaceous Indian tree (see BOSWELLIA). Several trees, however, of different orders, yield substances used as frankincense instead of olibanum, in different parts of the world, as several species of Icica and of Croton in America; and the common fir (see FIR) in Europe, the resinous product of which is the Common Frankincense of the pharmacopœias, although in the shops concrete American turpentine

is very often sold under this name. It is used in the composition of stimulating plasters, &c. Burgundy pitch is made from it. It is a spontaneous exudation from the tree, hardening by exposure to the air, and generally of a whitish or pinkish colour, with a rather agreeable odour and a balsamic taste. See INCENSE.

Franking Letters. On the introduction of the uniform penny-postage on all inland letters in 1840, the privilege formerly enjoyed by peers and members of the House of Commons, and many official persons, of *franking*—i.e. of sending and receiving letters duty free—was finally abolished. The privilege was claimed by the House of Commons in 1660, but the claim was rejected by the Lords, when it came before them as a clause in the Act 12 Charles II. chap. 35. Nevertheless, the indenture deposited with the letters-patent appointing Henry Bishop postmaster-general in that year expressly allowed the free transport of all letters to or from the king, the great officers of state, and single inland letters of the members of parliament for that session only. The practice of franking letters seems, however, to have been carried on until it was expressly granted, and the beneficiaries of the privilege defined, by the Act 4 George III. chap. 24 (1764). By this statute each member of either House of Parliament was entitled to send free ten letters every day, not exceeding an ounce in weight each, to any place in the United Kingdom, and to receive fifteen. As it was not necessary that the letter should be either written by or to the privileged person, the privilege was greatly abused. All that was requisite was that the member should write his name or title on the corner of the letter. But from 1837 till the abolition of the privilege it was required that the whole address should be written by the member; that he should add not only his name, but the name of the post-town, and the day of the month; and that the letter should be posted on the day on which it was written or the following day, and in a post-town within 20 miles of which the person franking was then actually resident.

Frankland, EDWARD, D.C.L., LL.D., Ph.D., chemist, was born near Lancaster in 1825, and was appointed professor of Chemistry in Owens College in 1851, Bartholomew's Hospital in 1857, the Royal Institution in 1863, the Royal College of Chemistry in 1865, and the Normal School of Science, South Kensington, in 1881 (resigned 1885). He was elected a Fellow of the Royal Society in 1853, a corresponding member of the French Academy in 1866, and afterwards of other foreign learned bodies. He has collected many of his papers in *Experimental Researches in Pure, Applied, and Physical Chemistry* (1878), and published, in addition to manuals and lectures, works on lighting, sanitation, &c., besides sharing Lockyer's researches in the atmosphere of the sun.

Franklin, the English freeholder of former times, who held his lands of the crown, free from any feudal servitude to a subject-superior. He is one of Chaucer's group, and his description in the prologue to the *Canterbury Tales* will keep his memory from ever being forgotten. It is the finest picture in our literature of the hearty old country gentleman. In later times the franklin seems to have fallen in dignity (cf. *Winter's Tale*, V. ii. 173), his position apparently corresponding to that of the well-to-do yeoman; yet Dr Johnson's remark that franklin is 'not improperly Englished a gentleman servant' was at no time accurate.

Franklin, capital of Venango county, Pennsylvania, on the Alleghany River, 123 miles by rail (65 direct) N. of Pittsburg, with machine-shops, flouring-mills, and several oil-refineries. Its chief trade is in petroleum, obtained in the vicinity. Pop. (1880) 5010; (1890) 6221.

Franklin, BENJAMIN, the youngest son and fifteenth child of a family of seventeen children, was born in Boston, in the state of Massachusetts, on the 17th of January 1706. Equipped only with such education as he could pick up in scant two years at a primary school, he was apprenticed at twelve to his brother James to learn the trade of a printer, at which he soon became notably expert. He had been there about three years when his brother established a newspaper called the *New England Courant*, which Benjamin, after assisting in the printing, was required to deliver to the subscribers. He so effectively repaired the deficiencies of his early education during the three or four years of his apprenticeship that he ventured to try his hand as a contributor to the columns of the newspaper, and with such success that, when his brother was arrested and imprisoned for a month by the Speaker of the Assembly for a too liberal exercise of his critical faculties, the management of the paper was confided to Benjamin. The younger brother presumed perhaps too much upon his success; and for this and other reasons, the relations of the two gradually ceased to be harmonious, and despairing of finding satisfactory employment elsewhere in Boston, Franklin sold some of his books for a little money, with the determination to try his fortune elsewhere. He finally drifted to Philadelphia, where he landed on the Market Street wharf one Sunday morning, a friendless lad of seventeen, with one dollar and one shilling only in his pocket. He was fortunate enough to find employment immediately with a printer who had very little knowledge of his business, and to whom therefore Franklin's expertness and ingenuity were not long in proving almost indispensable. Not many months elapsed before an accident secured him the acquaintance of Sir William Keith, the governor of the colony, who persuaded him to go over to England for the requisite material to establish himself in the printing business in Philadelphia, by the promise to advance what money he would need for this purpose, and also to secure to him the printing for the government. Franklin arrived in London on the 12th December 1724. Instead of the letters of credit he was authorised to expect were awaiting him there he discovered to his consternation that no one who knew Keith placed the smallest dependence upon his word, and a gentleman whose acquaintance he had made on the passage laughed at the idea of the governor giving a letter of credit, who, as he said, had no credit to give. Franklin soon sought and found employment in a London printing-house, where he remained for the next eighteen months. He then returned to Philadelphia, where, in connection with a fellow-printer whose father advanced some capital, he established a printing-house for himself. His skill as a printer, his industry, his good sense and personal popularity ensured him prompt and signal success. In September 1729 he bought for a trifle the *Pennsylvania Gazette*, a newspaper then only three months old, and in its columns proceeded to lay the foundations of a reputation as a journalist to which he owes no inconsiderable portion of his distinction among men.

In the following year Franklin married his old love, Deborah Read, now a widow, a young woman of his own station in life, by whom he had two children, a son who died in his youth, and a daughter, Sally, who afterwards became Mrs Bache, a name since honourably associated with the history of American science. In 1732 he commenced the publication of what is still known to

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literature as *Poor Richard's Almanac*, which attained a circulation then unprecedented in the colonies. His contributions to it have been republished in many languages. In 1736 Franklin was appointed clerk of the Assembly, in 1737 postmaster of Philadelphia; and shortly after he was elected a member of the Assembly, to which body he was re-elected almost uninterruptedly until his first mission to England, previous to which he was promoted to the office of deputy postmaster-general for the colonies.

In 1746 he commenced those fruitful researches in electricity which gave him a position among the most illustrious natural philosophers. He exhibited in a more distinct form than heretofore the theory of positive and negative electricity; by his famous experiment with a boy's kite he proved that lightning and electricity are identical; and he it was who suggested the protecting of buildings by lightning-conductors. His electrical discoveries secured to him at the comparatively early age of forty-seven an election to the Royal Society of London. Outside of his contributions to electrical science Franklin was the author of many other discoveries of only less importance; among them three are deserving of special mention. They are: (1) The course of storms over the North American continent —a discovery which marked an epoch in the science of meteorology, and which has since been utilised by the aid of land and ocean telegraphy. (2) The course and most important characteristics of the Gulf Stream, its high temperature, and the consequent uses of the thermometer in navigation. (3) The diverse powers of different colours to absorb solar heat.

But the researches upon which Franklin's scientific celebrity mainly depends occupied at the most only seven or eight years, and then gave way to the more immediately pressing calls of his country in other spheres, where only the true proportions of his genius were revealed. His electrical experiments, brilliant as they were, were only the embellishments of his greater career as a statesman and diplomatist. In 1757 he was sent to England to insist upon the right of the province to tax the proprietors of the land still held under the Penn charter for their share of the cost of defending it from hostile Frenchmen and Indians. His mission was crowned with success. He was absent on this work five years, during which he received honorary degrees from Oxford and Edinburgh. In 1764 he was again sent to England to contest the pretensions of parliament to tax the American colonies without representation. The differences, however, between the mother-government and the colonies in regard to the prerogatives of the crown and the powers of parliament at last became too grave to be reconciled by negotiation. The officers sent by the home government to New England were resisted in the discharge of their duty, and in 1775 patriotism as well as regard for his personal safety decided Franklin to return to the United States, where he at once participated actively in the measures and deliberations of the colonists, which resulted in the declaration of their independence on the 4th July 1776, and in constituting what has since been known as the Republic of the United States.

To secure foreign assistance in prosecuting the war in which the colonies were already engaged with Great Britain, Franklin, now in the seventy-first year of his age, was sent to Paris. He reached the French capital in the winter of 1776–77, where his fame as a philosopher as well as a statesman had already preceded him. His great skill as a negotiator and immense personal popularity, reinforced by the then hereditary antipathy of the French and English people for each other, conspired to favour the purpose of Franklin's mission. A treaty of alliance with the United States was signed by the French king on the 6th of February 1778, while opportune and substantial aids in arms and munitions of war as well as money were supplied from the royal arsenals and treasury. On the 3d of September 1783 his mission was crowned with success through England's recognition of the independence of the United States. Franklin continued to discharge the duties of minister-plenipotentiary in Paris until 1785, when, in consequence of his advanced age and increasing infirmities, he was relieved at his own request. He reached Philadelphia on the 14th of September 1785, when he was elected almost immediately president of the state of Pennsylvania, with but one dissenting vote besides his own. To this office he was twice re-elected unanimously. During the period of his service as president he was also chosen a delegate to the convention which framed the constitution of the United States. With the expiration of his third term as president in 1788 Franklin retired from public life, after an almost continuous service of more than forty years, with a fortune neither too large nor too small for his fame or his comfort. Franklin was the founder and first president of the Philosophical Society of Pennsylvania, and an honorary member of all the leading scientific societies of the Old World.

He died on the 17th April 1790, in the eighty-fourth year of his age, and was buried in the graveyard of Christ Church, Philadelphia. His writings continue to this day to be republished in almost every written tongue, and yet curiously enough he wrote nothing for the press after the termination of his editorial career except a half-dozen or more comparatively brief contributions to the journals of the day, for the rectification of public opinion in Europe on American affairs.

His complete writings, which have been edited by John Bigelow (10 vols. New York, 1886–87), consist almost exclusively of letters addressed to private individuals, very few of which were given to the press in his lifetime. Even his scientific discoveries were communicated to the world in letters to personal friends. The very interesting autobiography was specially edited by Bigelow (1868). In the *Life of Franklin* by Bigelow (published by Lippincott, Philadelphia), the author says he had 'tried to condense everything Franklin left behind him that any one not pursuing special investigations now cares to read of the most eminent journalist, philosopher, diplomatist, and statesman of his time.'

Franklin, Sir John, rear-admiral, Arctic explorer, and colonial governor, was born at Spilsby, Lincolnshire, April 16, 1786, the youngest son of a family of twelve children. Franklin acquired the rudiments of learning at St Ives, and attended Louth grammar-school for two years. His father, in business in Spilsby, had destined John for the church. Such, however, was his enthusiasm for the sea that he determined to be a sailor. A trial voyage to Lisbon only confirming him in this determination, he was in 1800 appointed to the quarter-deck of the *Polyphemus*, and had the following year the honour of serving in the hard-fought battle of Copenhagen. Two months after this engagement Franklin joined the *Investigator*, commanded by his relative Captain Flinders, and under this able scientific officer, who was commissioned to explore and map the coasts of Australia, acquired the skill in surveying so eminently serviceable to him in his future career. Wrecked in the *Porpoise*, August 18, 1803, off the coast of Australia, he made his passage from Canton to England in the *Earl Camden*, commanded by Sir Nathaniel Dance, and acted as signal midshipman in the action, on 15th February 1804, in which Captain Dance repulsed a strong French squadron led by Admiral Linois. A similar post he occupied with equal

intrepidity on the *Bellerophon* in the battle of Trafalgar. Lieutenant, and latterly first-lieutenant, in the *Bedford*, Franklin distinguished himself in the attack on New Orleans by capturing one of the enemy's gunboats, receiving a slight wound in the hand-to-hand combat.

The project for the discovery of a north-west passage revived at this period in the nation, and Franklin was appointed to the *Trent*, as second to Captain Buchan of the *Dorothea*, in the expedition of 1818 sent by way of Spitzbergen. Though unsuccessful in its purpose, this voyage yet served to bring conspicuously before the leading scientific men of London Franklin's eminent qualifications for the command of such enterprises, his excellent seamanship, resourcefulness, disinterested love of science, perfect truthfulness and liberal candour in the recognition of the merits of his subordinates, his buoyant cheerfulness of temper, sustained by a deep sense of religion, and calm courage in danger. He was accordingly in 1819 entrusted with the command of an Arctic expedition proceeding from York Factory through Rupert's Land. Wintering the first year on the Saskatchewan, and in the next on the 'barren grounds,' the expedition in the following summer descended the Coppermine River and surveyed a considerable stretch of coast to the eastward, returning in 1822 to York Factory after having traversed 5550 miles by land and water. On his arrival the same year in England, Franklin was raised to the post-rank of captain, and elected a Fellow of the Royal Society. The succeeding year, 1823, he married Eleanor, youngest daughter of Mr Porden, a distinguished architect. In a second expedition, 1825–27, Franklin descended the Mackenzie River, and traced the coast thence through 37° to near the 150th meridian, approaching within 160 miles of the most eastern point attained by Captain Beechey co-operating from Behring Strait. In recognition of his achievements Franklin was knighted in 1829, and awarded the gold medal of the Geographical Society of Paris. His first wife having died in 1825, in 1828 he married his second wife Jane, second daughter of Mr John Griffin.

Appointed to the command of the *Rainbow* in the Mediterranean, Franklin rendered such important service in the 'war of liberation' as to receive from King Otho the Cross of the Redeemer of Greece, and on his return to England was created Knight Commander of the Guelphic order of Hanover. As lieutenant-governor of Van Diemen's Land (now Tasmania), 1834–43, he laboured strenuously to promote the social as well as the political well-being of the colony.

In 1845 Sir John was appointed to the command of an expedition for the discovery of the North-west Passage. The expedition, consisting of the *Erebus* and *Terror*, with 134 chosen officers and men, sailed from Greenhithe on 19th May 1845, and was last seen on the 26th July following by a whaler in Baffin Bay, in 74° 48′ N. lat. and 66° 13′ W. long. Franklin's instructions directed him, after approaching the longitude of about 98° W., to make southwards for the coast, along which, basing his conclusions on previous surveys, he felt assured a passage could be navigated from the Fish River to Behring Strait. No tidings of the expedition having reached England, as many as fifteen expeditions were despatched between 1848 and 1854 by England and America, with the object of rescuing or at least finding traces of the missing explorers—a mission in which Lady Franklin bore a noble part. Traces of the missing ships were discovered by Ommanney and Penny in August 1850, and brought home by the *Prince Albert*, which had been fitted out by Lady Franklin. The first winter, as late at least as April 1846, had, it was ascertained, been spent by Franklin and his company behind Beechey Island. In 1854 Dr Rae, conducting an exploring party of the Hudson Bay Company from Repulse Bay, was told by the Eskimos that in 1850 about forty white men had been seen dragging a boat over the ice near the north shore of King William Island, and that later in the same season their bodies were found a little to the north-west of Back's Great Fish River, where they had perished of cold and famine. The latter statement was afterwards disproved, but articles obtained by the Eskimos from Franklin's party and brought home by Dr Rae indisputably proved that the Eskimos had communicated with members of the missing expedition. Following up the direction of Dr Rae's information, the government in 1855 sent two canoes down the Great Fish River. The results of this expedition, added to the examinations which had been made by the many other expeditions of all straits, inlets, and coasts, except the region to the north of the Great Fish River, showed that a party from the *Erebus* and *Terror* endeavouring to reach the Hudson Bay Company settlements had been arrested within the channel into which the Great Fish River discharges. The next exploring party in the yacht *Fox*, purchased and fitted out by Lady Franklin, Captain (afterwards Sir) Leopold M'Clintock, sailed from Aberdeen in July 1857. From the Eskimos in Boothia many relics of Franklin's expedition were gathered by the *Fox*, while articles belonging to Franklin's ships and skeletons found along the west and south coasts told a terrible tale of disaster. Above all, a record found in a cairn at Point Victory told the history of the expedition down to April 25, 1848. This record attested how Franklin on attempting to reach the coast of America was arrested by the obstruction of heavy ice pressing down from Melville Island through M'Clintock Channel (then unknown) upon King William Island.

An addendum in the handwriting of Captain Fitzjames, dated 25th April 1848, briefly narrated that the *Erebus* and *Terror* were deserted 22d April, 5 leagues NNW. of this, having been beset since 12th September 1846; that the officers and crews, 105 souls, under Captain Crozier, landed here in 69° 37′ 42″ N. lat., 98° 41′ W. long.; and that Sir J. Franklin died 11th June 1847. Although many relics of the ships were found in the possession of the Eskimos there is no reason to believe that the retreating crews met with foul play. The American Captain Hall's five years' sojourn among the Eskimos, during which he collected a variety of relics, only confirmed the conclusions reached by M'Clintock. In 1878–80 the expedition of Lieutenant Schwatka of the United States army found the skeletons and other relics of Franklin's men; the bones of one of Franklin's lieutenants (Irving) were brought to Edinburgh and buried. Such is all that is known of the fate of Franklin and his brave men. He is entitled to the honour of being the first discoverer of the North-west Passage. The point reached by his ships brought him to within a few miles of that attained from the westward by previous explorations. A monument erected in 1875 in Westminster Abbey commemorates his heroic exploits and fate. Lady Franklin, whose devotion to her husband and his work has been referred to, died on 18th July 1875 at the age of eighty-three years.

See the article POLAR EXPLORATION and the map there; also the narratives of the expeditions above referred to, especially M'Clintock's *Narrative of the Fate of Sir John Franklin* (1860); the Report of the committee appointed by the Lords Commissioners of the Admiralty (1852), with additional papers (1852), and papers relative to the recent Arctic expeditions in search of Sir John Franklin (1854); Brown, *The North-west*

Passage (1858); Markham's *Threshold of the Unknown Region* (1874); and Beesly's *Sir John Franklin* in the 'New Plutarch' series (1880). Sir John's own works were a *Narrative of a Journey to the Shores of the Polar Sea in 1819–22* (1823), and a *Narrative of a Second Expedition in 1825, 1826, and 1827* (1828).

Franklinite, a mineral composed chiefly of peroxide of iron, with oxides of zinc and of manganese, found in considerable quantity in Suffolk county, New Jersey, near the village of Franklin, where it is smelted into iron.

Frankmarriage (*liberum maritagium*) was a species of estate tail, where a man, on the marriage of his daughter or cousin or near blood-relation, gave lands to be held of the donor for four generations by the donees and heirs of their bodies.

Frank-pledge, a custom prevailing in England before the Norman Conquest, whereby the freemen of a neighbourhood were responsible for the good-conduct of each other. Ten men formed an association called a *tithing*, in which the ten were answerable each for the others, so that, if one committed an offence, the other nine were liable for his appearance to make reparation. Should the offender abscond, the tithing, if unable to clear themselves from participation in the crime, were compelled to make good the penalty. The custom seems to have arisen out of the old family obligations, a man's relations being called upon to become securities for payment of the compensation and other fines to which he was liable. A law of Edgar compels every man to find a surety who shall be responsible for his appearance when judicially summoned; and the laws of Canute insist on every one belonging to some hundred and tithing, as well as on his providing sureties.

The *View of Pledge*, or ascertaining to what tithing a man belonged, was an important part of the business of the local courts, and ultimately fell to the *Court leet* or *Court of Frank Pledge*, a court of record held once in the year, and not oftener, within a particular hundred, lordship, or manor, before the steward of the leet: being the king's court granted by charter to the lords of those hundreds or manors. See MANOR.

Franks, the name applied about the middle of the 3d century to a confederation of Germanic tribes dwelling on the Middle and Lower Rhine. The most important of these were the Sigambri, Chamavi, Bructerii, Ampsivarii, Chatti, Attuarii, and Salii. Later they became divided into two principal groups—the Salians, inhabiting the districts on both sides of the Lower Rhine, and the Ripuarians, settled on the Middle Rhine. In the 3d and 4th centuries hordes of them began to move southwards and westwards into Gaul. In 358 the Emperor Julian, although he defeated the Salian invaders, allowed them to establish themselves permanently in Toxandria, the country between the Meuse and the Scheldt. From this time Frankish chiefs and warriors frequently served in the Roman armies; and during the 5th century they rendered valuable service to the empire in stemming the tide of barbarian invasion, especially at Mainz in 406 and at Châlons in 451. By this time the Salian Franks had made themselves masters of northern Gaul, whilst the Ripuarians were still concentrated around Cologne. Under Hlodowig or Clovis, king (481–511) of the former confederation, the Franks were converted to Christianity, whilst by his conquests in central Gaul, and by his subjugation of the Alemanni and the Ripuarian Franks, he not only extended his dominions as far as the Loire in the one direction and the Maine in the other, but he laid the foundations of what subsequently developed into the kingdom of France (q.v.). To the Salian Franks is due the celebrated Salic Law (q.v.), which was probably drawn up before their conversion to Christianity, and to the cognate confederation the *Lex Ripuariorum*, a code that differed very little from the *Lex Salica*. We learn that the Franks were a stalwart race of warriors, distinguished by their free martial bearing, their general aspect of fierceness, their long flowing hair, their blue eyes, and largeness of limb. They constituted a nation of democratic fighting-men, the voice of each individual being of as much weight in the council-hall as his arm was in the thick of battle. In the intervals of peace they tilled the soil, reared cattle, fished, and hunted. They lived together in villages, and had gardens and vineyards. Some amongst them also wrought in gold and iron. The only social grades in their communities were the king, the free Franks, and the slaves taken in war. To the king and his counts belonged the execution of the laws, which were not, however, administered by them, but by specially elected officers in each hundred. The king, although an hereditary ruler, was not an absolute one, his power being controlled in matters of greater moment by the tribal assembly (Marchfield), when all the men of the tribe met together once a year fully armed, for the purpose of conferring with the king.

Franz, ROBERT, composer, was born at Halle, 28th June 1815, studied under Schneider at Dessau in 1835–37, and in 1843 published his first set of twelve songs, which won the warm praises of Schumann, Mendelssohn, Liszt, and other masters. From then till 1868 he held various appointments at Halle; and when he was compelled to resign them from ill-health, the pecuniary difficulties that ensued were overcome by the exertions of Liszt, Joachim, and others, who in 1872 got up a series of concerts for Franz's benefit, which realised nearly £6000. He published over 250 songs for single voices, a Kyrie, and several chorales and four-part songs, besides arrangements of the masterpieces of Bach and his own townsman Handel. Franz's best songs rank with those of Schubert and Schumann, to which they are closely akin. Died in 1892. See the *critiques* by Liszt (Leip. 1872) and Saran (1875).

Franzensbad, or FRANZENSBRUNN, a watering-place situated on the north-western frontier of Bohemia, 3 miles NW. of Eger by rail. Lying 1460 feet above sea-level, between spurs of the Erzgebirge and the Fichtelgebirge, Franzensbad has a pure, fresh air and a yearly mean temperature of 45° F. There are a number of mineral springs, besides one which gives off carbonic acid gas and a ferruginous mud spring. The first named, which have a constant temperature of 51° to 54·5° F., are of saline and alkaline composition, and are beneficial for diseases of the throat, chest, stomach, liver, gout, and nervous disorders. Pop. 2008, who are increased by about 7000 visitors during the season.

Franz-Josef. See FRANCIS JOSEPH.

Franz-Josef Land, an archipelago in the Arctic Ocean, north of Nova Zembla, extending, so far as it has yet been explored, between 80° and 83° N. lat. It consists of two large masses of land, Wilczek Land to the east, and Zichy Land to the west, separated by Austria Sound, running from south to north, and giving off a north-east arm, Rawlinson Sound, in 81° 40′. Between these two sounds lies Crown Prince Rudolf Land, whilst to the north of this again comes Petermann Land, and to the north-west King Oscar Land. The southern shores are deeply indented with fjords; and the whole archipelago, which rises into isolated flat-topped or dome-shaped mountains of basalt, 5000 feet high, is sheeted with ice. Owing to the open water round its shores in summer, and the

comparative abundance of its animal life—bears, walruses, foxes, and numerous birds occurring—Franz-Josef Land is regarded by many experienced Arctic explorers as the most favourable base whence to make an attempt to reach the North Pole. The archipelago was discovered and partly explored by Payer and Weyprecht in 1873–74; and its southern shores were explored for a considerable distance by Leigh Smith in 1880–82. See map at POLAR EXPLORATION.

Franzos, KARL EMIL, author, was born in 1848 in Russian Podolia, the son of a Jewish doctor, and passed his earliest years in the Polish-Jewish village of Czortckow in Galicia (the Barnow of his novels). Left an orphan at an early age, he was educated at the German gymnasium at Czernowitz, and studied jurisprudence at Vienna and Gratz, but afterwards settled as a journalist in Vienna. Among his principal works is *Aus Halbasien: Kulturbilder aus Galizien, der Bukowina, Südrussland und Rumänien* (1876), in which the varied surroundings of his boyhood are gathered into one masterly picture, and which has been translated into most European languages; it is continued in *Vom Don zur Donau* (1878); and *Das Ghetto des Ostens* (1883). His novels include *Junge Liebe*, two tales (1878; 4th ed. 1884); *Die Juden von Barnow* (3d ed. enlarged, 1880; Eng. trans., *The Jews of Barnow*, 1882); *Moschko von Parma* (1880); *Ein Kampf ums Recht* (1881; Eng. trans., *For the Right*, 1887); *Der Präsident* (1884); *Die Reise nach dem Schicksal* (1885); and *Tragische Novellen* (1886). Franzos' tales draw their characters from among his co-religionists, and while full of deep pathos, as such chronicles must needs be, they present pictures equally strong and truthful of life among the Polish and Galician Jews.

Frasca'ti, a town of Italy, 15 miles SE. of Rome by rail, stands on the slope of the Alban Hills, not far from the site of ancient Tusculum. On account of its lovely villas and salubrious air it is a fashionable resort for the people of Rome. The most splendid of these summer residences are the villas Aldobrandini, Rufinella, and Torlonia. Cardinal York was for many years bishop of the diocese, and his brother, Charles Edward, the Young Pretender, died here in 1788. Pop. 7134, who carry on gardening.

Fraser or **Great Sandy Island** lies off the east coast of Queensland, in Australia, stretching north-east from the coast so as to form Hervey Bay on the north and Wide Bay on the south. The Great Barrier Reef must be regarded as its submarine continuation.

Fraser, ALEXANDER CAMPBELL, born in 1819 at Ardchattan in Argyllshire, studied at the universities of Glasgow and Edinburgh, and in 1850–57 was editor of the *North British Review*. At first a Free Church minister, in 1856 he succeeded Sir William Hamilton in the chair of Logic and Metaphysics at Edinburgh, and in 1859 became Dean of the Faculty of Arts. His edition of Berkeley's works, in 4 vols., with dissertations and annotations, a life of the bishop, and an account of his philosophy, was issued by the Clarendon Press in 1871, and *Selections from Berkeley* in 1874, and in 1881 his monograph on *Berkeley* in Blackwood's 'Philosophical Classics,' to which series he also contributed *Locke* (1889).

Fraser, JAMES, D.D., second Bishop of Manchester, was born near Cheltenham in 1818, took a first-class in classics at Oxford in 1839, and in 1840 was elected to a fellowship at Oriel. He was ordained in 1846, and held the livings of Cholderton, Wiltshire, in 1847–60, and Ufton Nervet, near Reading, in 1860–70. He was a select preacher before the university of Oxford in 1854–56, and again in 1862–64, and published valuable reports on elementary education in England, on the educational systems of the United States and Canada, and on the employment of children; indeed, it was specifically on the ground of his 'interest in and mastery of the question of public education' that Mr Gladstone in 1870 offered him the bishopric of Manchester. Here his energy, his wide sympathy, and his strong sense secured him a unique position in his vast diocese, and caused his death, on the 22d October 1885, to be deplored as sincerely by dissenters as by churchmen. He published a number of sermons, and two vols. appeared posthumously (1887). See his Life by Hughes (1887).

Fraser, SIMON. See LOVAT, LORD.

Fraser, SIR WILLIAM, in 1852 was appointed assistant-keeper of the General Register of Sasines for Scotland, and in 1880 deputy-keeper of Records. He was made a C.B. in 1885, and a K.C.B. in 1887. Since 1858 he has issued a long series of sumptuous Scottish family histories—on the Stirlings of Keir; Montgomeries, Earls of Eglinton; Carnegies, Earls of Southesk; and Colquhouns; with the Books of Grandtully, Carlaverock, Menteith, Lennox, Buccleuch, Douglas, &c.

Fraserburgh, a fishing town in the north-east corner of Aberdeenshire, 47 miles N. of Aberdeen by a branch line (1865). It stands on a bay, 2½ miles wide, immediately south of Kinnaird Head (the *Promontorium Taexalium* of Ptolemy), on which are the Frasers' old castle, a lighthouse now, and the mysterious 'Wine Tower,' with a cave below. It was founded as Faithlie in 1569 by Alexander Fraser of Philorth, Lord Saltoun's ancestor, and in 1601 was erected into the free port, free burgh of barony, and free regality of Fraserburgh. There are a handsome town-house (1855), a restored market-cross, a public hall, &c.; but hardly a trace remains of an abortive university (1592). The harbour has been much improved and extended since 1855, and the rapid growth of the place is due to the great development of the herring-fishery, the fishing-boats having increased from 389 in 1868 to 677 in 1887. Pop. (1881) 6583; (1891) 7360.

Fraser River, the principal stream of British Columbia, is formed by two branches, the chief of which rises in the Rocky Mountains, in 53° 45′ N. lat. and 119° W. long., and proceeds in a north-west course to meet its fellow, which flows south-east from Lakes Stuart and Fraser. They unite near Fort George, in 54° N. lat. and 122° 45′ W. long.; thence the river flows in a southern direction, and after a total course of 800 miles falls into the Georgian Gulf, just north of the international boundary of 49° lat. Its chief affluent is the Thompson River. The rich alluvial deposits of gold along the lower basin of the Fraser first attracted emigration to British Columbia, and the precious metal has since been steadily worked; but the lower valley now enjoys a more secure reputation, as containing some of the best farming land in the province. The salmon canneries are also important. Steamboats can navigate the river for about 100 miles from its mouth to Yale, where the rapids occurring during the passage through the Cascade Range, with its magnificent scenery, begin. See COLUMBIA (BRITISH).

Fraticelli ('little brethren'), a sect of the middle ages which may be regarded as an embodiment, outside of the medieval church, of the same spirit to which is due, within the church, the Franciscan order with its many offshoots. The Italian word *Fraticelli* originally was the popular name of the Franciscan monks; but, in the progress of the disputes that arose in the order (see FRANCISCANS), the name was specially attached

to the members of the rigorist party, and eventually to those among them who pertinaciously refused to accept the pontifical explanations of the monastic rule, and in the end threw off all subjection to the authority of the church. Several of the popes, especially Gregory IX. and Nicholas III., attempted to reconcile the disputants. Pope Celestine V. granted permission to the rigorists to form for themselves a separate organisation, in which the rule of St Francis might be observed in all its primitive and literal rigour. The suppression of this order by Boniface VIII. appears to have furnished the direct occasion for the secession of the extreme party from the church. They openly resisted the authority of the pope, whom they proclaimed an apostate from the faith. The party thus formed was increased by adhesions from other sectarian bodies, as the 'Beghards' and the 'Brethren of the Free Spirit.' In vain Clement V., in the Council of Vienna (1311–12), put forward a new declaration regarding the rule of St Francis. They still held their ground, especially in Sicily, central and northern Italy, and Provence. John XXII., against whom they sided actively with Louis of Bavaria, condemned them by a special bull in 1317, and again in a similar document directed against Henry of Ceva, one of their chief leaders in Sicily. From these sources we learn that they regarded the existing church as in a state of apostasy, and claimed for their own community the exclusive title of the Church of God. They forbade oaths, and discountenanced marriage. They professed a divine mission for the restoration of the gospel truth. They held that all spiritual authority was forfeited by sin on the part of the minister. It would even appear that they proceeded so far as to elect for themselves a pope, with a college of cardinals, and a regular hierarchy. Their principles, in a word, seem to have partaken largely of the same fanatical and antisocial tendencies as characterised the Brethren of the Free Spirit; and in common with them the Fraticelli were the object of a rigorous persecution about the middle of the 14th century. The principles of the sect formed the subject of a public discussion at Perugia in 1374 between them and a Franciscan monk named Paolucci, which appears to have ended in their discomfiture. They still maintained themselves, nevertheless, in central Italy, down to the 15th century, when John of Capistrano received a commission to labour for their conversion in the March of Ancona; but before the beginning of the following century they seem to have disappeared altogether. See Mosheim, *De Beghardis et Beguinabus* (Leip. 1790); Milman's *Latin Christianity*, vol. v.; Herzog's *Real-encyklopädie;* also Lea's *History of the Inquisition* (1888).

Fratta-Maggiore, a town of Italy, 9 miles by rail N. of Naples, with many villas belonging to Neapolitans. It has extensive rope-works, and cultivates wine and hemp. Silkworms are reared in great quantities. Pop. 10,848.

Fraud, in the legal sense, may be defined as deceit which causes injury to another. Active misrepresentation usually amounts to fraud; but a certain latitude is tacitly permitted to persons puffing their own goods, or exaggerating their own resources and credit. Concealment of the truth amounts to fraud if the party who withholds information is under a legal duty to disclose what he knows. A person purchasing an estate is not bound in law to inform the owner of its advantages; he may have discovered a mine of which the owner knows nothing, but he may conceal his discovery without being guilty of fraud. There are certain cases in which the rules are applied with special rigour. The party deceiving may be in a fiduciary position. A solicitor dealing with his client; a director dealing with a person applying for shares; a man of business dealing with a person who trusts to him and can make no inquiries—all these are plainly under a special duty to state the facts fairly. The party deceived may be incapable of protecting himself; —e.g. transactions with infants or with persons of weak mind must be strictly scrutinised. Again, the transaction itself may be one *uberrimæ fidei*, in which the law requires perfect good faith. A person insuring a ship, for example, is bound to tell whatever he knows of the condition and situation of the ship. It is to be observed that fraudulent intention is not a necessary element in fraud. A prospectus which omits to notice a contract entered into by promoters of a company is none the less fraudulent because the omission is accidental. A gift of property may be set aside as a fraud on creditors, although the donor made it in the full belief that he was perfectly solvent. The general effect of fraud is to render void the contract or disposition of property induced by it, or to give the party injured a right of action for damages or restitution. Even marriage may be treated as a nullity on this ground, if the fraud be such as to exclude the notion of true consent. The principles set forth above are, in substance, common to the laws of all civilised nations.

Fraud is an element in theft, embezzlement, personation, and many other crimes. The offence of obtaining goods or money by false pretences was not indictable by the English common law; it was made punishable by acts passed in 1542 and 1757, the provisions of which were consolidated and amended by the 24 and 25 Vict. chap. 96, which prescribes five years' penal servitude as the maximum punishment. Every person who fraudulently represents as an existing fact that which is not a fact, and so obtains money or money's worth, commits an offence within the act. The false pretence must relate to some present fact, and therefore a promise merely to do some act is not such a false representation as will sustain a conviction. It is not necessary that the deception should be by words or writing, but any act tending to deceive will bring a person within the statute. Thus, a man at Oxford wearing a cap and gown, in order to induce a tradesman of whom he ordered goods to believe that he was a member of the university, was properly convicted. The deception practised, however, must not be simply as to the *quality* of an article, for this is regarded as merely a dishonest trick of trade, and not criminally punishable. It is also necessary that the owner should be deceived by the pretence; and where a tradesman is induced to part with goods to a regular customer making a false statement, not on account of the statement, but from his belief in the credit of the party, the transaction is not punishable under the act. It is no bar to a conviction that the crime on being proved amounts to larceny, nor is it necessary to prove an intent to defraud any particular person; the obtaining delivery of money, &c. to another person for the benefit of the party using the deception, and also the obtaining signature to, or destruction of, a valuable security, &c. by a false representation subject the offender to punishment. The same statute provides that a person attempting to extort money by threatening to accuse another of certain felonies, or of an infamous crime, is liable to penal servitude for life (see THREATS).—*Long Firm* is the name given to a company of swindlers who pretend to be established in business at a particular place, order goods to be sent to them as such, and decamp without payment to resume the system elsewhere. The

Statute of Frauds, frequently referred to, was passed in 1677

In Scotland this offence is known as Falsehood, Fraud, and Wilful Imposition. Each species of the offence which in England is punishable under the statute is in Scotland indictable at common law. Thus, false personation, as where a man in the assumed character of an exciseman received money as a composition for smuggled goods, has been held to warrant a conviction of falsehood. So, also, where the deception consists in fictitious appearances; as where a man by fitting his shop with false bales induced another to trust him with goods. Obtaining money by begging-letters and the common practice of ring-dropping fall under this denomination of crime.

In the United States, to constitute the offence known as False Pretences, it is not necessary that the loss occasioned be of a public nature. It consists of a false representation as to some fact existing in the past or present, made with the intent to defraud, by which representation a party is induced to part with something of value to him, generally money, goods, or merchandise. The offence may be committed by a false representation of the nature, quality, or quantity of the goods, or by a false personation, or a false representation of the capacity in which one assumes to transact business; also by the use of false marks or brands, or fictitious or worthless writings, or the false reading of a deed of conveyance to an illiterate person, or by a warranty consisting of a positive false statement of a material latent fact by which a party is induced to purchase. It differs from larceny in that the property is obtained with the consent of the owner, and the false pretence must be the operative cause of the transfer. It is usually a misdemeanour, but the grade of the offence, as also the punishment therefor, is governed by statutes of the several different states. It is recognised as an offence by act of congress, known as the Bankrupt Act (*Rev. Stat.* 3732), but congress has no power to define what shall constitute the offence within a state. The money or goods obtained on false pretence may also be recovered by civil action.

See Hunter's *Roman Law;* Pollock, *On Contracts;* May, *On Fraudulent Conveyances;* Hasting, *The Law of Fraud and Misrepresentation* (1888); M. M. Bigelow, *Law of Fraud on its Civil Side* (Boston, 1888).

Fraudulent Enlistment. See DESERTION.

Fraunhofer, JOSEPH VON, German optician, was born at Straubing, in Bavaria, 6th March 1787. In 1799 he was apprenticed to a glass-cutter and polisher in Munich, and in 1807 he was employed to found an optical institute at Benediktbeuern, of which he became sole manager in 1818, and which a year later was removed to Munich. There he became a member of the Academy of Sciences in 1823, and was also appointed professor and conservator of the physical cabinet of the same institution. He died 7th June 1826. His more important inventions and improvements in optical instruments include a machine for polishing parabolic surfaces, another for polishing lenses and mirrors without altering their curvature, a spherometer, a heliometer, a micrometer, an achromatic microscope, and the great parallactic telescope at Dorpat. But his name has been rendered most celebrated by the improvements he effected in the quality of telescopic prisms and in the mechanism for manipulating telescopes of large size, and above all by his discovery of the dark lines in the sun's spectrum (see SPECTRUM), which bear the name of Fraunhofer's lines.

Fraustadt (Polish *Wszowa*), a town of Prussia, 14 miles NE. of Glogau by rail. It has a tannery, dye-works, a cigar and a sugar factory; and near the town are many windmills. Near here the Saxons under King Augustus of Poland were utterly routed by Charles XII. of Sweden, on 13th February 1706. Pop. 7378.

Fraxinella. See DITTANY.

Fraxinus. See ASH.

Fray Bentos (officially *Independencia*), capital of the Uruguayan department of Rio Negro, on the Uruguay River, 72 miles SSW. of Paysandù, with an English chapel and some 2500 inhabitants. Here is the factory of the Liebig's Extract of Meat Company, employing nearly a thousand persons.

Frechette, LOUIS HONORÉ, LL.D., the 'Canadian laureate,' was born at Levis, Quebec, 16th November 1839, called to the bar in 1864, and, after five years' residence in Chicago, elected to the Dominion parliament in 1874. He has edited several journals, and published some prose works, plays, and translations into French; but his important productions have been his several volumes of poems, two of which were crowned by the French Academy in 1880. The others include *Mes Loisirs* (1863), *La Voix d'un Exile* (1869), *Pêle-mêle* (1877), *Les Oubliés* (1886), and *Voix d'Outre-mer* (1886), which have proved their author the most sympathetic of the interpreters of Canadian scenery and of French-Canadian traditions and aspirations.

Freckles (sometimes called *lentigo*) are small yellowish or brownish-yellow irregularly rounded spots, from the size of a pin's head to that of a split pea, frequently seen on the skin, especially of fair or reddish-haired persons. They are not often met with under the age of six or eight. They are most common on the face, but often occur on the hands and sometimes elsewhere. They are always most distinct in summer; but, though the influence of the sun's rays undoubtedly increases their distinctness, it is doubtful whether it can cause them. They are due to increased local deposit of pigment in the skin: and it may be noticed that persons subject to them do not bronze uniformly under the influence of exposure nearly so deeply as others. Many methods of treatment have been advocated for their removal; but in most cases at least the improvement is not permanent. Among the milder measures which sometimes succeed in improving the condition, is a lotion of hyposulphite of soda (15 to 30 grains) or of chloride of ammonium (15 grains), along with corrosive sublimate (¼ grain to the ounce of water) applied to the part on rag or lint, or hypochlorite of sulphur ointment (one drachm to the ounce).

Fredegond, first mistress, afterwards wife of Chilperic, king of Neustria, a women of violent and unscrupulous character, who shunned not to slay all who stood in her way, in order to secure the throne for her own son, Clotaire II. She is, however, chiefly memorable on account of the relentless feud she waged with Brunhilda, wife of Sigbert, king of Austrasia, and sister of Chilperic of Neustria's first wife, Galsvintha; a feud the bitter enmities of which were intensified by the rivalry between the two kingdoms. She died in 597 or 598.

Fredericia, a seaport and fortress of Denmark, on the east coast of Jutland, at the northern entrance to the Little Belt. Founded by Frederick III. in 1652, it was five years later stormed and razed by the Swedes, nor was it refortified until 1709. It suffered during the wars of 1848–49 and 1864. Pop. 8275.

Frederick, a well-built city of Maryland, 61 miles W. by N. of Baltimore by rail, with several foundries, tanneries, flour-mills, and other manufactories. It contains a college (1797), a Jesuit establishment, and a state institution for the deaf and dumb. Pop. (1890) 8193.

Frederick I., surnamed BARBAROSSA (Redbeard), Holy Roman emperor, of the Swabian family of Hohenstaufen, was born about 1123. He succeeded his father, Duke Frederick II. of Swabia, in 1147, and his uncle, Conrad III., as emperor in 1152. His reign was one long struggle against refractory but powerful vassals at home, and against the turbulent civic republics of Lombardy and the pope (Alexander III.) in Italy. By the capture in 1162 of Milan, the most hostile of the Italian cities, Frederick brought to his feet all the recalcitrant states of Italy; and even the pope, the last of his enemies, he seemed on the point of subduing five years later when he took Rome by storm. But at this juncture his army was suddenly smitten with a terrible plague, and his forces melted away from him. This was the signal for revolt in Lombardy; and when at length in 1174 Frederick was able to leave Germany with the intention of once more reducing his Italian subjects beneath his iron heel, he incurred a severe defeat at Legnano (1176). Nevertheless it was a defeat that proved to be more valuable to him than his previous successes. For it led him to change his policy of stern repression to one of clemency and concession, whereby he converted the Lombard cities from restless, determined enemies into contented subjects. At the same time, in 1177, he acknowledged Alexander III. as pope, and thus paved the way for the final pacification of 1183. In Germany Frederick endeavoured to curb the power of his greatest vassals by a policy of mingled conciliation and counterpoise: the hostility of the strongest he disarmed by investing them with new fiefs, or by raising their titular dignities, whilst the weaker he sought to keep in check by conferring additional rights upon their rivals, the municipal communities. Thus, he elevated the countship of Austria to the rank of a duchy, created Duke Ladislaus of Bohemia king, and granted Westphalia to the Bishop of Cologne, East Saxony to Bernhard of Anhalt, and Brunswick and Lüneburg to the Guelph princes. Besides this, he quelled the rebellious spirit of Henry the Lion of Bavaria, and asserted his feudal superiority over Poland, Hungary, Denmark, and Burgundy. When at the height of his power, however, he took the cross to go and war against Saladin. Marching by way of Hungary, Servia, Byzantium, and Asia Minor, he defeated the Moslems in two battles, at Philomelium and Iconium, but was drowned in a little stream in Pisidia, June 10, 1190. Personally a man of great physical beauty, and of frank and winning manners, Frederick's chief traits were a resolute will, degenerating at times into gross cruelty, considerable administrative skill, martial ardour, a love of danger for its own sake, and a magnanimous ambition. No ruler of Germany ever won a more lasting place in the affections of his subjects than Frederick Barbarossa, about whose memory the patriotic aspirations of the German people have continued to cling in legend and song down to the present day. One persistent tradition makes him still asleep in the Untersberg near Salzburg or the Kyffhäuser in Thuringia, whence he will return to succour Germany in her hour of greatest need. His red beard has already grown through the stone table before which he sits, and from time to time he raises his head to see if the ravens are still wheeling round the mountain, or the hour of awakening has come—the dawn of a new golden age for Germany. See works by Prutz (3 vols. Danzig, 1871–73), Ribbeck (Leip. 1881), and Kallsen (Halle, 1882).

Frederick II., OF GERMANY, grandson of Frederick I. (Barbarossa), and son of the Emperor Henry VI., and of Constance, heiress of Sicily, was born at Jesi, in Ancona, 26th December 1194. In the fourth year of his age his father died, leaving him king of Sicily under the guardianship of his mother, who secured the favour of Pope Innocent III. for her son by acknowledging the pope as her feudal superior and conceding to him important privileges. In his eighteenth year Frederick set out, under the auspices of Innocent, to wrest the imperial crown from Otto IV., whom he succeeded in driving out of the empire with little trouble. On his promising to undertake a crusade, the pope sanctioned his coronation at Aix-la-Chapelle in 1215. Like his grandfather, Frederick was actuated by an ardent desire for the consolidation of the imperial power in Italy at the expense of the pontificate, which he wished to reduce to the rank of a mere archiepiscopal dignity. Having secured the nomination of his son Henry to the rank of king of the Romans, and appointed Archbishop Engelbert of Cologne as his vicegerent, he left Germany, and, after having been crowned emperor at Rome in 1220, devoted himself to the task of organising his Italian territories. He founded the university of Naples, gave encouragement to the medical school of Salerno, invited to his court and patronised men of learning, poets, and artists, and commissioned his chancellor, Petrus de Vinea, to draw up a code of laws to suit all classes of his German and Italian subjects. Frederick's schemes for the union of his vast and widely scattered dominions were, however, frustrated by the refractory conduct of the Lombard cities, and still more by the antagonism of the popes Honorius III. and Gregory IX. Frederick's departure to the East was originally fixed for the year 1223, but the necessity of subduing the turbulent Italian nobles and cities, and curbing his Saracen subjects in Sicily, caused a delay of two years, and then a further delay of yet two years more. The pope at length grew so impatient that Frederick was constrained to embark from Italy. Nevertheless he returned a few days later, under the plea of personal sickness; this brought down upon him a bull of excommunication from the vehement Gregory IX. In the following year, however, the emperor at length fulfilled his vow, and fulfilled it in brilliant fashion, by securing from the sultan of Egypt, without striking a single blow, the possession of Jerusalem and the holy places, together with a truce for ten years. Then, after crowning himself king of Jerusalem with his own hand, 18th March 1229, he returned to Italy, where the continental half of his kingdom of Sicily had been overrun, at the instigation of the still irreconcilable pope, by a body of mercenary soldiers. During the remainder of his reign Frederick was engaged in a long and harassing contest with the papal power, the hands of his enemy being gradually strengthened by the accession of the revolted Lombard cities and of several of the princes and towns of Germany, headed by his own son Henry, and by the treachery of his most trusted and intimate friend, the chancellor Vinea. In 1239 he was again excommunicated for having proclaimed his natural son Enzio king of Sardinia, in defiance of the protest of the pope. Nor did the fury of the struggle abate when, in June 1243, Frederick's friend, Sinibaldi Fiesco, succeeded to the pontificate as Innocent IV. And the clouds of disaster, defeat, and misfortune were gathering thicker and more ominously above Frederick's head, when he died somewhat suddenly at Fiorentino, 13th December 1250.

This emperor is one of the most outstanding figures of the middle ages; and, like nearly all such personalities, his character was a blending of contradictory qualities. Intellectually he was perhaps the most enlightened man of his age, in many respects outrunning it by some centuries, as in his tolerance of the Jews and the Mussulmans, in the admiration of the spirit of free trade shown in his commercial legislation and policy,

in his recognition of popular representation by annual parliaments, and in his anticipation of the later humanistic movement; but at the same time he was a persecutor of the heretics of the church, a staunch upholder of absolute sovereignty, and a supporter of the power of the princes against the cities. The strength, energy, and elasticity of his character were sadly marred by very conspicuous strains of licentiousness, cruelty, and perfidy. But, though he lacked the moral greatness of his ancestor, Barbarossa, he deserves unstinted admiration for his encouragement of learning and culture, and his fostering care of the arts and sciences. He himself not only spoke the principal languages of his extensive empire—German, French, Italian, Latin, Greek, Arabic, and Hebrew—but he also was one of the first to write Italian poems, took a great interest in the arts, and was himself a diligent student of natural science. It has been brought as a reproach against him that he unduly neglected his territorial possessions in his native country of Germany, and that in religious matters, notwithstanding his crusade, he was far from being a model son of the church, though he was not, in all probability, the atheist, at least according to modern notions, that his ecclesiastical enemies made him out to be. See works by Schirrmacher (4 vols. Gött. 1859–65), Huillard Bréholles (12 vols. Paris, 1852–61), and Winkelmann (1889); and *The Popes and the Hohenstaufens*, by Ugo Balzani (Lond. 1889).

Frederick III. or **IV.**, emperor of Germany, and the fifth Duke of Austria of that name, was born at Innsbruck, 21st September 1415, being the son of Duke Ernest, of the Styrian branch of the House of Hapsburg. At the age of twenty he assumed the government of Styria, Carniola, and Carinthia. On the death of the Emperor Albert II. in 1440, Frederick was elected king of the Germans; twelve years later he received the imperial crown at the hands of the pope at Rome, and in 1453 he secured the archducal title to his family. Owing to the indolence and indecision of his character his reign was a period of anarchy, wars raging on all the frontiers of the empire, and internal disorders vexing its peace within. During the course of his long and inglorious reign Frederick lost his hold upon Switzerland; purchased peace from his brother Albert, who ruled in Upper Austria, by the payment of a large sum of money; suffered Sforza to possess himself of Milan, George Podiebrad to seat himself on the throne of Bohemia, and Matthias Corvinus on that of Hungary; surrendered the empire to the pope by the Vienna Concordat of 1448; remained apathetic when the Turks in 1469 penetrated as far as Carniola, and again in 1475, when they almost reached Salzburg; and finally in 1485 provoked Matthias of Hungary to invade his territories. Nevertheless, by the marriage of his son, Maximilian I., to Mary, daughter of Charles the Bold of Burgundy, he laid the foundation of the subsequent greatness of the Hapsburgs. Frederick died on 19th August 1493. Though he neglected the interests and duties of the imperial crown to indulge in his favourite studies, alchemy, astrology, and botany, he never lost an opportunity of promoting the aggrandisement of his own family. He was temperate, devout, parsimonious, scrupulous about trifles, simple in his habits, mild and phlegmatic in his disposition, and naturally averse to exertion or excitement. From his time the imperial dignity continued almost hereditary in the House of Austria, which has perpetuated the use of his favourite device, A.E.I.O.U.—*Austriæ Est Imperare Orbi Universo* ('It is Austria's destiny to rule the entire world'). See Chmel's *Friedrich IV.* (2 vols. Hamburg, 1840–43).

Frederick I., king of Prussia, and third elector of Brandenburg of that name, was born at Königsberg, 11th July 1657, and succeeded to the electorate in 1688. Following out the policy of his father, Frederick-William, the Great Elector, he lent valuable support to William of Orange in his attempt on England. He employed the treasure collected by his father largely in the purchase of minor principalities and territories; and further increased his revenue by lending his soldiers to fight the battles of the neighbouring princes, especially against France. But the outstanding event of his reign was his own elevation to the dignity of king, 18th January 1701, the title being taken from Prussia, the only independent portion of his dominions. Good-natured but vain, generous but ungrateful, Frederick left the finances of his country in an embarrassed condition. Nevertheless, his public spirit led him to found the university of Halle, to embellish Berlin, to found there the Academy of Sciences and the Academy of Painting and Sculpture, and also to establish a supreme court of appeal. Frederick died 25th February 1713, and was succeeded by his son, King Frederick-William I. See works by Hahn (3d ed. Berlin, 1876) and Ledebur (Berlin, 1878).

Frederick II., OF PRUSSIA, surnamed 'THE GREAT,' born at Berlin, January 24, 1712, was the son of Frederick-William I., and of Sophia-Dorothea, daughter of George I. of Great Britain. His early years were spent under the restraints of an irksome military training and a narrow and unsympathetic system of education, against which not only the natural restiveness of youth but also the more liberal tastes implanted by his mother rebelled fiercely but vainly. At the age of eighteen the prince made an unsuccessful effort to escape to the court of Great Britain. His father saw in this attempt an act both of political rebellion and of military insubordination, and, influenced perhaps by the desire of saving the glory and acquisitions of his house from one whom he considered an unworthy successor, would have punished Frederick with death, had it not been for the intercession of the emperor. As it was, the prince was ordered into close confinement at Küstrin, while his confidant, Lieutenant Katte, was beheaded before his eyes. Frederick recognised that submission was inevitable. He threw himself with nervous alacrity into the military and civil duties with which he was after a time entrusted, while his letters to his father of this period are couched in almost servile terms. He won his final restoration to favour when in 1733 he dutifully accepted the bride chosen for him by his father (the Princess Elizabeth-Christina of Brunswick-Wolfenbüttel, 1715–97). From 1734 Frederick resided at Rheinsberg, where he held a kind of small literary court, and devoted his leisure to the study of music and French literature, for which he had a keen and lasting admiration. He corresponded with Voltaire (who afterwards, in 1752, visited Berlin), and studied with much sympathy the 'philosophical' doctrines which were to play so important a part in the century. There is no doubt that he now began to nourish schemes of political ambition. Even before he came to the throne he clearly perceived that, if the House of Hohenzollern was to play an adequate part in European politics, its possessions must be consolidated and extended; before he died the area of Prussia was doubled, and, notwithstanding the temporary eclipse under Napoleon, the foundation of Prussia's greatness was laid. Hostile critics assert that Frederick's prevailing motive was mere selfish dynastic ambition; they point to the fact that all his wars were aggressive, and that in every case he struck the first blow; they reproach him with unpatriotically

encouraging the interference of France in the affairs of Germany for his private ends, and they taunt him with his contemptuous neglect of German literature and language, which last he could scarcely speak, and certainly could not spell. But there is no doubt that the terrible struggle of the Seven Years' War left him, if it did not find him, with a true appreciation of the solidarity of his own and his people's interest; he assuredly did not spare himself in their service; and his measures and reforms, harsh and autocratic as many of them now appear, were undertaken with a single eye to the national good. The rise of Prussia under Frederick really rendered possible the union of Germany which his critics accuse him of retarding, but which could never have been effectually carried through under a dominant Austria, haughty with centuries of imperial tradition.

On May 31, 1740, Frederick became king; and in the following October the accession of Maria Theresa separated the crown of Austria from the imperial diadem. Frederick, in possession of an admirably drilled army and a well-filled treasury, seized the opportunity. Reviving an antiquated claim to Silesia, he entered that province (December 1740) before his formal declaration of war reached Vienna, defeated the Austrians at Mollwitz (April 1741) and Chotusitz (May 1742), and, having concluded an alliance for fifteen years with France, forced Maria Theresa to yield him Upper and Lower Silesia by the Treaty of Breslau in June 1742, which closed this first Silesian war. The second Silesian war (August 1744 to December 1745) left Frederick with still further augmented territories, and the reputation of being one of the first military commanders of the day. The next eleven years were years of peace; but Austria was not yet reconciled to the loss of Silesia, and Frederick's energetic internal reforms were coloured by the expectation of renewed war. In 1756 the third Silesian war, better known as the Seven Years' War (q.v.), began. Frederick anticipated attack by himself becoming the aggressor, and during all this momentous struggle—one of the most remarkable of modern times—displayed a courage, a military genius, and a power of resource both in victory and defeat which justly entitle him to the name of 'the Great.' At the Peace of Hubertsburg (February 15, 1763), he had not only maintained his territory undiminished, but he had also added a tenfold prestige to Prussia and to Prussian arms. Jealousy of Austrian aggrandisement continued to influence his policy. In 1772 it induced him to share in that dishonest act, the first partition of Poland, which added Polish Prussia and a portion of Great Poland to the Prussian crown. In 1778 it led him to take arms in a brief campaign, which ended in the acquisition of the Franconian duchies. And one of his latest political actions was the formation of the 'Fürstenbund,' or League of Princes, which was the first definite appearance of Prussia as a rival to Austria for the lead in Germany. Frederick died at Potsdam, August 17, 1786, and was succeeded by his nephew, Frederick-William II.

Frederick, like Richelieu and like Bismarck, when foreign war ceased turned his immediate attention to the internal affairs of his kingdom. He was an able administrator at all periods of his reign, and not the least remarkable of his feats was his carrying on all his wars without incurring a penny of debt. He regarded himself as, in his own words, the first servant of the state; he was his own prime-minister in a very literal sense, for his cynical suspicions of human motives induced him to interfere directly in things great and small. His conviction of the immaturity of his country explains the discrepancy between his theoretical writings on government and the scant amount of liberty he granted to his people. He considered himself responsible for the good of his people, and he justified his arbitrary actions by his good intentions and his keener insight. As already remarked, Frederick's domestic legislation was influenced by what he believed to be the military requirements of the time; Prussia under him was governed as one huge camp. He endeavoured to increase the population—i.e. the supply of soldiers, by a system of 'planting colonies,' by lending his war-horses to plough the peasants' land, by distributing military stores, and by temporary remission of taxes in certain provinces. But he did not carry the enfranchisement of the peasantry to such an extent as to injure or offend the nobility, whom he required for officers. With a view to providing treasure for future wars he fostered woollen and other manufactures by a high protective tariff; but he made himself unpopular by the introduction of the French excise-system, known as the Regie, and the temporary inflation of his revenue was attended with later disastrous commercial results. During Frederick's reign, however, the country rapidly recovered from the ravages of war, while the army was raised to a strength of 200,000 men. Frederick was essentially a just, if somewhat austere man, and the administration of justice under his rule was pure, though he himself had his usual cynical distrust of his judges' integrity; the press enjoyed comparative freedom; and freedom of conscience was promoted. Though Frederick was himself a voluminous writer on political, historical, and military subjects, he had no sympathy with nascent German literature, a fact on which the latter is perhaps to be congratulated. The spirit of the century went faster than Frederick; had he lived he would not have understood the logical outcome of his *philosophe* doctrines in the French Revolution. His works, written wholly in French, have been published in thirty-one volumes under the auspices of the Berlin Academy (Berlin, 1846–57), which in 1878 also undertook an edition of his *Political Correspondence*.

The chief authorities for the life of Frederick are, besides his own *Œuvres* and *Correspondance*, and the official publications of the Prussian Archives, Preuss's *Friedrich der Grosse* (4 vols. Berlin, 1832–34); Carlyle's *History of Frederick II.* (6 vols. Lond. 1858–65); and Droysen's *Friedrich der Grosse* (2 vols. Leip. 1874–76), being part v. of his *Geschichte der Preussischen Politik*. Numerous monographs upon special epochs in his life or special phases of his character have also been published. The leader of the hostile school of criticism is O. Klopp, in his *Friedrich II. von Preussen und die Deutsche Nation* (Schaffhausen, 1867). Rigollot, in his *Frédéric II. Philosophe* (Paris, 1875), gives us a French view of the king; as does the Duc de Broglie in *Frédéric II. et Marie Therese* (1883). There is an English translation (1877) of Kugler's *History of Frederick the Great*, with 500 illustrations by the artist Menzel, who in innumerable publications illustrated Frederick and his times. See also Colonel Brackenbury's little Monograph (1884), and Herbert Tuttle, *History of Prussia under Frederick the Great* (2 vols. New York, 1888).

Frederick III., second German emperor and eighth king of Prussia, was the only son of the Emperor William I. and the Empress Augusta. Born at Potsdam, October 18, 1831, he was early trained to the profession of arms, whilst his general education was conducted by the Rev. W. Godet and Dr Ernst Curtius, the historian. The prince subsequently studied at Bonn University (1849–50), and then travelled in Switzerland, Tyrol, Italy, and France. For some years he now closely studied the art of war under Moltke. He paid several visits to England, and in January 1858 was married at St James's to Victoria, the Princess Royal. On becoming Crown-prince of Prussia in 1861, he

began to take a more prominent part in public affairs. In 1863 he protested against the drastic policy of King William and Prince Bismarck in relation to constitutional questions and the press. He went through the Danish war, and was present at the battle of Düppel, and at the later operations of the Prussian and Austrian forces, which resulted in the defeat of Denmark. On the outbreak of the war between Prussia and Austria on 12th May 1866 the crown-prince was placed at the head of the second Prussian army, forming the left wing of the forces in Silesia. During a brief but brilliant series of operations he fought victorious engagements at Trautenau and Nachod, capturing 8000 prisoners. His opportune arrival on the field of Sadowa, or Königgrätz, gave this crowning victory to the Prussians. For this he received the Order of Merit. In 1869 the crown-prince travelled through Palestine. In the Franco-German war 'our Fritz,' as the soldiers called him, commanded the third army, consisting of the armies of the south; and his were the victories of Wissembourg and Wörth. He next passed the Vosges Mountains, and effected a junction with the first and second German armies. In the memorable engagements which closed with the French capitulation at Sedan, the crown-prince's troops and those of Prince Frederick-Charles (q.v.) were engaged against the greater part of MacMahon's forces. The Germans succeeded in crossing the river Meuse, this difficult operation being effected by the crown-prince, aided by General von der Tann. The dignity of field-marshal was conferred on him, October 28, upon the fall of Metz; at Versailles, on 18th January 1871, he became crown-prince of the German empire; and for his distinguished services he received the Iron Cross and numerous other orders.

During the time of peace which now ensued the crown-prince manifested a keen interest in the welfare and development of Germany. In 1878, when the Emperor William was wounded by an assassin, the crown-prince was appointed provisional regent. On the occasion of Queen Victoria's jubilee, in June 1887, he rode in his white cuirassier's uniform by the side of the Prince of Wales—his last important appearance in public. It was already known that he was suffering from an affection of the throat, and in the course of a few months this assumed a malignant form. In the succeeding autumn he removed to San Remo. On 9th February 1888 the operation of tracheotomy was performed by Dr Bramann, in the presence of Sir Morell Mackenzie (who had been in constant attendance upon the prince) and Drs Schmidt and Hovell. The prince bore the ordeal with characteristic fortitude, and for some time relief was experienced by artificial respiration. On 9th March the Emperor William died; and the crown-prince was proclaimed emperor under the title of Frederick III. With the Empress Victoria, he set out for Berlin, and on reaching that city issued an eloquent proclamation to his people. During the next two months the insidious malady exhibited many fluctuations, but after a brave and patient battling against death, the emperor expired on 15th June 1888. The epithet of 'Frederick the Noble' well befits the character and career of this illustrious sovereign. Though a successful soldier, he had a great horror of war. He imbibed broad and liberal views of theology, literature, and politics; was opposed to the persecution of the Jews; encouraged art and letters; had an intense dislike for autocratic ideas, and sought as far as possible to liberalise the institutions of the empire. As a ruler, it was his earnest desire to reconcile the monarchy with popular aspirations, and had he lived he must have deeply impressed his personality upon the immediate future of Prussia and Germany. He was succeeded by his son William II. (q.v.). See Rennell Rodd, *Frederick, Crown-prince and Emperor* (1888).

Frederick V., Electoral Prince Palatine, son of Frederick IV., was born at Amberg, 26th August 1596, and succeeded to the Palatinate in 1610. He married, in 1613, Elizabeth (q.v.), the daughter of James I. of England, through whose ambitious counsels he was induced to put himself at the head of the Protestant union of Germany, and finally, although against his own inclinations, to accept the crown of Bohemia in 1619. His complete defeat at the battle of the Weisse-Berg, near Prague (1620), terminated his short-lived reign, in allusion to which he became henceforth known as the 'Winter King.' In the meantime the Palatinate was occupied by the Spaniards and Bavarians. Frederick therefore took refuge in Holland. Declared under the ban of the empire in 1621, he lost his electoral principality two years later, when the emperor conferred it upon Maximilian of Bavaria. Frederick died at Mainz, 29th November 1632. His son got back the Palatinate after the Treaty of Westphalia (1648).

Frederick III., of Denmark, was born in 1609, succeeded to the throne in 1648, and died in 1670. His reign was rendered memorable by the change effected in the constitution (see Denmark).—Frederick V. (1723–66) ascended the throne in 1746, and proved one of the best and wisest monarchs of his time. Denmark owed to him the increase of her national wealth, and the establishment of various branches of commerce and manufacture. He established an Asiatic Company, opened the American colonial trade to all his subjects, encouraged painting and sculpture, and sent a learned commission to travel and make explorations in Egypt and the East.—Frederick VI. (1768–1839) assumed the regency of the kingdom in 1784, on account of the insanity of his father, on whose death in 1808 he ascended the throne. In his reign feudal serfdom was abolished, the criminal code amended, and the slave-trade prohibited in the Danish colonies. For his luckless participation in the Napoleonic wars, and for the constitution which he granted in 1831, see Denmark.—Frederick VII. (1808–63), who succeeded in 1848, was the last of the Oldenburg line (see Denmark). The principal events of his reign were the wars and diplomatic negotiations arising out of the revolt of the duchies of Holstein and Sleswick (see Sleswick-Holstein).

Frederick, Prince of Wales (1707–51), eldest son of George II., quarrelled with his father over his own marriage. In 1737 he joined the parliamentary opposition, was banished from court in consequence of his ill-treatment of his wife and of his disobedience to his father. He died before his father, leaving his son to ascend the throne as George III. on the death of George II.

Frederick-Charles, a Prussian prince, nicknamed the 'Red Prince' from the colour of his favourite hussar uniform, was born in Berlin, 20th March 1828, the eldest son of Prince Charles, who was a brother of the Emperor William I. Frederick-Charles was educated for the army, and served in the first Sleswick-Holstein war, commanded the right wing in the second Danish war, and in 1866, in the campaign against Austria, won the great victory of Königgrätz. In the Franco-Prussian war he commanded the second army, drove Bazaine back to Metz, and on the 27th October received the capitulation of that fortress (see Bazaine). He was made a field-marshal next day, captured Orleans, broke up the army of the Loire, and scattered Chanzy's portion of it at Le Mans. This was his last action, for Paris capitulated immedi-

ately after. One of the ablest of Prussian generals, he added to his active service successful labours to reform and render more elastic the military system of the army. He died 15th June 1885.—In March 1879 his third daughter, Louise Margaret, was married to the Duke of Connaught.

Fredericksburg, a town of Spottsylvania county, Virginia, on the Rappahannock, 61 miles N. of Richmond by rail, with a military school, flour, paper, and sumach mills, and other manufactures. Washington's mother is buried close by. On the hills to the south Burnside (q.v.) attacked and was repulsed by the Confederates in December 1862. Pop. (1890) 4528.

Frederick-William, ELECTOR OF BRANDENBURG, commonly called 'the Great Elector,' was born 16th February 1620, at Cölln on the Spree, succeeded to the electorate in 1640, and died 9th May 1688. On his accession he found an empty exchequer, the towns and cities depopulated, and the whole electorate disorganised, exhausted, and horribly devastated by the Swedish and Imperialist armies during the Thirty Years' War. His first acts were to regulate the finances and to conclude a treaty of neutrality with Sweden, which left him at leisure to devote himself to the organisation of his army and the repeopling of the deserted towns and villages with immigrants. By the Treaty of Westphalia (1648), which he zealously promoted, at the sacrifice of a considerable slice of territory in Western Pomerania, he nevertheless recovered the eastern portion of Pomerania, the principalities of Halberstadt, Minden, and Kammin, and the reversion of the archbishopric of Magdeburg. Then in the course of ten years of peace he laboured hard to raise the condition of Brandenburg; but he also created an army of 25,000 men, organised on the Swedish model. Out of a quarrel between Sweden and Poland he contrived to draw advantage for himself, in that he secured the independence of the duchy of Prussia from Poland (1657). After another fifteen years of peace the elector, alarmed at the aggressions of Louis XIV. on the Rhenish frontier, induced the emperor, the king of Denmark, and the Elector of Hesse-Cassel to enter into a league against France. Thereupon Louis incited the Swedes to invade Brandenburg, and to advance upon Berlin. Frederick-William, however, signally defeated them at Rathenow and at Fehrbellin (1675), and drove them from his dominions. Nevertheless, being forsaken by the emperor and the other German princes, and being left to face France single-handed, he was obliged to agree to the Treaty of St Germain (1679), by which he restored all his conquests to the Swedes, in return for the withdrawal of the French army from Brandenburg and the payment to him of an indemnity of 300,000 crowns. From this time forth Frederick-William devoted himself to the task of consolidating his dominions, and fostering their agricultural, industrial, and commercial development. He extended a hearty welcome to several thousand French Protestants after the revocation of the Edict of Nantes, and encouraged the immigration of Dutchmen and other foreigners, whereby he introduced numerous industrial arts among his subjects. He founded the university at Duisburg, and the royal library at Berlin, and reorganised the universities of Frankfort-on-the-Oder and Königsberg, opened canals, established a system of posts, and greatly enlarged and beautified Berlin. He left a well-filled exchequer and a highly-organised army. A man of imposing personal appearance, he was of bold and energetic temperament, of a quick temper, a resolute will, and an ambitious mind that looked a long way ahead and laid plans accordingly. Brandenburg he converted from a weak constitutional state into what was virtually an absolute monarchy only less powerful than Austria in the German polity of states. He laid the foundations of the bureaucratic and military aristocracies of the subsequent kingdom of Prussia, and formed the nucleus of a small fleet. Besides this, he encouraged education, and made himself the champion of religious toleration. He was succeeded by his son, Frederick III., afterwards King Frederick I. of Prussia.

Frederick-William I., king of Prussia, born 15th August 1688 at Berlin, was in almost every particular the opposite of his father, Frederick I. In the same year (1713) that he ascended the throne he became embroiled in the war waged by Sweden against Russia, Poland, and Denmark, on behalf of the latter. At the Peace of Stockholm in 1720 Frederick-William received Hither Pomerania with Stettin. But the remaining twenty years of his reign were devoted to the amelioration of the internal condition of Prussia. Of a sternly practical turn of mind, despising the arts and sciences, rigidly economical, strict in his ideas of justice, blunt and determined, this king carried into all departments of his administration the habits and principles of the frugal military martinet. The results of his policy were seen at his death (31st May 1740), when he left to his son, Frederick II., a treasure of nine million thalers and an army of more than 80,000 men, the best drilled and disciplined force in Europe, so that Prussia, though ranking only twelfth among the powers of Europe in respect of population and area, came fourth in military power. He also fostered the industries and agriculture of his dominions, introducing the manufacture of woollen cloth, and settling in East Prussia 17,000 to 18,000 Protestant refugees from Salzburg. On the whole, his rule, arbitrary though it was, laid the foundation upon which Frederick the Great worked for the subsequent greatness of Prussia.

Frederick-William II., king of Prussia, nephew of Frederick II., was born 25th September 1744. As a young man he failed to win the goodwill of his uncle, owing to his excesses and his disinclination to work. Nevertheless, the natural mildness of his disposition, together with the abolition of some of the oppressive measures of Frederick II.'s reign, made him very popular at his accession in 1786. But he soon lost the affectionate regard of his subjects by his predilection for unworthy favourites, and by the abrogation of the freedom of the press and religion (1788). His uncle left him a treasury containing more than fifty million thalers; these he dissipated in a useless war with Holland. In short, his foreign policy was weak and lacking in character, whilst at home he starved the budding sense of patriotism in his subjects, and oppressed them with debt and increased taxation. He added New East Prussia, South Prussia, New Silesia, Danzig, and Thorn to his kingdom by the partitions of Poland in 1793 and 1795, and also acquired the districts of Ansbach and Baireuth. Frederick-William II. died 16th November 1797, and was succeeded by his son, Frederick-William III.

Frederick-William III., king of Prussia, son of Frederick-William II., was born 3d August 1770, and ascended the throne in 1797. His reign may be divided into three periods. During the first of these his lack of energy and purpose led him to take up an attitude of passive neutrality towards Napoleon; but at length the truculent policy of the latter so exasperated the Prussians that, instigated by their queen, they forced the king to declare war against the French (1806)—a most disastrous step, as, after being thoroughly worsted at Jena and Auerstädt, Frederick-William

was compelled to flee into East Prussia, leaving his kingdom to be overrun and his capital captured by Napoleon. Nor was that all: by the Treaty of Tilsit (1807) Prussia was diminished by one-half, being deprived of all her territories west of the Elbe, and all that she had acquired by the partition of Poland. The second period (1806–15) is marked by the administrative reforms of Stein (q.v.) and the war of liberation (see GERMANY). By the Treaty of Vienna (1815), which terminated that war, Prussia recovered her possessions west of the Elbe, and acquired the duchies of Berg and Juliers (Jülich), the northern half of Saxony, and other districts in Westphalia, besides securing the remaining (Swedish) portion of Hither Pomerania; but she gave up her Polish acquisitions, with the exception of Posen, to Russia, the province of Friesland to Holland, and Ansbach and Baireuth to Bavaria. The last period of this reign was generally one of reaction. The king and his minister Hardenberg applied the Metternichian principles of government in Prussia, rigorously suppressing the democratic movements of 1819 and 1830, and strictly curtailing the freedom of the press. Nevertheless, the policy of reform inaugurated by Stein did not remain altogether stationary; provincial diets were established (1823), though allowed merely consultative functions; the finances were put on a better footing; the system of taxation was greatly improved; education was encouraged; and the Zollverein or customs union was established. In private life this king exhibited the virtues of justice, a strong sense of duty, purity, and love of truth; but his public conduct was rendered unsatisfactory by his indecision of character, his great diffidence, narrowness of view, and the limited extent of his knowledge. His wife was the beautiful and noble-minded Louisa (q.v.), idolised by the Prussian people for her patriotism. He died at Berlin, 7th June 1840, and was succeeded by his son, Frederick-William IV.

Frederick-William IV., king of Prussia, son of Frederick-William III., was born October 15, 1795. His reign is characterised by one long struggle of the people of Prussia against their king for a constitutional form of government. Frederick-William IV. exhibited much of his father's vacillation and instability of purpose; and, although he began his reign (June 7, 1840) by granting minor reforms and promising radical changes of a liberal character, he always evaded the fulfilment of these pledges. He was possessed by high but vague ideas of the divine right of kings, and showed a strong tendency to mystic pietism. A determined enemy to the ideas of the French Revolution, he refused to accept the imperial crown offered him by the Liberal Frankfort Diet in 1849; and at first he resolutely opposed the popular movement which followed the French Revolution of 1848; but when the people emphasised their reiterated demand for constitutional government by storming the arsenal and seizing on the palace of the Prince of Prussia, afterwards the Emperor William I., who was at that time especially obnoxious to the Liberals, the king complied with their wishes. At length, on 31st January 1850, the country was granted a representative parliament, summoned in accordance with the terms of a written constitution, based upon democratic principles. In 1857 Frederick-William was seized with remittent attacks of insanity, and resigned the management of public affairs to his brother and heir, who from 1858 acted as regent of the kingdom till his own accession, as William I., on the death of Frederick-William, 2d January 1861. See his Life by Ranke (1878).

Frederick-William (1771–1815), DUKE OF BRUNSWICK. See BRUNSWICK.

Fredericton, capital of the province of New Brunswick, Canada, stands on the St John River, 58 miles NNW. of the port of St John. It is the seat of an Anglican bishop and of a university, and has some handsome government buildings. There are some manufactures, and a considerable trade in lumber is carried on. Pop. (1891) 6502.

Frederikshald, a fortified seaport of Norway, on the Idde fjord, near the Swedish border, 85 miles by rail SSE. of Christiania. Having been burned down in 1826, it was rebuilt in modern style, with broad and regular streets. Its inhabitants trade in timber. To the south-east of the town stands the fortress of Frederiksteen, built in 1661, which, though often assaulted, has never yet been taken. Charles XII. of Sweden was killed in the trenches before this fortress on 11th December 1718. A little farther to the east stands the fort of Gyldenlöve, which has played an important part in the wars between Sweden and Norway. It is now, however, of little consequence. Formerly called Halden, Frederikshald received its present name from King Frederick III. of Denmark. Pop. (1876) 9913; (1891) 11,217.

Frederikshavn, a port in the north of Jutland, on the Cattegat, 52 miles NE. of Aalborg by rail. It is much used as a harbour of refuge, and has a considerable trade, exporting butter, cattle, and pigs (to England), and importing wood, iron, corn, cotton-yarn, &c. Pop. 2891.

Frederikstad, a seaport town of Norway, at the mouth of the Glommen, 58 miles S. of Christiania by rail, exports from 150,000 to 170,000 tons of timber annually. Pop. (1876) 9672; (1891) 12,451.

Free Bench (*Francus Bancus*). By custom of certain manors of England a widow was entitled to dower, called 'free bench,' out of the lands which were held by her husband, provided she remained unmarried and chaste.

Free Church of England, an Episcopal church founded in 1844, closely agreeing with the evangelical section of the Church of England. It arose in opposition to the Tractarian movement, accepts heartily the doctrine of the Protestant reformation, and promotes active evangelical effort. The body is not large in numbers.—The Free Church Society (1857) and the Free and Open Church Association (1866) seek to abolish the pew-rent system. See PEWS.

Free Church of Scotland, the name assumed by those who at the 'Disruption' of the Church of Scotland, in 1843, withdrew from connection with the state, and formed themselves into a distinct religious community, claiming to represent the historic church of Scotland, and to maintain the principles for which it has contended since the Reformation.

There has been no serious difference between the Free Church of Scotland and the Established Church in the standards which they have hitherto received; but a catechism, approved by the Free Church Assembly after 1843, makes the right to vary the document of creed, or to exchange it for another (without the sanction of the state), one of the tests of the freedom claimed for the church against the decisions of 1843. Speaking generally, it may be said that the laws of the church existing and in force prior to the Disruption are acknowledged as still binding in the Free as in the Established Church, but only in so far as they have had church authority, and with the exception of those which the Free Church has since repealed. The same Presbyterian constitution subsists in both churches, with the same classes of office-bearers and gradations of

church-courts. The Free Church, indeed, professes to maintain this constitution and church-government in a perfection impossible in the present circumstances of the Established Church, because of the supremacy of parliament by which the Established Church is trammelled, and interventions of civil authority to which it is liable. And the whole difference between the Free Church and the Established Church relates to the necessary submission of the Established Church to this control of the civil power in things which the Free Church regards as belonging not to the province of civil government, but to the church of Christ, and to its office-bearers and courts as deriving authority from him; so that the controversy was often described as respecting the *Headship of Christ* or the *Kingdom of Christ*. It is to be borne in mind, however, that the doctrine of the headship of Christ over his church, being set forth in the Westminster standards, is fully professed both by the Established Church and by the Free Church of Scotland; the only question between them is whether or not the existing relations of the Established Church of Scotland to the state are consistent with the due maintenance and practical exhibition of this doctrine. And the question does not directly relate to *Voluntaryism* (q.v.). Those who constituted the Free Church of Scotland in 1843 firmly believed that the church might be connected with the state, and receive countenance and support from it, to the advantage of both. But they maintained that there must not, for the sake of any apparent benefits flowing from such connection, be any sacrifice of the independence or self-government of the church, as the kingdom of Christ, deriving its existence, organisation, and laws from him. Even then, too, most of the leaders of the Free Church held, with Dr Candlish and Dr Cunningham, that the separation of 1843 was practically final, and that in the improbable event of the state acknowledging the church's independence the church should hesitate before again forming with it so close and perilous a connection. The leaning thus indicated has since then steadily increased. Many of the second generation of Free Churchmen have accepted as practically if not theoretically true the inconsistency repeatedly urged upon their fathers by the law-courts, as existing between the claim of church freedom and all establishment whatever. And in coming to the same conclusion of final separation from establishment they have increasingly connected it with the equal rights of conscience of all citizens, and not, as their fathers did, with the claims and confession of the church alone.

The Westminster Confession of Faith asserts that 'there is no other head of the church but the Lord Jesus Christ;' and that 'the Lord Jesus, as King and Head of His church, hath therein appointed a government in the hand of church-officers, distinct from the civil magistrate.' The early Presbyterians of Scotland so far prevailed as to obtain at different times important acts of parliament in recognition of their principles, and 'ratification of the liberty of the true kirk;' and finally, after the Revolution of 1688, an act ratified the Westminster Confession of Faith itself, and incorporated with the statute law of the realm all its statements concerning the province of church-judicatories and that of the civil magistrate, and the bounds of their respective powers. The rights and privileges of the Presbyterian Church of Scotland, guaranteed by the Revolution settlement, were expressly secured by the Treaty of Union, and jealously reserved from the power of the British parliament; yet within five years afterwards, when Jacobite counsels prevailed in the court of Queen Anne, an act was passed for the restoration of patronage in Scotland, with the design of advancing the Jacobite interest by rendering ministers more dependent on the aristocracy. This act soon became the cause of strife within the Church of Scotland, and of separations from it during the 18th century. But when the 'Moderate' party, long dominant in the General Assembly of the Church of Scotland, became again the minority in 1834, the accession of the 'Evangelical' party to power was at once signalised by an attempt to restore to the congregation its influence in the election of their pastor. This was done by the *Veto Law*, by which it was declared that 'it is a fundamental law of this church that no pastor shall be intruded on any congregation contrary to the will of the people.' And the same General Assembly by which the Veto Act was passed asserted the constitutional principles and inherent powers of the church in another important particular, the admission of the ministers of 'chapels of ease' to the same ecclesiastical status as the ministers of endowed parishes, in consequence of which they became members of church-courts, and had districts assigned to them *quoad sacra*, with the full parochial organisation.

These acts were soon the subject of litigation in the Court of Session. A conflict arose which in various forms agitated the whole of Scotland, and which, ere long, related as much to the status of chapel ministers (and of ministers whom the church had of its own authority gladly welcomed back from the seceding bodies outside) as to the mere rights of presentees. It involved, indeed, the whole question of the relations of civil and ecclesiastical powers, at least as far as the Established Church was concerned. There was scarcely a spiritual or ecclesiastical act falling within the region thus dealt with by the church which the court did not now 'interdict' and prohibit; while other spiritual acts, such as admission to the ministry, it ordered the church to perform under penalties. But a graver matter still was the principle upon which these orders were uniformly based. The court not merely disallowed the claim of the church to freedom and legislative self-expansion; it founded its long series of judgments, beginning with the Auchterarder case, on the absolute subjection of the church to parliament, and on the authority of statute even in matters ecclesiastical. The heads of the Court of Session and House of Lords announced the law that 'parliament is the temporal head of the church, from which it derives all its powers;' that 'the law, and that alone, gave the church jurisdiction;' that therefore it is impossible to admit, not only 'that an establishment can ever possess an independent jurisdiction,' but even that there can be such a thing as 'a conflict between the civil and ecclesiastical courts of a country in which a church is established and endowed by the state.' And as to the plea that the rights of congregations were guarded on the religious side by a 'fundamental law' of the church, the House of Lords laid it down that 'whether that is, or ever was, a law of the Church of Scotland, is perfectly immaterial, if the statutes contain enactments and confer rights inconsistent with it.' These principles, common enough in the jurisprudence of some countries, appeared violently hostile to the old doctrine of the Church of Scotland. But the one thing in which that church now agreed with the court was that its carrying out the orders of the latter in the church sphere would involve acquiescence in the principles of establishment authoritatively laid down. Accordingly, the General Assembly formally refused, and in 1842, by a majority of 241 to 110, passed a *Claim of Right*, declaring to parliament and the crown that the church, unless relief were granted, must separate from the state. In November of the same year a *Convocation* was held to arrange for the future. In parliament Mr Fox Maule's motion for

inquiry, made on 7th March 1843, was supported by a large majority of the Scotch members, but rejected by Sir Robert Peel and the house. The crisis came on 18th May 1843, when the General Assembly should have constituted itself in Edinburgh. Instead of doing so, the ex-Moderator, Dr Welsh, handed a protest to the Queen's commissioner, and he and the others who had signed it, issuing from St Andrew's Church, moved in a long procession down the northern slope of Edinburgh to Canonmills. There 474 ministers (out of a total of 1203) resigned their churches, incomes, and homes; and amid a scene of great emotion Dr Chalmers was called to the chair of the first Assembly of the Free Church of Scotland.

The event produced an impression throughout Christendom. 'To the moral attitude of the Free Church,' said Mr Gladstone to the House of Commons a quarter of a century later, 'scarcely any word weaker or lower than that of majesty is, according to the spirit of historical criticism, justly applicable.' The sacrifices and sufferings which not only its ministers but its congregations were called on to undergo, especially in districts where land-owners for years refused sites for buildings, were no doubt the first cause of this. But something must be allowed to the extraordinary qualities of the Scotsmen who became the leaders and founders of the new body. Dr Chalmers, the greatest of them all; Dr Candlish, for thirty years his brilliant successor; Dr William Cunningham, the controversialist and theologian of the body; Dr Robert Buchanan, its administrator and (in his *Ten Years' Conflict*) its historian; Dr Guthrie, its orator; Mr Murray Dunlop, its lawyer; Hugh Miller, its *littérateur;* these men and some others, as they are sketched in their own utterances and in books like Lord Cockburn's *Journal*, take no common rank even as individuals. And they formed a group so impressive, intellectually and morally, that even the Duke of Argyll, who declined as a young man to follow the Free Church, when looking back thirty years later over the Victorian age with its statesmen and thinkers, describes these as 'the best and greatest men whom I have ever known.' But what chiefly attracted the eyes of public men outside Scotland to the Free Church was its success as an experiment in the voluntary support of the church on the great scale—by means of contributions not local or congregational, but with a national altruism and solidarity. The foundation for this success was already laid in its Presbyterian constitution, which, as Lord Selborne observes, always enables a church, so long as it is not impeded from without, to exercise itself 'in the whole art and power of self-government, self-legislation, and self-expansion.' But the crisis called for new efforts and more powerful organisation. The order of deacons was restored or enlarged; an army of local collectors worked under them, and the money locally collected was paid into a central *Sustentation Fund* and equally divided among the ministers throughout Scotland. A hundred thousand pounds was subscribed for building the churches even before the day of the disruption: five hundred of them were built within the first year. Manses were erected; schools built for the schoolmasters, for they also had been obliged to leave the parish schools; colleges instituted for theological students, under professors now excluded by law from the universities; and a home mission or church extension scheme was founded, through whose influence the number of pastoral charges in the Free Church has been almost doubled. But the church found it impossible, even amid the struggles of its infancy, to confine itself within Scotland. All its missionaries throughout the world had left the state with it, and thrown up their emoluments; and schemes and funds for foreign missions, for colonial missions, for continental missions, for Jewish missions, and a special scheme for the Highlands and Islands were instantly and simultaneously started. That enthusiasm should initiate all this in the moment of suffering was, perhaps, not wonderful: what is more noteworthy is the permanence of the results. During the earlier part of the first half-century of its existence the contributions of the Free Church maintained their average, and during the later part they have much increased it. The following are the figures for the year opening each decade: 1843, £363,871; 1853, £289,670; 1863, £343,626; 1873, £511,084; 1883, £628,222. The total for the forty years comes to nearly seventeen millions. In 1889 there were 1026 regular charges in the church.

The history of the Free Church since 1843 has reflected increasingly the general course of church life outside it in Scotland. In its earlier years it was much occupied, like every body on a national scale, with questions of centralisation as against local government. Thus, a controversy whether it should have one college or more was terminated by its adherents in Glasgow and Aberdeen liberally endowing, and so securing, the institutions in either city. In 1858 the *Cardross Case* arose, and created much interest, as raising legal questions affecting Free Church principles. But, while the earlier decisions of the Scottish courts in it appeared to threaten interference even with the internal action of churches, their later findings refused to the deposed minister of Cardross the means of prosecuting even that civil action of damages which the church professed their readiness to meet. In 1863 Dr Candlish and Dr Buchanan started the proposal of union with the United Presbyterian Church, which had by this time gathered into itself nearly all the Scottish secessions of the 18th century. Negotiations went on for years, and terminated in 1873 in a postponement of incorporating union, but with an obligation for a working agreement in the meantime, to include a 'mutual eligibility' of ministers from all the churches that had taken part in the negotiations. In 1874 patronage was abolished by parliament in the church established, without any proposed change upon the general Scottish law of church and state. The Free Church Assembly at once resolved that disestablishment was the proper remedy for the divisions of Scottish Presbyterianism (see note); and its union in 1876 with the Cameronian body (see CAMERONIANS) seemed to unite these ancient traditions with modern views. Theological questions of course retained their dominant interest; and in 1881 the church refused to retain Mr Robertson Smith as its professor in Aberdeen, while declining at the same time to affirm that his biblical views were heretical. This compromise was unsatisfactory to all sides. In 1889 a large committee was appointed to consider the question of revising the church's confession while maintaining its central doctrines of faith. In 1888 the General Assembly held its sittings in the capital of the Highlands, which it had only done once before, forty-five years earlier, in the eventful year 1843. Within this region its influence has from the beginning vastly exceeded that of the Established Church, although its Highland ministers are well known not to agree with their Lowland brethren about the necessity for creed revision and union with churches that renounce the establishment principle. The vitality within the church was evidenced by the warmth with which the effort was met to clear off all debt upon churches and manses before its jubilee year.

[NOTE—It ought, however, to be stated that there was a substantial majority in the Assembly that dissented from the resolution as to disestablishment; and the members

of that minority claim that the sentiments of a much larger proportion of the membership of the church are in accord with theirs.]

See the authorised edition of the *Subordinate Standards of the Free Church*, with 'Claim of Right' and 'Protest,' &c. (1851); Buchanan's *Ten Years' Conflict* (1849); Taylor Innes, *The Law of Creeds in Scotland* (1867); and the official *Annals of the Disruption* (1876–77).

Freedom of a City. See BURGESS.

Freedom of the Press. See PRESS.

Freehold, ESTATE OF (*liberum tenementum*, 'frank tenement'). Tenures of land in England are divided into free and base or customary. Free tenures included the military tenures of knight-service (see TENURE), &c., now abolished, and tenure in free and common Socage (q.v.), which is now the only form of lay freehold. Copyhold (q.v.) is now the only form of customary tenure; it is hardly correct to speak of base tenure, since the personal incidents of villeinage have disappeared. 'Customary freehold,' so called, is only a privileged kind of copyhold. There is no necessary connection between the tenure and the quantity of the tenant's interest in the land; but in point of fact only an estate for life or an estate of inheritance ranks as a freehold; a term of years, however long, is less than freehold. Lands may be held by free tenure of the king or of the lord of a manor, but no new free tenure under a subject has been created since 1290, when the practice of subinfeudation was abolished by the statute of *Quia emptores*. At the present day almost all freeholders hold of the crown. Seisin or possession of the freehold was formerly an important point in the law of wills, conveyances, and actions relating to land. The freeholders of a county were constituent members of the ancient county court; they had formerly the right to vote in the election of county coroners; and freehold property of the value required by modern statutes is a qualification for jurymen and parliamentary electors, and for certain public offices. Rent-charges and other interests in land may be held in freehold.

Free Imperial Cities, in the German empire, were those cities which owed allegiance to none but the emperor, which exercised suzerain rights within their own territories, and had the right of sitting and voting in the imperial diet. At first free cities were distinguished from imperial cities, the difference consisting in the fact that the former paid no feudal dues to the emperor, whereas the latter did. But from the 13th century there was practically no distinction, all towns which formed an integral part of the imperial polity of states being called free imperial cities. These cities, which had not a uniform municipal organisation, some being governed on democratic, others on aristocratic principles, were generally ruled by one or two imperial officers, called *Reichsvogt*, *Schultheiss*, or *Burggraf*. The peculiar privileges attaching to these cities were acquired in different ways—by creation of the emperor, by purchasing freedom from the minor prince or lord to whom they owed allegiance, by the dying out of the family of the territorial superior, or by force of arms. And they were lost by the corresponding opposite means: some towns were seized by the neighbouring lords, others passed by conquest out of the empire altogether, others voluntarily sold their privileges of freedom, others again were deprived of their position by the emperor as punishment for contumacy. The creation of free imperial cities was generally encouraged by the emperors, who found in them a useful means of checkmating the ambitions of the petty princes. But between the 13th and 15th centuries the majority of them succeeded in securing the office of *Reichsvogt*, *Schultheiss*, or *Burggraf* for their own citizens. In 1474 the free imperial cities formed two groups in the diet, the Rhenish and the Swabian; and they were formally constituted the third college of the diet after the Peace of Westphalia (1648). In February 1803 all the free imperial towns of Germany, except Hamburg, Lübeck, Bremen, Augsburg, Nuremberg, and Frankfort-on-Main, lost their privileges; and of these Augsburg, Nuremberg, and Frankfort ceased to be free imperial cities in 1806. In 1815, however, the three Hanse towns, together with Frankfort, were admitted into the German Confederation as free towns. But by the incorporation of Frankfort with Prussia in 1866 there were left but three free cities in Germany—Lübeck, Bremen, and Hamburg.

Free-lances were roving companies of knights and men-at-arms, who, especially after the Crusades had ceased to give them employment, wandered from state to state selling their services to any lord who was willing to purchase their aid in the perpetual feuds of the middle ages. In Italy they were known as Condottieri (q.v.). In Germany the name *Landsknechte* was given to a famous organisation of mercenary foot-soldiers, originally raised by Maximilian I. in 1487 from the inhabitants of his Austrian hereditary dominions. The name is not, as is commonly said, a corruption of *Lanzknechte* ('lancemen'), but was given to distinguish the men of the Austrian lands from the Swiss mercenaries. The Landsknechte played a distinguished part in the wars of the 15th and 16th centuries, but fell into disrepute after the Thirty Years' War, by which time their numbers were made up of recruits from all European countries.

Freeman is one who has inherited the full privileges and immunities of citizenship; *freedman*, one who has been delivered from the restraints of bondage, but who, usually, is not placed in a position of full social or even political equality with him who was born free. In old Rome, indeed, the equivalent for freeman (*liber homo*) comprehended all classes of those who were not slaves; but the distinction here pointed out was preserved by the application of the term *ingenuus* to him who was born free, and of *libertinus* to him who, being born in servitude, was emancipated. As the organisation of Roman society survived the convulsions of the middle ages to a far greater extent in the towns than in the landward districts, where the institutions of Feudalism (q.v.) almost entirely superseded it, it is in the borough and other municipal corporations that we still find *freemen*, or persons inheriting or acquiring by adoption, purchase, or apprenticeship the rights of citizenship. In Anglo-Saxon England the freemen were divided into Ceorls (q.v.) and Eorls (see EARLS). See BOROUGH, BURGESS, CITY, SLAVERY. In the United States the term freedmen was used of the coloured people emancipated by the civil war. The duty of caring for those helpless people, finding them work, organising education, and preparing them for the privileges of freedom was thrown on the war department; and in 1865 an act of congress created in that department the bureau commonly known as the 'Freedmen's Bureau,' whose duties practically ceased in 1870. The founding of several seminaries for coloured persons, such as Howard University and Fisk University, was a permanent result of its work.

FREEMAN'S ROLL.—By the Municipal Corporations Act of 1835 it was provided that every person who, if the act had not passed, would, as a burgess or freeman, have enjoyed, or might have acquired, the right of voting in the election of members of parliament was to be entitled to enjoy or acquire such right as heretofore. And it was further enacted

that the town-clerk of each borough should make out a list, to be called the *Freeman's Roll*, of all persons admitted burgesses or freemen, for the purpose of such reserved rights as aforesaid, as distinguished from the burgesses newly created by the act, and entitled to the rights which it newly conferred; these last were to be entered on another roll, to be called the *Burgess Roll*. See BURGESS.

Freeman, EDWARD AUGUSTUS, one of the most learned of English antiquaries and historians, born at Harborne in Staffordshire in 1823, was elected scholar of Trinity College, Oxford, in 1841, and fellow in 1845. He held the examinership in the School of Law and Modern History in 1857 and 1863, and in the School of Modern History in 1873; and was created D.C.L. of Oxford in 1870, and LL.D. of Cambridge in 1874. In 1884 he became regius professor of Modern History at Oxford. He received decorations from Greece, Montenegro, and Servia, and was created a corresponding member of learned societies at St. Petersburg, Göttingen, and in Massachusetts. Freeman was a Liberal in politics, and contested Mid-Somerset in that interest in 1868, but without success. His principal work is his *History of the Norman Conquest* (5 vols. 1867–76), one of the greatest monuments of English historical learning, which shows its author to possess almost every requisite of an historical style save one—that of condensation. His other works include *A History of Architecture* (1849); *History and Conquests of the Saracens* (1856); *History of Federal Government* (vol. i. 1863); *History of the Cathedral Church of Wells* (1870); *Old English History* (1869); *Growth of the English Constitution* (1872); *Historical Essays* (4 series, 1872–92); *Comparative Politics* (1873); *Historical and Architectural Sketches*, chiefly Italian (1876); *The Ottoman Power in Europe* (1877); *Historical Geography of Europe* (2 vols. 1881); *The Reign of William Rufus, and the Accession of Henry I.* (2 vols. 1882); *Some Impressions of the United States* (1883); *English Towns and Districts* (1883); *Chief Periods of European History* (1886); *Methods of Historical Study* (1886); *Exeter* (1887) in the series of 'Historic Towns;' and *History of Sicily* (3 vols. 1891–92). Freeman was the leader of what has been called the Teutonic school in English history, and it is not improbable that, carried away by his prepossessions, he placed too great reliance on the evidence offered by the language and institutions, and overestimated the Teutonic element in the blood of the English people. As an historian he showed equal erudition and accuracy; but his learning was marred by its pedantry; while his insight and breadth of view were scarce proportional to his knowledge. He maintained a high ideal of the dignity of real history and the necessity for truth, and made unsparing onslaught on those writers who make the true subordinate to the picturesque. Died March 17, 1892.

Freemasons. The masonic brotherhoods of the middle ages were organised incorporations, not substantially different in their nature from the other guilds, governed by rules of their own, and recruited from a body of apprentices who had undergone a period of probationary servitude. Fable and imagination have traced back the origin of freemasonry to the Knights Templars, the old Roman empire, the Pharaohs, Hiram of Tyre and the Temple of Solomon, or even the times of the Tower of Babel and of the Ark of Noah. The masonic craft in reality sprang into being about the same time and from the same set of causes as other incorporated crafts; but a variety of circumstances combined to give it an importance and influence beyond the rest. Men skilled in the hewing and setting of stones were naturally prized in an eminently church-building age. Their vocation necessarily involved travelling from place to place in search of employment. Wherever a great church or cathedral was built the local masons had to be reinforced by a large accession of craftsmen from other parts; and the masons from neighbouring towns and districts flocked to the spot and took part in the work, living in a camp of huts reared beside the building on which they were engaged. A master presided over the whole, and was assisted by wardens having surveillance of the rest. A mason, therefore, after going through his apprenticeship and probations, could not settle down like other craftsmen among his neighbours and acquaintances, but must travel from place to place to find employment; hence it became desirable or necessary to devise means by which a person once a member of the fraternity might be universally accepted as such, without requiring, wherever he went, to give fresh evidence of his skill, or having to undergo a renewed examination on his qualifications. In order to accomplish this end, and to enable a mason travelling to his work to claim the hospitality of his brother-masons on his way, certain signs and words were conveyed to him, which he was bound to keep secret. This arrangement is the sole shadow of foundation for the popular notion that the masonic brethren were in possession of secrets of vital importance, the knowledge of which had been from generation to generation confined to their own order. It has been supposed that the possession of the masonic secrets enabled the masons to design the great cathedrals of the 13th and 14th centuries; whereas it is now certain that during the purest ages of Gothic architecture, both in France and in England, the architects were not members of the masonic fraternity at all, but either laymen of skill and taste, uninitiated in the mysteries of masoncraft, or oftener bishops and abbots. The masons who worked from the architect's design were, at the same time, not the mere human machines that modern workmen too generally are, but men who, in carrying out an idea imparted to them, could stamp an individuality of their own on every stone. Architecture was then a progressive art, and the architect of every great church or cathedral had made himself acquainted with the works of his predecessors, and profited by experience, adopting their beauties and shunning their defects. The nature of the advance which architecture was then making has been compared by Fergusson to the advance with which we are familiar in the present day in shipbuilding and other useful arts. 'Neither to the masons nor to their employers, nor to the Abbé Suger, Maurice de Sully, Robert de Sussarches, nor Fulbert de Chartres is the whole merit to be ascribed, but to all classes of the French community carrying on steadily a combined movement towards a well-defined end.' In Germany, however, the masons of the 14th century, who had attained a wonderful skill in carving and in constructing arches, overstepping their original functions, took to a great extent the office of architect into their own hands; and it is undeniable that the churches designed by German masons, though rich in the most exquisite workmanship, are not comparable in the higher elements of beauty to the works of non-masonic architects.

The epithet 'Free,' as applied to the craft, was originally used as an abbreviation of the term 'freemen masons'—free of their guild. Scotland possesses the earliest record of the presence of theoretical or speculative masons in mason lodges. This is shown in the minute of a conventicle of the Lodge of Edinburgh, held at Holyrood House in the year 1600.

The history of freemasonry has been overlaid with fiction and absurdity, partly from an exaggerated estimate of its importance in the development of architecture, and partly from a wish to connect medieval masonry with the institution that passes under the same name in the present day. Modern (or so-called 'speculative') freemasonry is an innocent mystification unconnected either with the building craft or with architecture. It is of English origin, and dates from the 18th century. According to its peculiar phraseology, it is founded in the 'practice of moral and social virtue;' its distinguishing characteristic is charity, in its most extended sense; and brotherly love, relief, and truth are inculcated by its precepts. In freemasonry there are three grades—apprentice, fellow-craft, and master-mason; there being peculiar ceremonies at the making of each; and it is only on attaining to the degree of master-mason that a brother enjoys the full benefits and privileges of the craft.

The 'Lodges' of Scotland profess to trace their origin to the foreign masons who came to Scotland in the 12th century to build the Abbeys of Holyrood, Kilwinning, and Melrose. Those of England go still further back, to an assemblage of masons held by King Athelstan, at York, in 926. The mother-lodges of York and Kilwinning were the parents of many lodges erected in different parts of Great Britain; while several of the pre-18th century Scottish lodges were self-constituted. Towards the close of the 18th century it was in some quarters (as by Robison in his *Proof of a Conspiracy*, &c. 1797) made a charge against freemasonry that under its symbolism was concealed a dangerous conspiracy against all government and religion. The accusation was probably groundless enough as regards British freemasonry; and so little effect was produced by it that, in an act passed in 1799 for the suppression of secret societies, an exception was made in favour of freemasons. On the Continent political intriguers may sometimes have availed themselves of the secrecy afforded by freemasonry to further their schemes. In 1717 a Grand Lodge was formed in London, with power to grant charters to other lodges. Under its sanction the first edition of the constitutions of the fraternity was published. The Grand Lodge was for a length of time on an unfriendly footing with the lodge of York, in consequence of having introduced various innovations not approved of by the older lodge, and of having granted charters within the district which York claimed as its own. In 1782 the then Duke of Cumberland (brother of George III.) was elected Grand Master of the Grand Lodge; and on his death George IV., then Prince of Wales, succeeded to the office, which he continued to hold till he was appointed regent, when, it being considered unsuitable that he should longer exercise any personal superintendence, he took the title of Grand Patron. In 1813 an understanding and a union was brought about between the two rival Grand Lodges by their respective Grand Masters, the Dukes of Kent and Sussex. The fraternity has since been managed by the 'United Grand Lodge of Ancient Free and Accepted Masons of England,' consisting of the Grand Master, with his Deputy, Grand Wardens, and other officers, the provincial Grand Masters, and the Masters and Wardens of all regular lodges, with a certain number of stewards annually elected, who meet four times a year for the despatch of business, besides which there is an annual masonic festival, at which every mason is entitled to attend. The Grand Lodge of England has at present nearly two thousand lodges under its protection; the Prince of Wales was elected its Grand Master in 1874.

In Scotland the masons, when they were a real company of artificers, were, like other handicrafts, governed by wardens of districts appointed by the king. In 1598 a reorganisation of the mason lodges was effected under William Schaw, principal warden and chief master of masons, who in the following year confirmed the three 'heid lodges' in their ancient order of priority—Edinburgh first, Kilwinning second, and Stirling third. In 1736, the operative element in mason lodges having become absorbed in speculative masonry, the Grand Lodge of Scotland was instituted by the representatives of thirty-four lodges, by whom also William St Clair of Roslin was elected Grand Master, on account of his ancestors' alleged ancient connection with the mason craft as patrons and protectors. Priority was assigned to the lodges according to the antiquity of their written records. The Lodge of Edinburgh (Mary's Chapel), with its records dating from 1599, was placed first, and Kilwinning, possessing records from 1642, second. The Lodge of Kilwinning did not formally object to this till 1744, when it withdrew from the Grand Lodge and resumed its independence. On relinquishing this position in 1807 it was re-admitted into the Grand Lodge by the title of Mother Kilwinning, with precedence over the other lodges, and the Provincial Grand Mastership of Ayrshire confirmed in perpetuity to its Master.

Besides granting charters of affiliation, the chief use of the Grand Lodge, whether of England or Scotland, consists in its acknowledged authority to enforce uniformity of ceremonial and other observances, and to settle all disputes that may arise within the lodges under its charge. In Scotland the officers and members of the Grand Lodge are delegates from the respective lodges; the delegation being the masters and wardens or their proxies. As a source of revenue, for each member made by a lodge a fee must be remitted to the Grand Lodge, whereupon a diploma of brotherhood will be issued. There are upwards of six hundred lodges under the Grand Lodge of Scotland. The Grand Lodge of Ireland, instituted in 1730, exercises jurisdiction over nine hundred lodges. There are funds of benevolence connected with each of the British Grand Lodges.

Modern freemasonry spread from Britain to the Continent, to America, and to India. It was introduced into France in 1725, into America in 1730, Russia in 1731, and Germany in 1740. Grand Lodges now exist in France, Belgium, Holland, Denmark, Sweden and Norway, Germany, Switzerland, Italy, Spain, Mexico, Egypt, Portugal, Greece, Canada, in Central and South America, in British Columbia, and in Australia. Lodges in connection with European grand bodies exist in India, China, Japan, Africa, Polynesia, Turkey, the West Indies, Syria, Newfoundland, and New Zealand. There are forty-eight Grand Lodges exercising control over nearly ten thousand lodges in the United States, and nowhere is masonry in greater honour or importance. Roman Catholics treat freemasonry as a pantheistic system, essentially opposed to belief in the personality of God, subversive of all legitimate authority, whether of the church or of the state—the hatching ground of most of the revolutionary societies of continental Europe (see Addis and Arnold's *Catholic Dictionary*, 1883). It has been expressly condemned by bulls from five popes.

The deep symbolical meaning supposed to be couched under the jargon of the masonic fraternity is as apocryphal as the dangers of masonry to government and order. A set of passwords and a peculiar grip of the hand enable the initiated to recognise each other, and give a zest to their convivial meetings; and, if the institution possesses any practical utility, it is in its enabling a mason,

in a place where he is a stranger, to make himself known to his brother-masons and claim their protection and assistance.

See J. Fellowes, *Mysteries of Freemasonry* (new ed. 1882); J. How, *Freemasons' Manual* (1880); A. G. Mackey's *Manual of the Lodge* (New York, 1862), *Masonic Ritualist* (1867); *Encyclopædia of Freemasonry* (1874), and *Lexicon of Freemasonry* (7th ed. 1885); Paton's *Freemasonry, its Symbolism and Religious Nature* (1873); Lyon's *Freemasonry in Scotland* (1873); R. F. Gould, *Four Old Lodges* (1879), and *History of Freemasonry* (1886); the *Handbuch der Freimaurerei*, published as 2d ed. of Lenning's *Encyklopädie der Freimaurerei* (4 vols. 1863–79); Schauberg's *Vergleichendes Handbuch der Symbolik der Freimaurerei* (3 vols. 1861–63); and the anonymous *Maçonnerie Pratique: Cours d'enseignement Supérieur de la Franc-maçonnerie* (2 vols. Paris: Baltenweck, 1885–86); Findel's collected works on Freemasonry (6 vols. Leip. 1882–85); Fort's *Antiquities of Freemasonry* (Phila. 1878).

Free Port, a port at whose wharves the vessels of all nations can load and unload free of customs duties and commercial charges, with the exception of the usual harbour dues. A free port is thus, from the commercial point of view, an open harbour in contradistinction to one that is closed to all vessels except those of the country in which it is situated, and from the administrative point of view financially a foreign territory within the state to which it politically belongs. In the middle ages free ports were established for the purpose of attracting trade to particular maritime centres, especially by Italy, France, Spain, Austria, and Portugal, at the period when the exploitation of their colonies for the benefit of the mother-country was the ruling principle in the commercial policy of those states. In the end of the 18th and the beginning of the 19th century free ports acquired a position of peculiar importance during the years in which prohibitive and protectionist measures were in force. Since then, however, they have decreased both in importance and in number. At the present time their chief use is that of entrepôts for facilitating the more convenient interchange and distribution of commodities destined for more or less distant markets. To all intents and purposes their utility has been destroyed by the rival system of bonded warehousing, which has always prevailed in England and the United States in preference to the other system (see BONDED WAREHOUSES). In 1889 the only free ports remaining in Europe were Trieste and Fiume in Austria, and Hamburg and Bremen in Germany; but both Trieste and Fiume were on the point of being abolished as free ports, whilst in Hamburg and Bremen since 1888 only a restricted area has been maintained as a free port. Among free ports outside of Europe are Hong-kong, Menado in Celebes, Singapore, Georgetown (Penang), Amboyna, Banda, Ternate, St Thomas (on the island of the same name in the West Indies), and Livingstone in Guatemala.

Freeport, capital of Stephenson county, Illinois, on the Pecatonica River, 121 miles WNW. of Chicago by rail, with a Presbyterian college and some manufactures. Pop. (1890) 10,189.

Freesoilers, a political party in the United States, the outcome of the Wilmot (q.v.) proviso, founded in 1848 to oppose the extension of slavery to the territories. At Buffalo in that year they nominated Martin Van Buren for president and Charles Francis Adams for vice-president, who secured a popular vote of 291,000, but no electoral votes. In 1852 their candidates polled only 156,000 votes; but in the period of political agitation that followed the freesoil principles assumed great prominence, and were adopted by the Republicans, in whose party, on its organisation in 1856, the Freesoilers were absorbed.

Free Spirit, BRETHREN OF THE, a fanatical sect diffused (often secretly) over Germany, Italy, and France, between the 13th and 15th centuries. Their doctrine was a species of pantheistic mysticism, which they applied with fearless consistency to all the details of moral obligation. Often condemned as heretics, they suffered severely at the hands of the Inquisition; and were confounded with the Beghards and Beguines (q.v.). See BROTHERHOODS.

Freestone. See BUILDING STONE.

Freethinkers, a term used loosely of all who reject belief in divine revelation, but especially of the Deists. See DEISM.

Free-town, capital of Sierra Leone, a British settlement on the west coast of Africa, is situated on the north side of the peninsula of Sierra Leone, about 5 miles from the Atlantic. The town is enclosed by a range of wooded hills, and, though the temperature is tolerably uniform, the climate is unhealthy, especially for Europeans. Pop. (1881) 21,913; (1891) 30,033, who consist almost exclusively of liberated Negroes. The town was originally founded, under the name of Granvilletown, in 1787.

Free Trade. 'Free Trade' is often used in a loose popular sense as practically equivalent to freedom of contract and *laisser-faire;* and thus particular kinds of land laws, bimetallism, factory acts, and various regulations affecting labour and manufactures are spoken of as infringements of free trade. Nothing, however, is gained by giving such an extended meaning to a definite expression, perfectly clear and precise in the historical sense. Historically, free trade refers to a particular policy as regards international or foreign trade only, and its principal features are absence of differential duties, and of artificial encouragements, such as bounties, by which the home producer is favoured as compared with the foreigner in the same department. The essence of free trade is equality and uniformity in the financial treatment of home, colonial, and foreign produce of the same kind. Thus the imposition of taxes upon commodities merely for revenue purposes (e.g. the tax on tea in the United Kingdom) is not held to be an infringement of free trade. Similarly the absolute prohibition of the importation of certain articles, supposing that the production at home is equally prohibited (e.g. immoral books), would not offend against free trade in its historical sense.

The economic system opposed to free trade, and the essence of which lies in the preferential treatment of the products of the home country or of certain 'favoured' nations, has received different names according to the objects professedly in view. When Adam Smith advocated the principles of free trade, he attacked the elaborate economic policy known as the Commercial or Mercantile System (q.v.). Of this system, protection to home industries was only a part. At least equal stress was laid upon a favourable balance of trade which was supposed to be indicated by a balance of the precious metals being due to a country. By this principle of a favourable balance a government was guided in framing commercial treaties and in the treatment of its colonies. At a later date, however, the use of the term protection was extended to cover practically the same ground as the expression 'Mercantile System,' which fell into disuse. Still more recently the name 'fair trade' has been invented to describe a mild form of the protective system, in which the basis of economic policy is supposed to be reciprocity or free trade only with such nations as grant similar privileges. Sometimes 'fair trade' is also held to include differential treatment of colonies by the mother-country as against foreigners, and is thus associated with

schemes for imperial federation. It is worth noting that up to the beginning of the 19th century fair trade was the polite name for smuggling, and that, according to Adam Smith, 'to pretend to have any scruple about buying smuggled goods would, in most countries, be regarded as a pedantic piece of hypocrisy.'

The principal practical difficulty in deciding whether a tax is really opposed to free-trade principles arises in the case of the possible use of substitutes. If, for example, the cheaper kinds of foreign wines are being taxed avowedly for revenue purposes only, an indirect encouragement may at the same time be given to the production and consumption of beer in the home country. Again, it is difficult in many cases to find a fair common measure for home and foreign articles, and thus to make customs and excise duties really equivalent. In wines and spirits the alcoholic test alone is obviously unfair, but it is difficult to decide how much should be fairly allowed for other qualities. Nor will a simple *ad valorem* tax be a sufficient guide, because the effect upon demand of a rise in price is different in different cases. It may even be said that all taxation of those foreign goods which, from the nature of the case, cannot be produced at home (such as tropical products in the temperate zones) furnishes an artificial encouragement to home industries. If, for example, tea and coffee are rendered very dear by taxation, the use of aerated waters and home-made wines may be stimulated. The case of drawbacks, in which an excise duty is drawn back upon the exportation of the article taxed, presents similar difficulties. If the drawback really exceeds the tax already paid, it amounts to a bounty; and in fact most of the bounties given upon exportation are disguised in the form of drawbacks.

Taking free trade in this historical if somewhat narrow meaning, it is convenient to examine the general economic theory on which the policy rests before giving actual examples of free-trade policy and its opposite, protection. The question is, 'Why should a nation give no preference to its own subjects over foreigners in the financial treatment of commodities in general, or at least of some particular kinds?' It will be seen at once that the establishment of a universal negative in any question of practical politics is only possible by making very stringent assumptions as to the object or end of political union. Suppose, for example, that we accept the maxim of Adam Smith, that defence is of far more importance than opulence, we at once make out a *primâ facie* case for the encouragement of those industries—e.g. shipbuilding and navigation—which may be assumed indirectly to contribute to national defence; and we understand why Adam Smith considered the Navigation Acts to be the wisest commercial provisions in the statute-book. Similarly various other social or political objects may be thought so desirable that the state ought to use its influence, by adjusting industrial finance, in order to promote these objects. It may be argued, for instance, that the state should look to the conditions under which labour does its work quite as much as to the mere cheapness of the final product; and that a nation ought to consider much more than individuals can be expected to do the remote consequences of certain lines of industrial development. In this way the arguments for protection founded upon a variety of industries, the possible exhaustion of peculiar natural resources, the encouragement of the growth of towns and manufactures in young countries, must be deemed *primâ facie* worthy of consideration; although, of course, it may prove in the sequel that free trade is much more likely than protection to attain these and other important social ends, in addition to cheapness and plenty.

It is necessary, then, in order to understand the purely economic theory of free trade, to omit provisionally, for the sake of simplicity, not only many possible objects of financial policy, but also various considerations of great social and moral importance. We must begin by regarding the primary object aimed at as the present acquisition of the means of satisfying material wants at a minimum real cost—that is to say, the question must first of all be considered from the point of view of the consumer for the time being. With this narrow view of the subject it is easy to establish the case in favour of free trade. For with freedom of competition no foreign commodity would be imported unless it could be sold at least as cheaply as when produced at home, and the natural result of competition would be to lower the price; hence, to discourage importation by differential taxation would be to raise prices by restraining competition. Again, to artificially encourage exportation by means of a bounty may by diminishing the supply in the home-market raise the price; and, if an increased supply can only be obtained at an increasing cost, this must be the result. But although free trade may result, as just shown, in present maximum cheapness, it may be objected that all cheapness is relative to the means of purchase—i.e. to income—and that, if the former is promoted by free trade, the latter is augmented by protection. And at first sight it seems plausible to argue that if a certain policy increases employment it increases earnings, and that employment must be increased by encouraging home industry at the expense of foreign. The refutation of this fallacy in its grossest form is one of the greatest triumphs of the so-called orthodox political economists. Bastiat, for example, in his famous petition of the candle-makers against the sun, in which it is ironically shown how much encouragement would be given to all the industries directly and indirectly concerned in the production of artificial light by shutting up windows, &c., has made clear the error involved in 'making work,' or in increasing obstacles in order to encourage employment. Again, whilst it is allowed by free-traders that protection to any particular industry may turn more labour and capital into that channel, and thus increase the gross earnings of those employed in it, it is maintained that on the whole, from the national point of view, there is a loss. In the first place, the very object of protection is to raise the price above what it would be if foreign imports were admitted freely, and thus the large body of consumers (including other labourers) are taxed for the benefit of the small class of producers. Secondly, the labour and capital of the country are drawn from the channels into which they would naturally flow, and are thus on the whole less advantageously employed; in other words, the gross annual produce of the land and labour of the society is less than it otherwise would have been. If, for example, by the exclusion of foreign corn the price is raised, not only are consumers taxed by the rise in price, but the labour and capital devoted to the production of corn are drawn from other employments, in which more commodities might have been produced, and on balance exchanged for more corn. We thus arrive at the great maxim of free-traders, that imports are paid for by exports, and 'if you take care of the imports the exports will take care of themselves'—in other words, if foreign labour is encouraged by the free admission of foreign goods, still, *ipso facto*, the home industry must be equally encouraged, because goods to an equal value must be made to be exported to pay for these imports. In fact, it is maintained that the home industry is

more encouraged than otherwise would be the case, because there is less waste of labour, capital, and natural resources. A certain quantity of labour and capital devoted to the more careful cultivation of land would raise more agricultural produce, but if devoted to some kind of export, this export might obtain by exchange far more corn raised at much less expense on virgin soil.

To the statement, however, that a country need regard only its exports, preliminary objection may be raised on the same ground on which the above maxim itself is really founded—viz. that all trade is reciprocal, and that ultimately imports and exports are a form of barter. For it may be said that, unless a country's exports are sent by the best route to the best market, they cannot purchase so great a quantity of imports, and it is quite as reasonable to regard the export trade as active, and the import trade as passive, instead of the converse. Suppose, for example, to take an extreme case, all other nations effectually prevented the importation of English manufactures, England would be unable to pay for its imports, and imports must cease. And, without going so far, it may still be maintained (as by Adam Smith) that distant and roundabout trades are not so advantageous to a country as near and direct trades.

Apart from this objection the position of free-traders appears to be sound under the assumptions usually made. These assumptions, however, require careful statement. In the first place, it is assumed that labour and capital can without loss or difficulty be turned from a decaying into a thriving industry, and that, if any home product is displaced by foreign competition, 'something else' will be made with the same labour and capital. But it may be objected that every industry requires a certain amount of specialised capital and peculiar skill and training which cannot be transferred to other employments; capital and labour, for example, formerly used in agriculture cannot without great loss be turned into the manufacture of cotton goods. There is some force in this objection, and Adam Smith placed it under the possible exceptions to a general free-trade policy which he considered worthy of consideration. At the same time, as he points out, there is a tendency to exaggerate the difficulty of absorbing any surplus labour set free from an old industry, and at anyrate the argument is one not for absolute protection, but for partial protection during a limited transition period, whilst labour and capital are being withdrawn. There is, however, a more serious objection to this assumption of the perfect mobility of labour and capital from one industry to another. A merchant, as Adam Smith said, is a citizen of no particular country, and if capital and labour are supposed to move without any difficulty within the limits of one country, their migration from country to country cannot be considered, especially in modern times, to offer any insuperable difficulty. Thus, it is theoretically possible that under the stress of foreign competition agriculturists might take their labour and capital from the United Kingdom to the United States, instead of to the cotton-mills of Lancashire or the coal-mines of Northumberland. The result would be that a trade formerly conducted between the rural and the manufacturing districts of England would now be conducted between the latter and the western states of America. Nor is this migration of industries a pure theory; we find many examples in history not only of the transference of industries from one part of the same country to another, but also from one country to another. Whether this transference would have been prevented by protection is, of course, a matter for further inquiry; the point at issue at present is simply the possibility of the free-trade assumption, that any displaced capital and labour will find employment within the country, not being realised. The importance of the exception is seen from a popular argument, often used as a rough and ready proof of free trade—viz. that if protection is a good thing for one country against another, it must be good for one district, county, town, &c. against others in the same country. But the answer is obvious, that, although from the national point of view the migration of industries within the country is a matter of indifference, it is a matter of supreme importance to the districts affected; and historically it may be noted that in England, as in other countries during the medieval period, the towns adopted stringent protective measures against one another; and, although this parochial patriotism has disappeared to a great extent, the commercial rivalry of nations is as strong as ever.

It is worth observing that Adam Smith always emphasised the importance to a country of employing its capital, so far as possible, within its own borders, and if it were employed out of the country he ranked the relative advantages according to the nearness of the foreign locality and the frequency of the returns. And, in his view, it was not a question of profit, for he expressly says that greater profits may be earned in distant than in near trades, and in foreign countries than at home. But the point is that if the capital is employed at home the labour of the country finds employment at home, and the home country enjoys the things produced. Suppose, for example, that a large quantity of British capital is exported to make harbours, railways, &c. in a foreign state; greater profits may be earned, but so far there will be less employment for British labourers whilst the works are being made, and when they are finished the benefits of use will be enjoyed by the foreigner. Many of the successors of Adam Smith, in their eagerness to give free trade the simplicity of an axiom, have omitted from their argument the element of nationality, and have forgotten that there is a question of 'somewhere else' as well as of 'something else.' The great merit of Adam Smith is that he fully recognises at every stage of his reasoning the difficulties which spring from territory being of the essence of the modern nation; and instead of arguing simply (but illogically) that, because universal free trade would be good for the world at large, therefore it would be equally good for every part of it, he maintains that, taking everything into account, and giving due weight to the principle of nationality, the interest of a particular nation would be advanced by free trade and retarded by protection or artificial management on the part of government. At the same time, however, it may be admitted that in some respects Adam Smith's argument needs development, because no economist would now feel justified in laying so much stress as he did upon reasons drawn from a peculiar view of natural theology and an optimistic mode of regarding the operations of nature. No matter how strong may be the belief in the beneficent guidance of an 'invisible hand' which leads the individual, whilst pursuing his own interest, to promote that of the public, it is necessary to give more specific grounds, and of a more purely economic character, in deciding between two methods of taxation and two methods of conducting international trade. Certainly, too much reliance must not be laid on the general argument derived from a survey of life as a whole in an age in which nature has come to be regarded as 'red in tooth and claw,' and as working out its ends by a prodigal waste of suffering and misapplied effect. It will be found, however, that the principal result of Adam Smith's natural

theology has been negative omission rather than positive error.

Taking the world as a whole at any particular time, we can easily see that free trade would give the most advantageous employment of labour and capital, because everything would be produced under the most favourable conditions; but the difficulty is to show that free trade is the best policy for a country which adopts Adam Smith's fundamental position as to the relative advantage of keeping capital and labour employed within its own borders. On this view it is not enough to show that under free trade the consumer would obtain maximum cheapness and the capitalist maximum profits, but we must also show that the nation makes the best use of its resources for its own members. The arguments relied upon by Adam Smith are partly positive and partly negative, the former being based on the power of the self-interest of individuals, and the latter on the weakness of governmental control. Every person, he says, naturally prefers to employ his capital in the support of domestic industry, but then this qualifying clause is added, 'provided always that he can thereby obtain the ordinary, or not a great deal less than the ordinary, profits of stock.' This leaves the position open to the attack that, by supporting foreign in place of home industry, the individual may obtain more profits; or more generally that profit, as Adam Smith himself often points out, is not synonymous with national advantage. But the objection is not so serious as at first sight appears. For, in the first place, if capital when employed at home does not obtain ordinary profits, a check will be placed on accumulation, and it is certainly more advantageous for a nation to employ some of its surplus capital abroad, or in encouraging foreign industries, than to have no surplus through forcing it to stay at home; secondly, it must be noted that most of those who support a protectionist policy, on the ground of encouraging home industry, estimate the encouragement given by the profit earned, and would to the last disapprove of any policy which would lead to less than the ordinary rate being obtained.

It may, however, be further objected that by protection to home industries, and by the prevention of the admission of certain kinds of foreign goods, more capital may be employed at home at the ordinary rate of profit. The usual answer is that this capital must be drawn from other more advantageous industries also at home; but in an old country in which profit is at a minimum and capital overflowing its channels this answer does not hold good. It is true that the consumers of the protected article lose so much by the rise in price, but it may be rejoined that to the nation this loss is more than compensated by the increase in the field for employment. Again, take a simple hypothetical case. Suppose that a new country yields only agricultural produce, and exchanges part of this for manufactures. If it imposes protective duties on manufactures, and if it can provide, through the growth of wealth and population, the necessary labour and capital without diminishing the amount of agricultural produce, the result is that its agricultural labour supports its own instead of foreign cities. Under the supposition made, the agriculturists will obtain less home manufactures than they would have done from abroad, at least for a time, but it is possible that the diversion of labour and capital may ultimately result in more wealth. In the ordinary argument for free trade sufficient allowance is not made for the growth of capital and population, nor for the advantages to be gained from employing them within the country. The question is regarded exclusively from the point of view of the consumer, under the hypothesis of a fixed amount of labour and capital already fully employed in the most advantageous manner.

The theoretical exception to free trade which has just been considered may be strengthened by the argument drawn from the stimulus given to production by a variety of industries, and by promoting trade directly between the towns and the neighbouring country districts, a consideration which was the basis of Wakefield's scheme of colonisation. It is urged, especially in the case of new countries, that, unless towns are encouraged by the protection of manufactures, there will not be a ready market for all the by-products of agriculture.

At this stage it may be well to note the other principal exceptions which have been taken to free trade from the nationalist standpoint. It is said that every nation should retain for the benefit of its own people any peculiar natural resources, and if possible also any inventions and artificial means of production. In the United Kingdom, for example, one of the principal causes of commercial supremacy is always said to be the close proximity of excellent coal and iron fields. But coal and iron are exhaustible, and the more they are exported so much the sooner will the point of exhaustion be reached. It is maintained that in the interests of posterity we should sacrifice the profits of a present trade and restrain the exportation. Carey even argues that the continuous exportation of all raw produce is practically equivalent to the exportation of the soil. In former times the wool of England was supposed (though, as is shown in Smith's *Memoirs of Wool*, probably without good cause) to be much superior to that of other countries, and accordingly, after being for some centuries the great staple of export, the exportation was later on forbidden under most severe penalties, and similar penalties were imposed on the exporters of sheep and rams. The same policy was carried out in reference to machinery and the instruments of production generally, including 'the living instrument' man. The answer made to this case of protection on the part of free trade is that it is impossible to tell, as regards the remote future, whether the peculiar advantage attaching to natural resources will continue (e.g. coal with the development of electricity from other forms of energy), and that, as regards instruments, they can be copied and imitated although the actual exportation is prevented. It is also argued that restraints upon the production of machinery by limiting the market will tend to check the progress of invention.

Another exception to free trade has been made on the ground of national independence. As already noted, it was on this ground that Adam Smith approved of the Navigation Acts. Recently the increasing dependence of the United Kingdom upon foreign nations for its food-supplies (see FOOD) has attracted much attention, and has led to proposals for differential duties in favour of the colonies. The same argument was the principal one used in the long agitation which resulted in the repeal of the Corn Laws. The answer is that cheap food is of such importance to the masses of the people that nothing which would raise its price would be assented to, and that indirectly through the growth of wealth and population under the stimulus of cheap food the nation has become much stronger than it would have been if it had tried to preserve its independence. Further, it is said that the dependence is really mutual, and that the food-growing countries rely upon selling their food to obtain clothes and other necessaries just as much as the importers of food rely upon them.

A favourite exception to free trade is that a

nation ought to consider principally, not the cheapness of goods to the consumer, but the effect of the conditions of labour upon the producer. No nation would be content with being the hewer of wood and drawer of water to the rest of the world, and the more a nation is composed of highly-skilled workers engaged in healthy, pleasant, and energising occupations, so much the better. It is assumed that, if by protective or prohibitive duties foreign wares of the higher class be excluded, they will be produced at home by native artists and craftsmen. It is, however, more probable that many of the articles would not be produced at all, and that in any case the absence of the foreign stimulus would eventually check the higher industrial development. If, for example, foreign paintings were excluded from a country to encourage painting, and engravings to encourage engraving, and so on, it is more than probable that the art of the country in question would lose not only in quality but in quantity. It may also be pointed out that the best way to promote the higher forms of industry is not by the simple process of exclusion, but rather by an elaborate system of technical and artistic education. The protectionist is always in danger of forgetting that it is not enough to show that certain ends are worthy of attainment, but that he must also prove that the rough and ready device of excluding foreign competition is the best means to adopt.

At this point it is convenient to complete the positive argument in favour of free trade. Hitherto the question has been regarded on the free-trade side mainly from the point of view of cheapness to the consumer, whilst abundant and varied employment for the producer and other important social aims have only been considered as possible grounds of exception to a free-trade policy. But Adam Smith, especially, and many of his successors have supported free trade with these objects professedly aimed at by protectionists always in view. Freedom of action and freedom of movement free-traders hold to give the greatest encouragement to the development of enterprise, and to the progress of invention, and thus indirectly at least to the employment of labour in a variety of industries. The natural result of free trade is to increase the efficiency of labour and capital through the stimulus of open competition, whilst the natural result of protection is to establish routine methods. Here it is important to observe that the practical abandonment of the wages-fund theory, according to which wages were supposed to be paid simply out of pre-accumulated capital, for the theory that wages are paid out of the price of the produce of labour, renders the usual statement of the theory of free trade, from the standpoint of capital only, incomplete and one-sided. The new theory of wages adds, however, much force to the position that the efficiency of labour is, on the whole, increased by free trade and diminished by protection. Again, under free trade an industry which ceases to be profitable, and to satisfy consumers, on the opening up of foreign markets is soon abandoned with a loss only to those engaged in it at the time, whilst under protection vested interests are created, and the loss is perpetuated. It must, however, be allowed that this argument from the absence of the stimulus of competition under protection loses force in proportion to the area, wealth, and population of the country to which it is applied. In the United States, for example, there is abundant scope for competition, and the same remark applies to a possible federation of the colonies and dependencies of the British empire.

On the whole, then, so far as the positive arguments are concerned, by which free trade is generally supported, it must be allowed that it is easy from the national standpoint to discover hypothetical exceptions, which might be thought, to adopt Smith's language, 'worthy of deliberation.' And, contrary to the popular opinion in England, most economists of repute have allowed theoretically that under certain circumstances a country might gain by stepping aside from a general policy of free trade. Adam Smith, in addition to the exceptions already noted, approves of retaliation, if by that means a great market might be secured for exports; Ricardo points out a mode by which a country might gain by the monopoly of its colonial trade, and J. S. Mill allows that the Navigation Acts, though economically disadvantageous, were politically expedient, and also supports the argument derived from Adam Smith in favour of temporary protection, with a view to the more speedy development of industries for which a new country seems naturally adapted. The latest systematic English writer on the subject, Professor Sidgwick, expressly says that, when the matter is considered from the point of view of abstract theory, it is easy to show that protection, under certain not improbable circumstances, would yield a direct economic gain to the protecting country.

But it must always be remembered that the positive argument in support of a general free-trade policy is only part, and probably the least important part, of the case. It is one thing to allow that, provided a government is perfectly wise and able at once to change its policy according to the variations of industry, it might use its power in such a manner as to direct the capital and labour of the country into more advantageous channels than those of pure free trade; but it is quite another thing to admit that any government would be capable of managing the industries of a great nation in this way. Those who quote Adam Smith for his theoretical exceptions forget that he always laid most stress on the negative side of the argument—that is to say, on the weakness and incapacity of governments. 'The statesman,' he writes, 'who should attempt to direct private people in what manner they ought to employ their capitals, would assume an authority which could safely be trusted not only to no single person, but to no council or senate whatever.' The clearest illustrations in support of this position are found in the commercial history of England. Even in the middle ages, when changes were comparatively slow and competition was fettered in all directions by custom and routine, the government was unable to carry out the objects which it had in view in protecting certain native industries. It is worth noting also that several important manufactures took their rise through imitation of foreign wares, under the guidance of foreign workmen, in direct opposition to the supposed interests of home producers. It is a curious fact that precisely that part of the old commercial system which was most approved of by Adam Smith—viz. the Navigation Laws—was the first to be seriously attacked on the ground of the practical difficulties involved. These acts naturally induced foreign nations to retaliate, and the attempt to obviate this difficulty by means of reciprocity treaties led to still further complications with other countries. Apart from the peculiar practical difficulties that arise in particular cases, certain general reasons may be given why protection is likely to fail when everything is taken into account. The taxation for protective purposes of any product necessarily involves the taxation of substitutes; and since in general a duty so far as it is protective is not productive of revenue, for the main object of protection is to exclude the foreign product, there is the expense of supervising and guarding against the evasion of a number of unproductive taxes. Apart from these indirect evils, the real incidence of import duties is extremely difficult to determine. Again, in every industry there

are always a certain number of producers and traders on the margin of bankruptcy, and they ascribe their failure to the insufficiency of the duties. Thus a duty which at first might have been proposed as a temporary expedient tends not only to become perpetual, but to increase. It is well known, for example, that under the old Corn Laws there was a constant demand for increasing protective duties. Those actually engaged in any industry at the time when protection is given may gain immediately through obtaining a practical monopoly of the market, and exceptional profits and wages may be obtained until they are reduced by competition. But when those employed in other industries see this apparent advantage obtained by the favoured industry, they also naturally clamour for protection, and thus the interference of government once begun spreads with increasing rapidity, a fact which has found illustration in every protectionist country. The insuperable practical difficulty is not only to decide on national grounds what industries should be protected, but afterwards to persuade those engaged in other employments that they do not require protection. Hence it is easy to understand why under the old system England and other countries were practically compelled to impose a general duty upon all foreign manufactures not specially taxed. Thus the general result of protection is to stifle foreign trade, and indirectly, by curtailing the market for exports, to fetter home industries. To render the negative argument in support of free trade complete, it would be necessary to take into account also the more general arguments advanced in support of natural liberty as against governmental interference—e.g. the increasing burdens of the necessary functions of government with the progress of civilisation, the dangers of the increase of power by increasing the functions of officials, the evils of restraints upon individual liberty, &c., which obviously have an important bearing upon the particular case of protection, but which are too general to be more than indicated in a special article. When on the one side the simplicity of free trade is considered, and on the other a complete survey is made of the practical difficulties involved in protection, compared with the doubtful advantages to be gained in the exceptional theoretical cases noted, and when it is borne in mind that the objects avowedly aimed at by protectionists—e.g. variety, skill, national independence, &c.—are much more likely to be obtained by other social methods under the system of natural liberty than by the simple device of imposing heavy taxes on foreign goods, a strong case is made out on balance for adopting free trade as the general rule of industrial policy; and in all probability free trade would have been more generally adopted, if the economical arguments had not been overshadowed by political prejudices, resting on very different foundations.

The question of Free Trade and Protection is discussed at length in all the text-books on political economy; and to PROTECTION we ourselves devote a special article. The introductory essay in Macculloch's edition of the *Wealth of Nations* (1828; new ed. 1857), still the great storehouse of facts and theories, gives a good account of the literature of the subject previous to Adam Smith. The principal subsequent addition to the arguments for free trade is the theory of foreign trade in Ricardo's *Principles* (1817), developed by J. S. Mill, Cairnes, and more recently by Professor Bastable, and criticised somewhat adversely by the French mathematician and economist Cournot, and by H. Sidgwick. Popular expositions of free-trade principles are well represented by Chevalier's *Examination of the Commercial System known as Protective*, Bastiat's *Sophismes économiques* (Eng. trans., *Popular Fallacies regarding General Interests*, 1846), Sir Thomas H. Farrer's *Free Trade versus Fair Trade* (1885), Fawcett's *Free Trade and Protection* (1878; 6th ed. 1885). The history of the free-trade movement in England is given in John Morley's *Life of Cobden* (1881). The best-known writers on the protectionist side are the American economist Carey, in *Principles of Social Science* (1858–59), and the German economist List, in *National Systems of Political Economy* (1841; 7th ed. 1884). A judicial account of the principal arguments on both sides is given in the article on 'Trade' by Professor Lexis, in the German *Handbook of Political Economy*, edited by Schönberg (2d ed. 3 vols. 1885–86).

Free-will. See WILL.

Freezing Mixtures. When matter passes from the solid to the liquid, or from the liquid to the gaseous (or vaporous) state, a considerable quantity of heat in general disappears or is rendered 'latent,' owing to the fact that, energy being required to effect these changes of molecular state, it is taken from the energy in the form of heat already existing in the substance; and this abstraction of heat causes a fall of temperature (see HEAT; MATTER, STATES OF). This property is taken advantage of for the production of low temperatures. The solution of a salt in a liquid, and the liquefaction of two or more solid substances when mixed, are both examples of the change from the solid to the liquid state, accompanied by a lowering of temperature, unless this be neutralised by heat developed by some purely chemical action. The following table gives the composition of freezing mixtures commonly in use. The solid materials should be finely powdered and intimately mixed together in a vessel of low thermal conductivity. The first column of the table gives the components in each mixture; the second their relative proportions by weight; in the third the resulting temperature (Centigrade) of the mixture, assuming that, with the exception of snow or ice, the temperature of the materials previous to mixture is 10° C. The fourth column gives the diminution of temperature in degrees Centigrade:

Components.	Relative proportion by weight.	Temperature of mixture.	Diminution of temperature.
Water	1	16°	26°
Ammonium nitrate	1		
Snow or pounded ice	5	..	20°
Common salt	2		
Snow or pounded ice	1	..	45°
Calcium chloride, crystals	2		
Ammonium nitrate	1	14°	29°
Sodium carbonate	1		
Water	1		
Sodium phosphate	27	29°	39°
Ammonium nitrate	18		
Fuming nitrous acid	8		
Water	4		
Sodium sulphate	8	18°	28°
Hydrochloric acid	5		
Snow	8	32°	42°
Hydrochloric acid (at 0° C.)	5		

Such mixtures are only applicable where a low temperature is required for a short space of time, and are of no use where a continuous process of refrigeration is necessary. For this latter purpose the low temperature produced by the expansion of gases and vapours is chiefly used, the principal substances employed being water, ether, ammonia, and carbon bisulphite. A full account of these processes, and of the apparatus connected with them, will be found under REFRIGERATION. Low temperatures are also obtained by the evaporation of a liquid, either under artificially diminished pressure, or where its vapour pressure is constantly small; the energy necessary to effect the change of state being taken from the heat in the substance itself. The evaporation (and consequent cooling) of water from the surface of porous earthenware vessels, called water-coolers, is due to this principle. The same is true of the formation of ice in shallow lakes at night in tropical climates.

The extremely low temperatures reached by Natterer and others, in their experiments on the

liquefaction of gas, were obtained by a mixture of solid carbonic anhydride and ether; or of solid nitrous oxide and carbon bisulphide. By such means the temperature of −140° C., the lowest yet attained, was reached. See also COLD, FROST, ICE, THERMOMETER, WATER.

Freiberg, an ancient city of Germany, the centre of administration for the Saxon mines, is situated on the northern slope of the Erzgebirge Mountains, at a railway junction, 20 miles SW. of Dresden. The existing cathedral, built in the late Gothic style, on the site of an earlier one (burned in 1484), contains tombs of the Saxon electors of the Albertine line, and has a Romanesque portal called the Golden Gate. The town owes its origin to its silver-mines, discovered about the year 1163. Parts of the ancient walls and flanking towers still remain. At the school of mines, founded in 1765, the most famous institution of the kind in Europe, instruction is given in surveying, mining, the preparation of ores, geology, mineralogy, &c. It possesses a laboratory, a library, a collection of mining models, and mineralogical and geological collections. The mineral ores extracted near Freiberg are silver, bismuth, nickel, cobalt, zinc, arsenic, &c., the mines giving employment to about 6800 men. The manufactures consist principally of gold and silver ware, wire, chemicals, machines, leather, and cigars. Founded in 1175, Freiberg suffered more than once in the Thirty Years' War and the Seven Years' War. Pop. (1875) 23,559; (1885) 27,266; (1890) 28,955.

Freiburg, or FRIBOURG, a canton of Switzerland, bounded on the N. and E. by Bern, and on the S. and W. by Vaud and the Lake of Neuchâtel, with three enclaves in Vaud. Area, 644 sq. m.; pop. (1888) 119,155, principally of French descent and Roman Catholics in religion. The official language is French, but all the laws and decrees binding on the whole canton are published in both French and German. The surface is hilly, the canton being invaded by offshoots of the Bernese Alps, which rise to upwards of 7000 feet in height. The river Saane or Sarine, a tributary of the Rhine, traverses almost the whole extent of the canton from its southern to its northern extremity. The country abounds in excellent meadows and pastures, upon which are reared fine breeds of horses and cattle. Dairy-farming, especially cheese-making (Gruyère), is pursued with great success. The other chief pursuits are agriculture, watch-making, and straw-plaiting. Timber, cheese, and cherry brandy are exported. Freiburg was received as a member of the Swiss confederation in 1481, and in 1848 a liberal constitution was established, but revised in a reactionary direction in 1857. It sends six members to the national council.—The capital is Freiburg, or Fribourg, on the Saane, 19 miles by rail SW. of Bern. The town is built in the valley and up the slopes of the hill to the edge of the precipice overhanging the river. The banks of the Saane (Sarine) are united by a suspension bridge, 870 feet long (see BRIDGE, vol. ii. p. 445). The church of St Nicholas, a fine Gothic structure, begun in 1283, has one of the finest-toned organs in Europe, and a lofty belfry. Pop. (1893) 12,567.

Freiburg IN BREISGAU, a town of Germany, in the grand-duchy of Baden, is situated on the western edge of the Black Forest, 32 miles NNE. of Basel. It is an open, well-built town; the walls and ditches with which it was formerly surrounded have been converted into promenades and vineyards. The cathedral, one of the most beautiful and perfect specimens of Gothic architecture in Germany, cruciform in shape, and built of red sandstone, was begun in 1122, but not completed till 1513. Its western steeple, 381 feet high, is remarkable for its elegance and lightness. The university, which was founded in 1455, in 1888 had 87 professors and teachers and 884 students. The chief manufactures are sewing silk, cotton and thread, buttons, artificial beads, chicory, paper, parquetry, &c. Wine and timber are the chief articles of trade. Pop. (1885) 41,310; (1890) 48,909, of whom more than one-half are Protestants. Freiburg is the seat of a Catholic archbishop. Founded in 1091 by the Duke of Zähringen, and created a town in 1115, Freiburg has repeatedly changed masters; twice it was given over to France (1679–97 and 1744–48). It also played an eventful part in the Thirty Years' War. In 1806 it fell to Baden; and in 1848 the Baden revolutionists were defeated here by the troops of the German confederation.

Freight is the reward paid to the owner of a ship for the carriage and safe delivery of goods. A person chartering a ship pays freight for the goods sent by it, and dead freight in respect of any deficiency of cargo; the terms of the agreement are fixed by the Charter-party (q.v.). A person sending goods by a general ship pays freight for them; and the contract takes the form of a bill of lading. So far as the rights of parties are not made the subjects of positive stipulation in the contract of affreightment, they are ascertained with reference to the usage of trade. The carrier's duty is to have the ship ready to start at the time appointed (wind and weather permitting), and to receive the goods and carry them to their destination; having performed these duties, he has a lien on the goods and a right of action in case of non-payment of freight. The shipper's duty is to have his goods forward in time. Freight is not usually payable unless the voyage is completed; but it is sometimes prepaid, in whole or in part, at the risk of the shipper. It was formerly held that the wages of the crew depended on the earning of freight by the ship; as Lord Stowell expressed it, 'freight was the mother of wages.' This rule has been finally set aside by the Merchant Shipping Act, 1854. Even in case of shipwreck a seaman may recover his wages; but his claim will be barred if evidence can be given to show that he failed to exert himself to the utmost to save the ship and cargo. The old rule is adhered to in America; but it does not apply to the master, nor does it apply to seamen if freight has been lost by the fault of the master or owners. Freight may be made the subject of insurance. See CARRIER, INSURANCE.

Freiligrath, FERDINAND, a poet of Germany, was born at Detmold, in the principality of Lippe, 17th June 1810. The favourable reception accorded to his first collection of *Poems* in 1838 induced him to abandon commercial pursuits and devote himself to literature. From this time onwards he led a very unsettled life. In the poetry of this his earlier period it is the originality both of subject and of treatment, the oriental glow of the diction, the energy of the descriptions, and the finish of form that have secured the poet fame. But about the year 1844 a great change came over the spirit of his writing. Freiligrath was drawn into the political contest of the period as a bold champion and singer of democratic opinions. The publication of his radical *Glaubensbekenntniss* ('Confession of Faith'), in the same year, compelled him to take refuge in Belgium. In 1846 he repaired to London, and, although two years later he celebrated the revolutionary movement in the poems *Die Revolution* and *Februarklänge*, he was nevertheless included in the amnesty of March 19, and returned to Germany, settling at Düsseldorf, where he became the leader of the democratic party. Shortly after, he was impeached on account of his poem,

Die Todten an die Lebenden ('The Dead to the Living'), but after a celebrated trial acquitted, 3d October 1848. Nevertheless, a second prosecution in 1851 compelled him to flee once more, and he again took refuge in London. Nor did he return to Germany until 1868. His last years were spent at Stuttgart and Cannstatt, where he died 18th March 1876. In his later years Freiligrath returned in some respects to the style of his first work, a decided contrast to the somewhat strained and artificial poems of his political period, chief amongst which are *Ça Ira!* (1846) and *Neuere politische und sociale Gedichte* (1851). The latest poems were published as *Neue Gedichte* (1876). Freiligrath is also memorable as a translator from the English, particularly by his renderings of Longfellow, Shakespeare, &c. The popularity of his earliest book, *Gedichte*, is attested by its reaching a 43d edition in 1883. A complete edition of his works appeared at Stuttgart (6 vols. 1870; 5th ed. 1886). See his Life by Schmidt-Weissenfels (1876), and Buchner (1881).

Freischütz ('free-shot'), the name given to a legendary hunter and marksman who gets a number of bullets (*Freikugeln*) from the devil, six of which always hit the mark, while the seventh is at the absolute disposal of the devil himself, who directs it at his pleasure. A northern variant makes the man a fowler who sells his soul to the devil for an unerring aim for seven years. Fortunately there is one condition—that the enemy should always be able to name the game being shot, and the fowler's wife, seeing in this a way of escape for her unhappy husband, strips, tars, and feathers herself, and so outwits the devil to her husband's salvation. The story was first treated by Apel in the first part of his *Gespensterbuch* (1810), and was adapted by F. Kind for the opera, *Der Freischütz* (Fr. *Roland des Bois*), which the genius of Weber has given to the world. See Grässe, *Die Quelle des Freischütz* (Dresden, 1875).

Freising, a town of Bavaria, on the Isar, 22 miles NNE. of Munich by rail, with 8850 inhabitants, and manufactures of threshing-machines and hand-mills, turf-cutting, and book-printing (since 1495). The chief buildings are the beautiful cathedral (1160) and the former episcopal palace (now a theological seminary). Close by is an old Benedictine abbey (725–1803), now a royal model-farm, with schools of brewing and horticulture. The bishopric of Freising dated as far back as 724 A.D., and its bishops were made princes of the empire in the 17th century, their authority embracing an area of 320 sq. m., with 27,000 inhabitants; the see was secularised in 1802.

Freistadtl (Hung. *Galgócz*), a market-town of Hungary, 40 miles NE. of Presburg by rail, on the Waag, opposite the fortress and prison of Leopoldstadt. Pop. 6409.

Fréjus, a small town in the French department of Var, a mile inland from the Mediterranean Sea, and 22 miles SW. of Cannes by rail. It was originally a colony from Marseilles, and was afterwards colonised anew by Julius Cæsar, and called Forum Julii; here Agricola was born. It has traces of a lighthouse, walls, an amphitheatre (restored, 1868–69), and other Roman remains. The ancient harbour, in which Augustus stationed the fleet of 300 galleys which had been captured from Antony at Actium, has become silted up. Here, or rather at the new harbour of St Raphael, 1½ mile off, Napoleon landed on his return from Egypt in 1799, and embarked for Elba in 1814. Pop. 2712.

Frelinghuysen, FREDERICK, an American statesman, grandson of a Dutch pastor who emigrated to New Jersey in 1720, was born in 1753, graduated at Princeton, and was admitted to the bar in 1774. He raised a corps of artillery, and took part in the battles of Trenton and Monmouth Court-house; and he was a member of the Continental Congress in 1778 and 1782–83, and a United States senator in 1793–96. In 1794 he was made a major-general of militia. He died in 1804.—His second son, THEODORE, was born in 1787, graduated at Princeton in 1804, and practised law in Newark, where he became state attorney-general. In the United States senate (1829–35) his speeches earned him the title of 'the Christian statesman.' He became chancellor of the university of New York in 1839, and in 1844 was nominated by the Whig party for the vice-presidency of the United States, on the same ticket with Henry Clay. In 1850 he was chosen president of Rutgers College, New Brunswick, where he died in 1861.—His nephew, FREDERICK THEODORE, born in 1817, graduated at Rutgers in 1836, and succeeded in 1839 to his uncle's practice. He was attorney-general of New Jersey in 1861–66, and in 1866–69 and 1871–77 he sat in the United States senate, where he carried a bill against polygamy, and had charge of Charles Sumner's civil-rights bill. He was secretary of state in Arthur's cabinet, 1881–85, and retired from office exhausted by his labours, to die at Newark, 20th May 1885.

Fremantle, the principal seaport of Western Australia, at the mouth of the Swan River, 12 miles SW. of Perth by rail. Its chief building is the town-hall, erected at a cost of £12,000. A series of extensive works have been undertaken for the improvement of the harbour, which is somewhat exposed, especially on the north side. The town was named after Captain Freemantle of H.M.S. *Challenger* (1829). Pop. about 5000.

Fremont, capital of Sandusky county, Ohio, at the head of navigation on the Sandusky River, 30 miles SE. of Toledo by rail, with manufactures of flour, iron, lime, and farming-machinery. Pop. (1880) 8446; (1890) 7141.

Frémont, JOHN CHARLES, an American explorer, was born at Savannah, Georgia, January 21, 1813, the son of a Frenchman and a Virginian lady. In 1835 he was appointed professor of mathematics in the navy, but soon turned his attention to civil-engineering, and was employed in surveys under the topographical corps, in which he received a commission in 1838. In 1842 he explored the South Pass of the Rocky Mountains, under government authority, and demonstrated the feasibility of an overland route between the two sides of the continent. The highest peak of the Wind River Mountains (13,570 feet above the sea), which he ascended in August, is now called Frémont's Peak. His report of the expedition attracted much attention. In 1843 he again crossed the South Pass, explored the Great Salt Lake, and advanced as far as Fort Vancouver, near the mouth of the Columbia River. On his return, in the following winter, he encountered great sufferings from cold and hunger, and was compelled to force a passage over the snow-covered mountains into California, which he accomplished in forty days, reaching the Sacramento in March, with his men almost reduced to skeletons. He returned to Kansas in July, and the remainder of the year was taken up in preparing his report. He was brevetted captain in January 1845, and in the spring of the same year set out on a third expedition to explore the watershed between the Mississippi and Pacific. During the war with Mexico he cleared the northern part of California of Mexican troops, but became involved in a dispute between two of his superior officers in regard to the right of command in California, which led to his trial by court-martial, when he was sentenced to be dismissed from the service. The president

remitted the penalty, but Frémont resigned his commission. In 1848 he started upon a fourth expedition, at his own expense, along the upper waters of the Rio Grande; but, the guide having lost his way among the snows of the great Sierra, the survivors—only two-thirds of the party—were compelled to return to Santa Fé, after unspeakable sufferings, in which they had been even driven to cannibalism to support life. In 1849, however, he succeeded in reaching California, where he settled, and in the following year took his seat as senator for the newly-admitted state. In 1850, also, he received a gold medal from the king of Prussia, and the 'founder's medal' of the Royal Geographical Society of London, while the Geographical Society of Berlin made him an honorary member. In 1853 he conducted a fifth expedition along the route of the fourth. In 1856 he was the Republican and anti-slavery candidate for the presidency, but was defeated by Buchanan; in 1864 he was again nominated by a section of the party, but withdrew in favour of Lincoln, 'to prevent the election of the Democratic candidate.' In 1861 and 1862 he served in the civil war with the rank of major-general, but for personal reasons resigned his command in the latter year and took no further part in the war. In 1878 he was appointed governor of the territory of Arizona, a position which he held until 1881. 30th April 1890 he was commissioned a major-general of the United States army on the retired list, and died on the 13th of July following. He published, besides accounts of his explorations, *Memoirs of my Life* (New York, 1886). See also his wife's *Souvenirs of my Times* (Boston, 1887).

French Beans. See BEAN.

French Berries, AVIGNON BERRIES, PERSIAN BERRIES, or YELLOW BERRIES (Fr. *Graines d'Avignon*), small berries, the fruit of certain species of Buckthorn (q.v.), but principally of the Yellow-berried Buckthorn (*Rhamnus infectorius*), which were formerly largely imported from the Levant and southern France as a yellow dye; being fugitive, however, this dyestuff has very much given place to that of mineral dyes.

French Honeysuckle (*Hedysarum coronarium*), a beautiful leguminous biennial, only seen in flower-gardens in northern Europe, but pretty extensively cultivated in Italy, the Balearic Isles, &c., as green fodder or for hay. The genus Hedysarum contains many species, extensively diffused over the warmer parts of the world. A few are found in cold regions, as *H. alpinum* of the Alps or *H. fruticosum* in Siberia. The bast of *H. lagopodioides* of the East Indies yields a textile fibre.

French Polishing, the name given to the usual method of polishing furniture. Simple varnishing with copal or mastic varnish, put on with a brush, produces a comparatively uneven surface, which soon wears off with friction. A French-polished surface, on the other hand, is beautifully smooth, glossy, and very durable if occasionally rubbed over with ordinary furniture paste. The process consists in rubbing the 'polish,' which chiefly consists of shell-lac dissolved in alcohol (methylated spirit), well into the pores of the wood. After it has been left for a night to harden, the surface is next rubbed over with sand-paper. These operations are repeated several times, but the wood finally receives two rubbings with the polish only. The pads or rubbers used are either of flannel or cotton-wool, covered with thin calico dipped in linseed-oil. An 'egg shell' finish is given to the surface either by rubbing over the ordinary French-polished surface with pumice and linseed-oil, or by applying the polishing solution in a thin state. Ebony, satinwood, and Spanish mahogany are more easily polished than oak, American walnut, or rosewood. Neither vessels containing hot water nor bottles of perfumes made up with alcohol should be placed on polished wood.

The composition of French polish, sometimes called cabinetmakers' polish, varies very much. A good receipt is 1½ lb. shell-lac, 1 oz. mastic, 2 oz. gum benzoin, 1 gallon methylated spirit. Another is 10 parts shell-lac, 40 parts methylated spirit. For light-coloured woods the polish should be made of white shell-lac. See *Fabrication of Varnishes, Lacquers*, &c., by Erwin Andres (trans. by Brannt, Phila. and Lond. 1882).

French River, a stream of Ontario, empties Lake Nipissing into Lake Huron, entering Georgian Bay, after a rapid course of 60 miles.

Frere, SIR HENRY BARTLE EDWARD, English diplomatist and administrator, was born in Wales, 29th March 1815, and educated at Haileybury College for the Indian Civil Service, which he entered in 1833. After distinguishing himself as an administrator in Mahratta, he became British Resident at Sattara in 1847, and three years later chief-commissioner of Sind. There he began a series of useful works in the opening up of routes of communication, the cutting of canals, and the construction of a harbour at Kurrachee. This work was interrupted by the Mutiny. When the troubles began Bartle Frere's first step was to occupy the fortress of Moultan, in consequence of which he was able not only to keep his own province in subjection, but also to send help to his colleagues in the adjoining provinces. In 1862 he was appointed governor of Bombay, which post he held until his return to England in 1867. He was then knighted, and nominated a member of the Indian Council in London. Five years after his return home he was sent out to Zanzibar as a special commissioner to inquire into the slave-trade, and signed a treaty with the sultan abolishing the traffic in slaves with the interior of Africa. In 1877 he was appointed governor of the Cape and High Commissioner for the settlement of affairs in South Africa. It was intended that he should carry out the confederation of the South African colonies, but his purpose was frustrated by the action of the Boers and by the wars against the Kaffirs (1877–78) and the Zulus (1878–79). Respecting the justifiableness of this last war, and Sir Bartle Frere's treatment of the Zulu king, Cetewayo, there existed considerable difference of opinion amongst English statesmen and others conversant with the questions at issue. Recalled by the government in 1880, Sir Bartle devoted himself during the next four years to the duties entailed upon him by his position as president of various learned societies (amongst others the Royal Asiatic and the Royal Geographical), and to the promotion of missionary work. He published several works on Indian and African subjects. He died at Wimbledon, 29th May 1884. On 5th June 1888 the Prince of Wales unveiled a monument to him on the Thames Embankment.

Frere, JOHN HOOKHAM, the translator of Aristophanes, was born of a good Suffolk family, in London, 21st May 1769, and was educated at Eton and Caius College, Cambridge. He next entered the foreign office under Lord Grenville, and in 1796 he was returned for the Cornish pocket-borough of Looe. Along with his old schoolfellow Canning he gave steady support to Pitt's government, and contributed to the *Anti-Jacobin*. His chief piece was *The Loves of the Triangles*, a parody on Darwin's *Loves of the Plants*, but he had a share with Canning in *The Needy Knife-grinder*. Under-secretary for Foreign Affairs (1799), he was appointed envoy to Lisbon (1800), and then twice minister to Spain (1802 and 1808), where his position was one of

extreme difficulty. He was recalled after the retreat to Corunna, and, renouncing public life, retired in 1821 to Malta, although he was offered the embassy to St Petersburg and twice the honour of a peerage. Here he devoted himself to the study of Greek, Hebrew, and Maltese, was famous for his hospitality, and died 7th January 1841. Frere's clever mock-heroic poem entitled *Prospectus and Specimen of an intended National Work by William and Robert Whistlecraft, of Stowmarket, in Suffolk, Harness and Collar Makers*, &c. (1817), suggested its *ottava rima* to Byron for his *Beppo;* but his fame rests securest on his admirable translations of the *Acharnians*, the *Knights*, the *Birds*, and the *Frogs* of Aristophanes. These are themselves works of genius, and remain without a rival in English, yet were privately printed, and only made public by Sir G. Cornewall Lewis in the *Classical Museum* for 1847. Frere's works, with a memoir, were published in 1871 by his nephews, W. E. and Sir Bartle Frere.

Frère, PIERRE ÉDOUARD, figure-painter, was born in Paris, 10th January 1819. He studied under Delaroche, but speedily turned his attention to the rendering of humble life, and especially to the portrayal of cottage children. His works are usually small in size, painted with extreme care and accuracy, and characterised by the greatest sweetness and purity of feeling. He first exhibited in the Salon of 1843, and his works have frequently been on view in London. His 'Student,' 'Luncheon,' 'Sempstress,' 'Prayer,' and 'The Gleaner Boy,' when they were exhibited in the French Gallery in 1857 and 1858, won the most enthusiastic praise from Mr Ruskin, who pronounced that their painter united 'the depth of Wordsworth, the grace of Reynolds, and the holiness of Angelico.' In 1855 he became a Knight of the Legion of Honour. He died at Écouen, 23d May 1886.

Fréron, ÉLIE CATHERINE, French writer, born in 1718 at Quimper, was a professor in the Collége Louis le Grand, and died 10th March 1776 at Paris. He wrote in defence of church and king against the Encyclopédistes, especially Voltaire, who, stung by these attacks, retaliated by ridiculing his adversary in the drama *L'Écossaise* (1760).

Fresco. Fresco-painting is the art of painting with colours, consisting chiefly of natural earths, upon walls covered with damp, freshly laid plaster. The art of painting upon plaster surfaces is of great antiquity. The sides of the Etruscan tombs were coated with lime and decorated in this manner; the same method was employed in Egypt and in many of the mural paintings of Pompeii; and the process was continued by the early Italian painters, and is that known as *secco* or *fresco secco*. It is described as follows in a treatise upon painting by the monk known as Theophilus, a work certainly written before the close of the 12th century: 'When figures or other objects are drawn on a dry wall, the surface should be first sprinkled with water till it is quite moist. While the wall is in this state, the colours are to be applied, all the tints being mixed with lime, and drying as the wall dries, in order that they may adhere.' The method is still in general use in Italy and in Munich, for the production of both exterior and interior decoration. In modern practice lime and fine sand are used for the final coating of plaster, which is allowed to dry thoroughly, and then smoothed by the application of pumice-stone. On the evening before the painter is to begin his work the surface is thoroughly damped with water in which a little lime has been dissolved, and the process is again repeated next morning. The colours are the same as those used in true fresco-painting, which we next describe; but *fresco secco* possesses this advantage over true fresco, that the artist can leave his work at any point, and, having simply redamped the wall, again resume it. The *secco* process is excellently adapted for rough decorative work, and is as durable as true fresco; but it is less suited for delicate and refined artistic productions.

True fresco, the *buon fresco* of the Italians, did not come into use till about the close of the 14th century; and the subjects from Genesis by Pietro d'Orvieto, in the Campo Santo, Pisa, to which the date of 1390 has been assigned, are regarded as the earliest extant works in the method. In true fresco the plaster is laid fresh and damp every morning on the wall. Upon this surface the artist places his full-sized outline cartoon, and transfers its forms, by pouncing or by tracing with the blunted point of a style, to the moist plaster. He then proceeds to fill in the outlines of his design with the brush, guided by a small coloured study which he has previously prepared. At the close of his day's work the portions of the plaster ground which he has not covered are carefully scraped away, and before the painting is resumed a fresh surface is laid. Care is taken that the lines of junction in the plaster shall occur in the shadows, or coincide with the contours of the figures, so that they may not unduly attract attention; and the frequent occurrence of such joinings in a mural painting is one of the most obvious tests of its having been executed in true fresco. As he can use only such colours as resist the decomposing action of lime, the palette of the fresco-painter is far more restricted in range than that of the painter in oils. His white is simply a finely-prepared lime; his yellows, the ochres; his reds, the ochres burned, with cinabrese and sinopia, both earths; his green, terra vert; his black, lampblack and charcoal; his blue, ultramarine and cobalt: and in the application of these he is obliged to make allowance for their becoming paler in tone as the ground of plaster dries. He must also work lightly, so as not to injure his surface, and avoid retouching as far as possible, as only a certain proportion of moist colour can be properly incorporated by the plaster, and if this proportion is exceeded the pigments remain unfixed upon the surface. When properly applied the colours enter into complete combination with the lime of the plaster. Thus, a painting in fresco can be washed without injury; and with ordinary care, in a southern climate and upon a properly built wall, the process is a very permanent one.

In the fine arts generally, the material conditions of the process employed have the most powerful effect upon the temper of the artist; and in the imitative arts they go far to determine the particular qualities of visible things which the artist shall be inevitably led to emphasise. This is especially the case in regard to the process which we are considering. The rapidity of handling necessary in fresco-painting upon a damp surface of fresh plaster, and the practical impossibility of correction except by the summary method of cutting away the faulty portion and relaying it with a new plaster ground, necessitated the clearest apprehension on the part of the painter of what he meant to perform, and was as stringent a discipline as could well be imagined in certainty and decision of handling. Again, the process rendered impossible any trivial *finesse* of mere imitative dexterity. Reproduction of the niceties of texture, for instance, a legitimate enough aim for the oil-painter of cabinet-sized subjects, and one which his process enabled him to attain, was beyond the scope of the fresco-painter's method; who was accordingly led to concentrate his attention upon other things—upon nobility of design, dignity of grouping, expressiveness of gesture and countenance—in fact, upon the very qualities proper to that class of monumental

mural work for which fresco was employed in Italy. Further, his process led him to seek for colour rather than for chiar-oscuro; and the restriction of his palette to a comparatively few pigments, and these mainly natural earths, tended towards that simplicity and pure harmony of colouring proper to paintings covering large surfaces and employed as an architectural adjunct—a result facilitated by the softening influence of the lime with which the colours combined, and by the fine, dead, lustreless surface of the plaster ground.

Fresco-painting was accordingly the chosen method by which the greatest Italian masters expressed, upon the walls of cathedral and council-room, their deepest conceptions of religion and polity. Giotto employed it in the Arena Chapel of Padua and the church of St Francis at Assisi; Orcagna in the church of S. Maria Novella, Fra Angelico in the Convent of St Mark, Masaccio in the Brancacci Chapel of the Carmine, Gozzoli in the Riccardi Chapel, at Florence; Perugino in the Sala del Cambio of his native city; Luini in the churches of Milan, Lugano, and Saronno; Pinturicchio in the cathedral library of Siena; Correggio in the cathedral of Parma; Raphael in the Vatican: and when Michael Angelo was directed by Pope Paul III. to paint his 'Last Judgment' in the Sistine Chapel in oils, instead of in fresco as at first agreed on, he protested that oil-painting was an art for women and indolent persons, that fresco was the art for men and painters, and was allowed to have his way. The celebrated 'Last Supper' of Leonardo at Milan is a mural painting in oils, not fresco; and the method used, combined with the fact that the production of the work extended over a period of years, and that the faulty masonry of the wall afforded insufficient protection against damp, accounts for the ruined state in which the subject now exists.

While, however, the qualities which we have indicated above are those peculiar to fresco-painting executed on newly-laid plaster, and are characteristic of works substantially carried out in this method, it is seldom that we find the process employed in its absolute purity, entirely unsupplemented by other modes of execution. From the earliest times the Italian painters have been unable to resist the temptation of adding more of detail and enrichment than the rapidity of true fresco rendered possible. In a greater or less degree they all retouched their frescoes with distemper colour, in which pigments were mixed with a vehicle of albumen and yoke of egg, with fig-tree juice, and with gum tragacanth, and applied at leisure, after the plaster had become dry—a practice which tended to lessen the permanence of the work. In the treatise on painting by Cennini (1437) it is stated that distemper was always used in the completion of frescoes; and these retouchings are styled *a secco* by Vasari, a phrase to be distinguished from the *fresco secco* already described. The works of Masaccio may be taken as examples of paintings executed in what is practically true fresco with little retouching; while Pinturicchio's subjects in the cathedral library at Siena show the largest introduction of distemper, further heightened by gilding.

In modern times the processes of fresco were introduced into Germany by Cornelius, Overbeck, Veit, and F. W. Schadow, who had learned the art at Rome, and had there decorated the Casa Bartoldi, the palace of the consul-general of Prussia; and much work of the kind was executed in the north by these painters, J. Schnorr, and Kaulbach.

In England an effort was made to found a national school of mural art by the appointment of a Royal Commission for the decoration of the new Houses of Parliament at Westminster. A report was prepared embodying much valuable information regarding the various processes of fresco; cartoon competitions were held for the purpose of selecting painters capable of historic art; and Dyce, Armitage (who had aided Delaroche in his great mural painting in oils on the *Hémicycle* in the Palais des Beaux-arts, Paris), Watts, Cope, and other prominent painters received commissions for frescoes; but the scheme was never carried out in its entirety. The great monumental works by Maclise in the Houses of Parliament, 'The Interview of Wellington and Blücher after Waterloo' and 'The Death of Nelson,' were carried out in stereochromic or 'water-glass' painting, invented by Dr J. R. Fuchs (see GLASS, SOLUBLE), in which a painting executed in *fresco secco* was protected by the application of a solution of silica and potass. But, though many interesting experiments have been made, no school of fresco-painters has yet been formed in England. England's moist climate, and especially the vitiated atmosphere of London, seems almost inevitably fatal to the permanency of works executed in fresco; and while subjects painted by G. F. Watts many years ago, on the walls of a villa near Florence, are still uninjured, his frescoes, produced by exactly the same process, at Westminster and in Lincoln's Inn bear marked signs of deterioration. See CARTOON, DISTEMPER, PAINTING, MURAL DECORATION.

Fresh-water Herring. See COREGONUS.

Fresnel, AUGUSTIN JEAN, French physicist, born at Broglie, Eure, 10th May 1788. He chose the profession of engineer, finally becoming head of the department of public works (*ponts et chaussées*) at Paris. He died at Ville d'Avray, near Paris, 14th July 1827. In 1825 he was elected a Fellow of the Royal Society of London. His claim to notice rests upon his optical investigations, which contributed materially to the establishment of the undulatory theory of light. His discoveries are connected chiefly with the properties of polarised light, and with the theories of the interference and diffraction of light. He invented the compound lighthouse lenses which bear his name. The French government published his collected works (3 vols. 1866–70).

Fresnillo, a mining town of the Mexican state Zacatecas, lies 7200 feet above sea-level, at the foot of the argentiferous Cerro de Proaño, and has amalgamation works, &c. Pop. 15,000.

Fret, a figure in Heraldry, resembling two narrow bendlets dexter and sinister interlaced with a mascle. When six, eight, or more pieces

Fret.

Fretty.

are represented crossing and interlacing like lattice-work, the shield is said to be fretty.

Freund, WILHELM, German philologist, born of Jewish parents, 27th January 1806, at Kempen in Posen. Having studied at Berlin and Breslau (1824–28), he taught at Breslau, Hirschberg (1848–51), and Gleiwitz (1855–70), and finally settled down at Breslau to a life of literary activity. His principal work is a *Wörterbuch der lateinischen Sprache* (4 vols. Leip. 1834–45), on which the best-known English-Latin dictionaries (Andrews, Lewis and Short, &c.) are based. Besides this he wrote a number of school-books, especially on the Greek and Roman classics, and some on

philology, as *Wie studiert man Philologie?* (5th ed. Leip. 1885), and *Grundzüge der philologischen Wissenschaften* (3d ed. 1885 *et seq.*). Died in 1894.

Freycinet, CHARLES LOUIS DE SAULCES DE, French statesman, born at Foix in 1828, was an engineer of note when the Franco-Prussian war broke out. In October 1870 Gambetta appointed him his subordinate in the war department; his conduct as such he has himself described in *La Guerre en Province pendant la siége de Paris* (1871). Elected to the senate in 1876, he became minister of Public Works in 1877, and premier in 1879, with the portfolio of foreign affairs. He resigned in 1880, but formed a ministry again in 1882 and 1886; and in 1889 he became minister of War under M. Tirard. He has published several works on engineering, sanitation, &c., and in 1878 was elected a member of the Academy of Sciences.

Freyja, in Scandinavian Mythology, the goddess of love, who dispenses all joys, delights, and pleasures. She was wont to drive out in a chariot drawn by two cats. She claimed one-half of those slain in battle. She wept golden tears for her husband, who had travelled into distant countries. This goddess was particularly worshipped in Sweden. Freyja gave her name as the general designation for all women of rank and wealth in medieval times (*frouwa* = *frau*). See FRIGGA.

Freyr, in northern Mythology, the son of Njord, of the dynasty of the Vanagods, was adopted with his father among the Æsir. He presided over rain and sunshine, and bestowed good harvests, peace, and wealth. His wife was Gerda, daughter of the giant Gymer, and Freyr's wooing forms one of the most beautiful episodes in northern mythology. He was held in especial veneration by the Swedes, his principal temple being at Upsala. His festival was celebrated at Christmas (Yule-tide).

Freytag, GEORG WILHELM FRIEDRICH, Orientalist, was born at Lüneburg in 1788, and from Göttingen proceeded to Paris, where he became a pupil of Silvestre de Sacy. Under him he continued the study of Arabic, Persian, and Turkish, until he was called to the chair of Oriental Languages at Bonn in 1819. He died there, 16th November 1861. His reputation rests on his *Lexicon Arabico-Latinum* (4 vols. 1830–37), and his works on Arabic literature and history, as editions of Lokman's *Fables* (1823), Hamâsa's *Odes* (1828–52), and Ibn Arabshah's *Fakihet al-Kholefa* (1832–52), *Carmen Arabicum* (1830), *Chrestomathia Arabica* (1834), *Arabum Proverbia* (1838–43), and *Selecta ex Historia Halebi* (1819).

Freytag, GUSTAV, German novelist and playwright, was born 13th July 1816, at Kreuzburg, in Silesia, studied at Breslau and Berlin, and from 1839 till 1847 was a *privat-docent* of German language and literature in the former university. Afterwards he lived successively at Dresden, at Leipzig and in the neighbourhood of Gotha, and (since 1879) at Wiesbaden. A deputy to the North German Diet, he served in the French campaign (1870), and in 1854 was created a *hofrath*, in 1886 a *geheimrath*, of Coburg-Gotha. His comedies and other plays—*Die Valentine* (1846), *Die Journalisten* (1853), &c.—proved brilliant successes both on and off the stage; but his greatest achievement in literature is undoubtedly *Soll und Haben* (1855; 30th ed. 1885), a realistic novel of German commercial life, which was translated into English under the title of *Debit and Credit* (1858). It was followed, but not surpassed or even equalled, by *Die Verlorne Handschrift* (1864; Eng., *The Lost Manuscript*, 1865), and the series (1872–81) called *Die Ahnen* (*Our Ancestors*), which includes *Ingo und Ingraban*, *Das Nest der Zaunkönige*, *Die Brüder vom Deutschen Hause*, *Markus König*, *Die Geschwister*, and *Aus einer kleinen Stadt*. All these, with his poems, his sketches of German life, past and present, and an autobiography, are comprised in the collected edition of his works. Died April 30, 1895. See Alberti, *Gustav Freytag* (1885).

Friar, a name common to the members of certain religious orders in the Roman Catholic Church, and generally employed in contradistinction to the name Monk and Regular Clerk. The name friar, although from its etymology (*frère*, 'brother') it belongs to the members of all religious brotherhoods, yet has come to be reserved almost exclusively for the brethren of the Mendicant orders; who at their institution stood to the old established orders as poor to rich, rude to cultivated, popular to aristocratic, the ascetic and self-denying to the comparatively leisured and comfortable. It is applied chiefly to the four great orders, Dominicans, Franciscans, Augustinians, Carmelites, and later to the Trinitarians and Servites, and to the various branches of these orders. The Franciscans were properly denominated 'Friars Minor' (*Fratres Minores*). The Dominicans received, in contrast, the title 'Friars Major,' which, however, was perhaps rather a sobriquet than a serious name. From the colour or other peculiarity of their habit, the Franciscans were popularly called Grey Friars; the Black Friars were Dominicans; the White Friars were the Carmelites; Austin Friars were the Augustinians; and the Crutched or Crouched Friars was the name given to the Trinitarians, from the cross which was embroidered upon their habit (*Cruciati*, 'crossed'). In the Mendicant orders the friars in priest's orders are styled 'father,' the other members simply 'brother.' See the articles on the several Mendicant orders, also MONACHISM; and Jessopp, *The Coming of the Friars* (1888).

Friars' Balsam. See BENZOIN.

Fribourg. See FREIBURG.

Friction (Lat., 'rubbing;' Fr. *frottement*). In the science of Mechanism as well as in practical engineering one of the two main hindrances to motion and work is the tangential reaction between the pieces of a machine when one slides or rolls upon another. Since no surface is absolutely smooth, any two bodies in contact produce a mutual resistance to relative motion at all the points where they touch, and some measurement of this obstructing force is of the first importance in certain practical problems. A recent theory is that frictional resistance is due to the development of electricity over the area of contact.

Statically, friction is a force acting in the tangent plane of two bodies, when one slides or rolls upon another, and always in a direction opposite to that in which the moving body tends. The laws of the action of this resistance were investigated in 1781 by Coulomb at Rochefort, and more fully illustrated in 1830–34 by Morin at Metz, but the conclusions reached by George Rennie's experiments are of still greater importance in practical mechanism.

The general results established as to friction are—(1) It does not depend upon the extent of the surface in contact, but upon the pressure exerted between the touching bodies; (2) it does not depend upon the rate of relative motion of the surfaces, except in certain extreme cases; (3) statical friction—i.e. for the state bordering on motion—is increased if the surfaces have for a certain time remained in contact; (4) the energy which seems lost, owing to friction, develops heat or electricity; (5) the lighter the normal pressure between two pieces of a machine, the finer and more fluid should be the unguents applied to reduce the friction; (6) in rolling friction, and especially carriage traction, the resistance is inversely as the radius of the wheel or roller.

A main object of all the experiments was to obtain that measure of the force of friction which is called its coefficient. If M (fig. 1) represents a block of oak resting on an elm plank, AB, then when the plank is raised till M is just on the point of sliding down

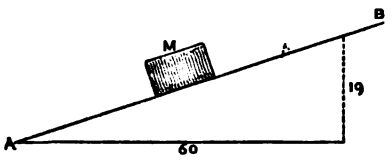

Fig. 1.

the inclined plane the fraction $\frac{19}{60}$ is called the 'coefficient of friction for oak on elm,' 60 being the length of the base, and 19 the perpendicular or vertical at its extremity. Thus, the angle A is called the angle of friction, and tan A (= $\frac{19}{60}$) is another name for the coefficient of friction. That fraction is easily shown to be the ratio of the resistance to the normal pressure between the surfaces in contact.

Statical friction or adhesion must manifestly vary according to the quality of the surfaces in contact. In some woods, when smoothed by rubbing, the coefficient of friction is reduced from $\frac{1}{2}$ to $\frac{1}{3}$; and when the surfaces are smeared with oil, grease, or other lubricant the adhesion is not only greatly diminished, but is affected so long as any trace of unctuous matter remains. If wood rests motionless on wood for 100 seconds, the adhesion is greater than after resting only 20 seconds; but after about two minutes the coefficient is not increased by continuing the contact.

When once the adhesion is overcome, the friction is sensibly diminished during motion, as is shown by the following coefficients selected from Morin's tables:

Surfaces in Contact.	Adhesion.	Friction during motion.
Wood on wood, dry	·50	·36
" " soaped	·36	·14
" " greased	·19	·07
Wood on metal, dry	·60	·42
" " greased	·63	·45
Metal on metal, dry	·18	·18
" " oiled	·12	·07

The coefficient of friction was determined by George Rennie for all ordinary bodies with various details. The following are some of his results for kinetic friction:

Steel on ice	·014	Soft steel on soft steel	·146
Ice on ice	·028	Leather on iron	·25
Hardwood on hardwood	·13	Granite on granite	·30
Brass on wrought-iron	·135	Sandstone on sandstone	·36
Yellow deal on deal	·35	Woollen cloth on cloth	·43

The following table gives not only the coefficient of certain selected substances, but also their angle of friction as already defined:

Surfaces in Contact.	Friction.	Angle.
Wrought-iron on brass	·17	9° 39′
Steel on cast-iron	·20	11° 19′
Marble (polished) on marble	·16	9° 6′
Birch on birch	·64	32° 38′
Wrought-iron on oak	·62	31° 47′
" " elm	·25	14° 3′

It should be noted that, though technically prejudicial to the work of machines, friction plays an important and useful part in practical mechanics as well as ordinary life. It is necessary, e.g., not only to enable a man to walk, but for the action of the driving-wheel of every locomotive; and is essential to the utility of all nails, screws, and wedges, as well as railway-brakes, &c. In the important case of a strap round a drum, friction is utilised to convey motion most simply and usefully. Besides lubricants rollers or wheels are often used in mechanism to diminish friction, by changing a sliding or rubbing motion to a rolling one. A roller is theoretically better than a wheel, because in the latter case the stress is thrown on a slender axle. Fig. 2 gives an instance of the former contrivance, showing a cross section of a gudgeon, G, turning midway between six rollers, R, of the same size enclosed in a fixed circular box with closed end.

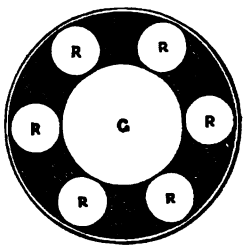

Fig. 2.

With reference to the reduction of friction by lubricants, it is found that if suitably chosen and applied they tend to equalise the coefficient or measure of obstruction. Thus, hog's lard and olive-oil interposed in a continuous stratum between the surfaces of wood on wood, wood on metal, metal on wood, or metal on metal (when in motion), have nearly all the same coefficient of friction—the value being in all cases included between ·07 and ·08. Tallow gives the same coefficient as the other unguents, except in the case of metal on metal, when the coefficient rises to ·10. Blacklead is frequently used to reduce the friction between wood and wood.

With regard to fluid friction, we need only note that it depends on the viscosity of the liquid, and in certain cases is reduced by increase of temperature. Thus, a solid body in ice-cold water finds greater resistance to motion than in warm water. Some recent physicists have shown that the fluid friction due to our ocean Tides (q.v.) is gradually retarding the earth's rotation, and bringing the moon nearer. See Thurston's *Friction and Lost Work in Machinery* (New York, 1886).

END OF VOL. IV.